Wildlife Conservation Society

Makira Forest Protected Area

Project Design Document

Draft: October 2011

For submission to: SmartWood Program, Rainforest Alliance

Following Climate, Community and Biodiversity (CCB) Standards Second Edition, December 2008

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Abbreviations and Acronyms

CBO – community-based organisation

CBNRM - community-based natural resource management

COAP - Code des Aires Protégées

COBA – Communautés de Base (community-based organisation)

COGE – Comité de gestion (management committee)

DPRH – Direction de la Pêche et de Ressources Halieutiques

DSRP – Document de Stratégie de Réduction de la Pauvreté

FAO – Food and Agricultural Organisation

FID – Fonds d'Intervention pour le Développement

GCF – Gestion Contractualisée des Forêts

GELOSE – Gestion Locale Sécurisée

MCC - Makira Carbon Company

MEF – Ministère de l'Environnement et des Forêts

MAEP – Ministère de l'Agriculture, de l'Elevage et de la Pêche

MECIE - Mise en Compatibilité des Investissements avec l'Environnement

ONE – Office National pour l'Environnement

PA – Protected Area

PSDR – Projet de Soutien au Développement Rural

PSP – Projet Sectoriel Pêche

REDD – Reducing Emission from Deforestation and Forest Degradation

SAPM – Système d'Aires Protégées de Madagascar

VCS – Voluntary Carbon Standard

WCS – Wildlife Conservation Society

ZOC - Zone of Controlled Occupation

ZUD - Zone of Sustainable Use

EXECUTIVE SUMMARY

High levels of species endemism, across multiple taxa, and high degrees of habitat loss, particularly deforestation, of the biologically rich Eastern Rainforests biome of Madagascar make the island nation a biodiversity hotspot. A staggering one percent of all of the Earth's biodiversity is found in the Antongil Bay landscape that encompasses the forest of Makira and the nearby Masoala national park. The Bay is Madagascar's last great wilderness and the epicenter of the island's unique biodiversity. Makira's remarkable diversity of intact ecological systems supports habitats teeming with wildlife and provides ecosystem services vital to both human and animal communities. The forest of Makira rings with the distinctive calls of Indri, red-ruffed lemurs and serpent eagles. Currently 20 lemur species are found there giving Makira the highest diversity of lemur species among all of Madagascar's protected areas. This diversity includes the Silky Sifaka: one of the 25 most threatened primates in the world. The forest of Makira also supports critically important populations of Madagascar's unique cat-like carnivore, the fosa.

Madagascar's biological richness stands in stark contrast to the economic privation afflicting most of the country's 18+ million people. Greater than 70% of the population lives below the poverty line and 75% live in rural areas dependent solely on natural resources for meeting basic household needs. This dependence on forest resources for subsistence coupled with high rates of population growth, inadequate policy and weak rule of law has resulted in widespread deforestation, fragmentation and general environmental degradation. Any measure to conserve Madagascar's forests and forest resources, for biodiversity protection and maintenance of critical ecosystem services, must address the economic constraints and challenges that drive deforestation and forest degradation across the country. The sale of carbon dioxide (CO2) emissions reductions from avoided deforestation through the growing carbon market may represent a unique opportunity to reconcile natural resource conservation and poverty reduction in Madagascar. The funds generated from this market can be used to fund protected area creation and management to conserve biodiversity and safeguard critical ecosystem services important for human livelihoods. These funds can also provide financial incentives for community led land stewardship. With this in mind, the Wildlife Conservation Society, the Government of Madagascar and other partners have been working with local communities living in the Makira plateau in north-eastern Madagascar to establish a protected area that will be financed by the marketing and sale of CO_2 emissions reductions credits.

The funds from carbon sales, generated through the avoided deforestation of the Makira forest, will be used to finance the long-term conservation of the forests, improve community land stewardship and governance, and support sustainable livelihood practices leading to improved household welfare.

GENERAL SECTION

G1. Original Conditions in the Project Area

General Information

This section of the Project Design Document provides information on the original conditions at the project area and the surrounding project zone prior to initiation of the Makira Forest Protected Area Project. Information included in this section of the document pertains to general climate, community and biodiversity parameters.

G1.1. Project location and basic physical parameters

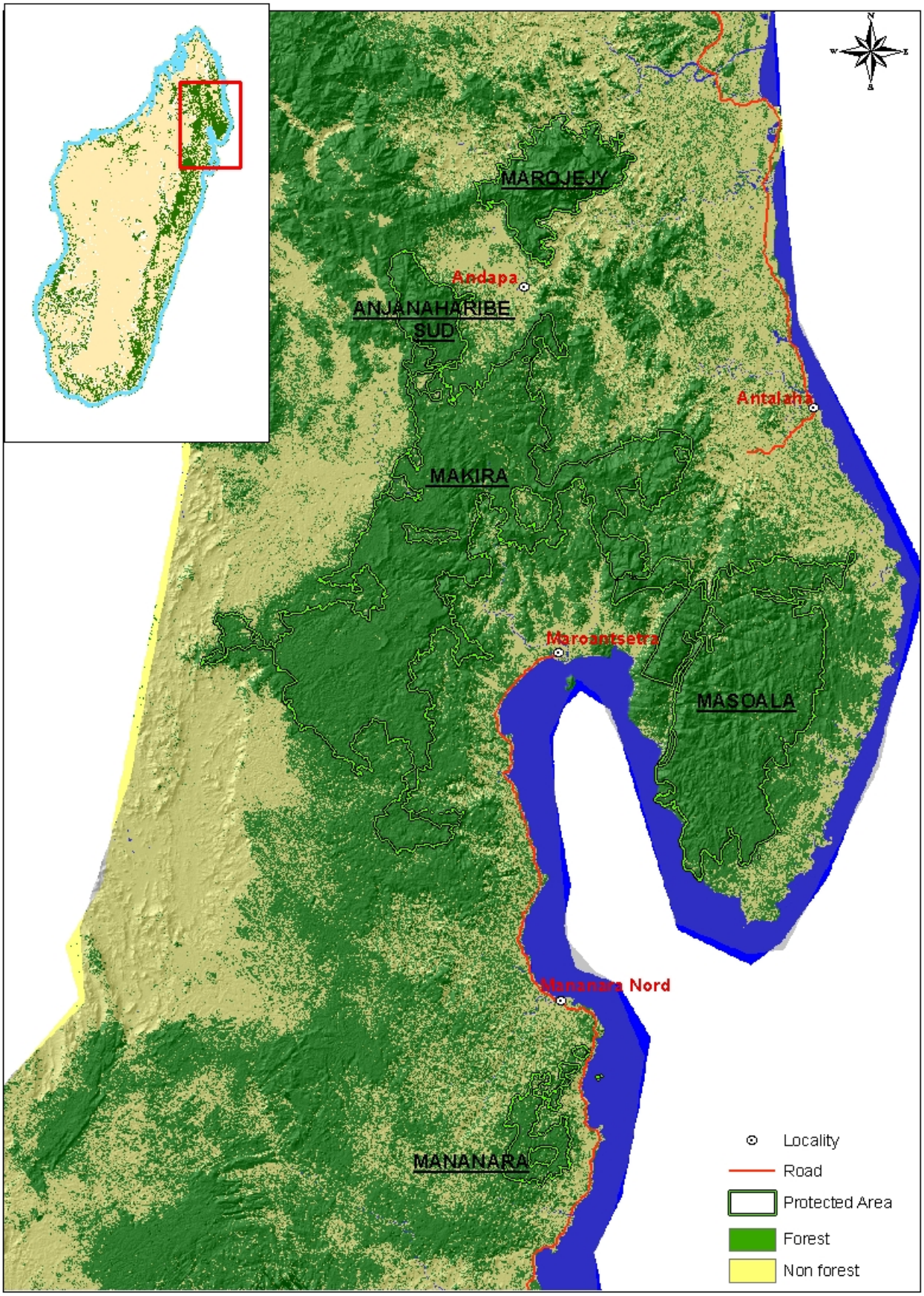
Location:

The Makira forests lie within the Antongil Bay landscape and represent one of the largest expanses of humid forest left in the biologically rich Eastern Rainforest Biome of Madagascar. The forests of Makira are a key, intact biodiversity stronghold and a vital bridge maintaining long-term connectivity and altitudinal gradient protection across protected areas in the Northeastern region. These protected areas include: the Special Reserve of Anjanaharibe-Sud and the National Park of Marojejy in the North; the National Park of Masoala in the East; and the National Park of Mananara-Nord, the Special Reserve of Marotandrano and the Special Reserve of Ambatovaky in the South (see Figure 1).

The Makira Forest Protected Area Project, hereafter referred to as the Makira Project, is located in the Makira forests in the North-eastern Madagascar, 40 km west of the town of Maroantsetra, within the following boundaries: 14º 41' 40.7'' S in the North, 15º 51' 40.8''S in the South, 48º 58' 20.18'' E in the West and 50º 1' 3.7'' E on the East. The Makira Project falls within three regions (Analanjirofo, Sava and Sofia) and five districts (Maroantsetra, Antalaha, Andapa, Befandriana Nord and Mandritsara). The Makira Project also involves 21 communes and 63 Fokontany.

Figure 1, presents the boundaries of the Makira project zone, including the Makira Protected Area (MPA) in the centre including zones for controlled occupation (ZOC) and sustainable use (ZUD) and the surrounding protection zone constituted by the community management areas (cf. Section 1.3). The term project zone instead of project area has been chosen to designate the entire intervention zone of the Makira project in order to prevent confusion with the project area for climate aspects (cf. Section 1.3 and climate sections).

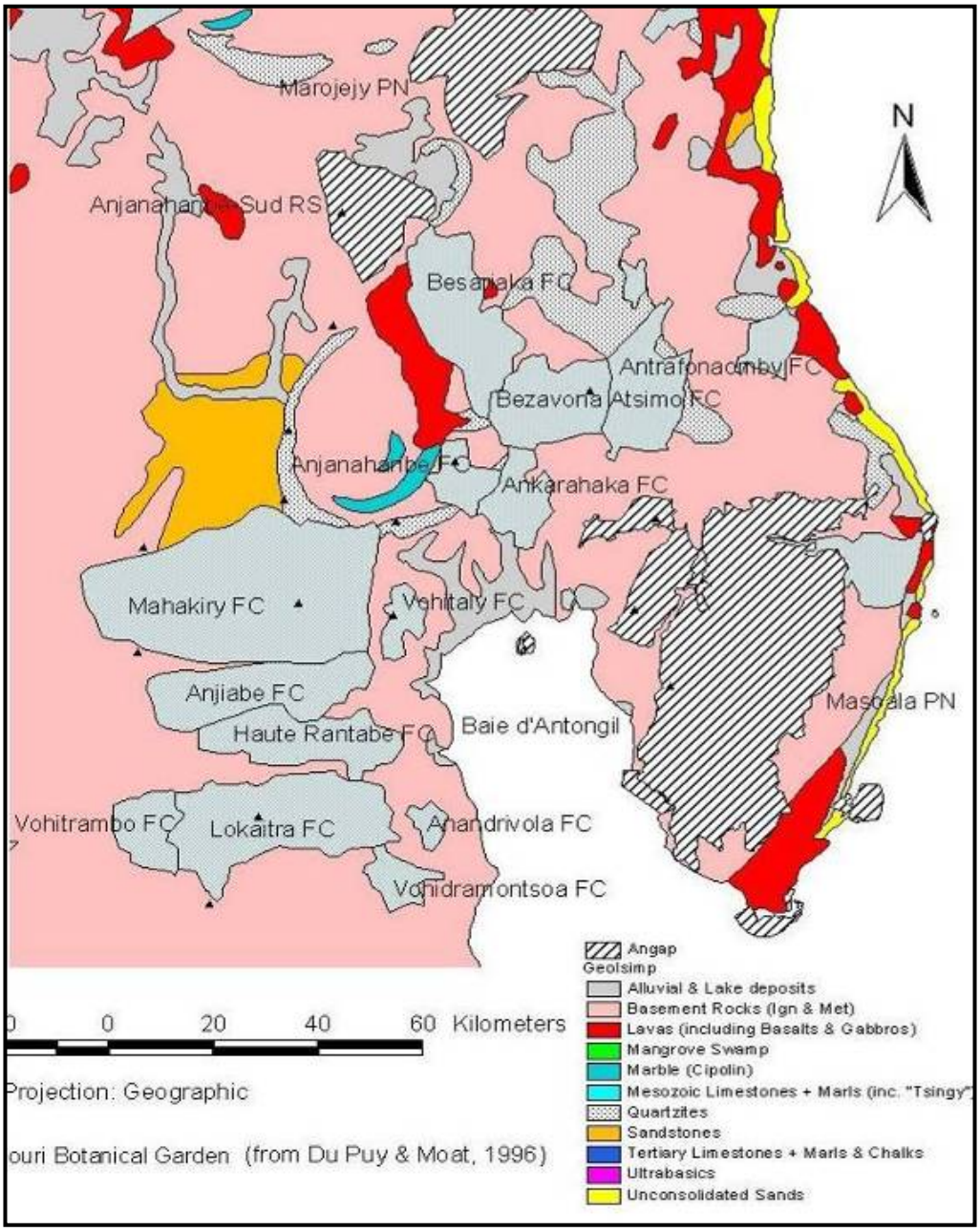
Figure 1: Location of the Makira project zone



Soil and geology:

Two topographic zones characterize the Makira plateau: a narrow alluvial flat on the eastern side that is dominated by Antongil quartzite and granite; and a more mountainous western side dominated by graphitic rock (see Figure 2) (Besairie, 1972)[1]. The project zone is dominated by yellow or red ferralitic soils. The concentration of organic matter in this type soil varies between 1 and 6.5% and it is among the most fragile of topsoil. Without protective vegetation cover, this topsoil is rapidly eroded. Moreover the area has high rainfall and so is particularly vulnerable to the loss of topsoil by erosion.

Figure 2: Geological map of Makira and the surrounding region



[1] Besairie, H. 1972. Géologie de Madagascar, Service Géologique de Madagascar, Tananarive

Climate:

The climate varies across the Makira plateau, being more humid on the eastern side, while the western side is sub-humid to dry. The average rainfall in the Makira plateau is approximately 3,500 mm per year on the east side and about 1,200 mm on the west side. The highest rainfall is occurring from December to April and a pronounced dry season from September to November. The area, particularly the north, is also prone to cyclones during the rainy season. The strong winds and flooding associated with the cyclones have, in recent years, destroyed crops, housing and roads; and caused severe soil loss on erosion-prone hillsides. Together these impacts have contributed to the impoverishment of rural families.

Hydrology:

The high rainfall in the area makes the project zone an important water catchment area and rivers flowing from it play an important role in the agricultural areas located downstream. Intact natural forest protects the main watersheds from erosion and regulates water flow in the plains. These watershed services are vital to the local and regional economies, which are based on both subsistence and cash crops.

G1.2. Types and condition of vegetation within the project zone

Forest structure:

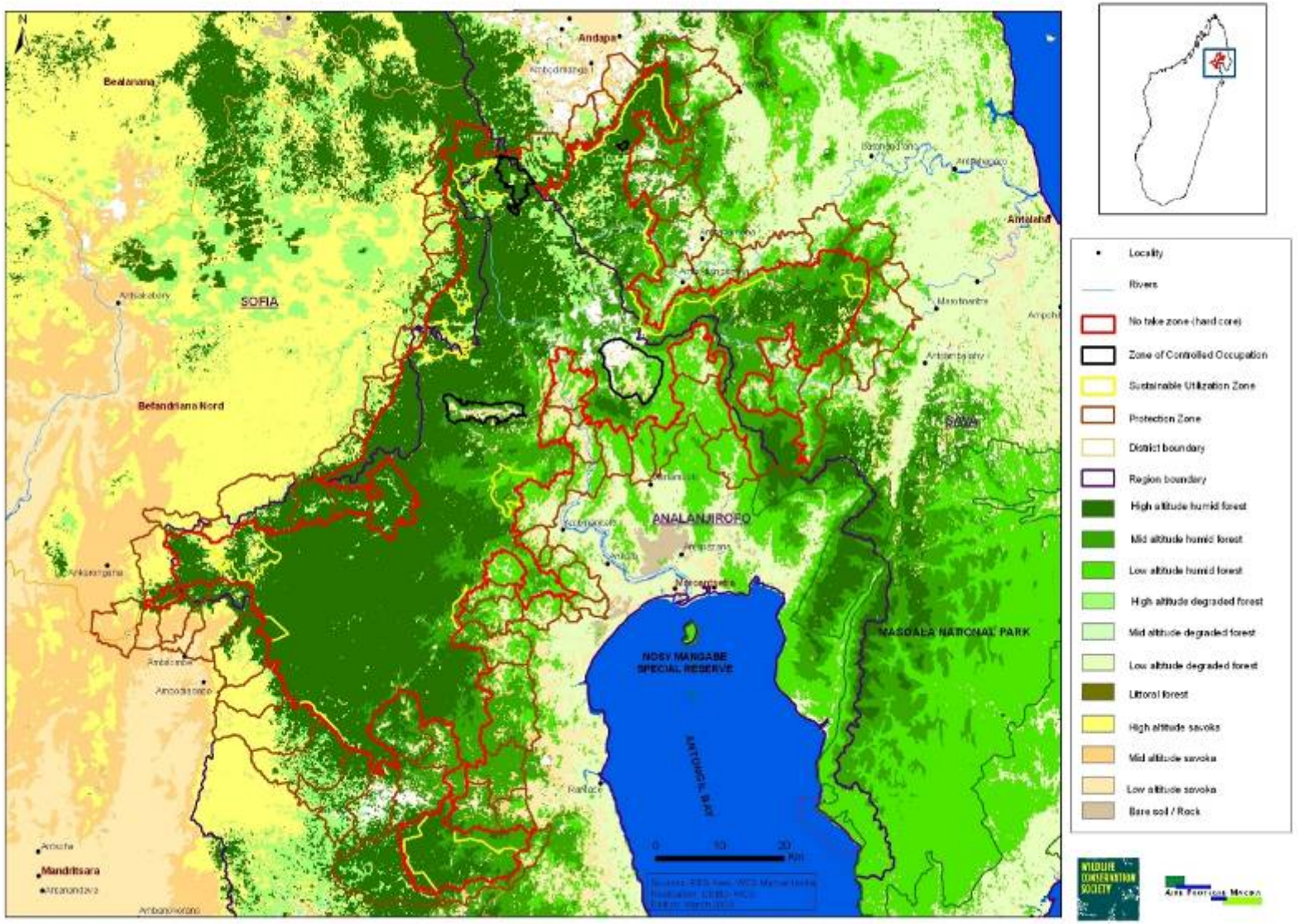
The overall forest cover within the project zone is about 86% and formed by dense humid Eastern Rainforest of Madagascar, quasi pristine and only slightly degraded in some places. Two main forest types are encountered: humid low altitude forests (0 to 500m) in the east of the project zone and mid-altitude forest (500m and more) more encountered in the west. The forest structure and composition vary along an altitudinal gradient. It is denser and tree heights can reach more than 20m on lower altitude compare to higher altitude. A map of the vegetation is given in Figure 3.

Vegetation diversity:

Makira forest is diverse in terms of botanical structure and tree species. A preliminary botanical survey identified about 53 families of forest tree species and estimated the tree density to be 20,806 trees per hectare for trees below 10 cm diameter and 337 trees per hectare for larger trees (Antilahimena, 2003)[2]. The same author identified 161 of tree species, of which about 26 species need further investigation for identification and one was a species new to science.

[2] Antilahimena, P. 2003. Rapport préliminaire sur l'inventaire des plantes de la forêt de Makira. Unpublished report for WCS Makira.

Figure 3: Makira's forest cover types



A recent revision of endemic flora in Madagascar identifies numerous new species from Makira region (Lowry et al., 1999[3]; Schatz et al., 1999a[4] & 1999b[5]). The remoteness of Makira means that it is the largest intact forest track in an area of globally important and highly threatened biodiversity - the Antongil Bay watershed. This area is thought to encompass as much as 1% of the world's flora (Meyers, 2001)[6].

G1.3. Project area and project zone boundaries

The boundaries of the Makira Project intervention zone (project zone) are based on those of the Makira Forest Protected Area; which is divided into the following two management zones:

(i) The 'Core Protected Area' including:
   a. Five 'Controlled Occupation Zones' (ZOC), which are defined areas occurring largely within the Core Protected Area where small resident populations will remain living;
   b. Fifteen "Zones of Sustainable Use" (ZUD), which are uninhabited agricultural areas occurring largely within the Core Protected Area;

(ii) The 'Protection Zone', which forms a belt around the entire Core Protected Area, encompassing the adjacent community areas, including forest and non-forest land. It serves as a buffer between the Core Protected Area and the lands where local communities live.

Sorface areas of these different zones are presented in Table 1 below and figure 4.

Table 1: Zoning of Makira Protected area and its protection zone

Designation	Units	Sub-Units	Number	Area	Management Technique (Gestion)
Protected Area	Zone of Strict Pro-tection or *Noyau Dur*	-	1	331,993	Forests under strict protection with no commercial or subsistence harvests or removals allowed
	Multiple Use Zones or *Zone Tampon*	Zone of Controlled Settlement / Occupation (ZOC)	5	11,875	Zones (mostly non forested within the protected area where people live and where no extension of settlement or immigration is allowed. Inhabitants are registered. Subsistence activities (agri-culture and cattle-grazing) are allowed.
		Zone of Sustainable Use (ZUD)[1]	15 (6 com-munity and 9 individual)	28,602	Zones (forested) within the protected area where use of natural resources for subsistence is permitted. Commercial mining and logging are forbidden. Permanent settlement is forbidden
Protection zone	Community-managed sites		83 GCF sites	335,173ha	Each GCF site includes a conservation zone and an area for customary uses

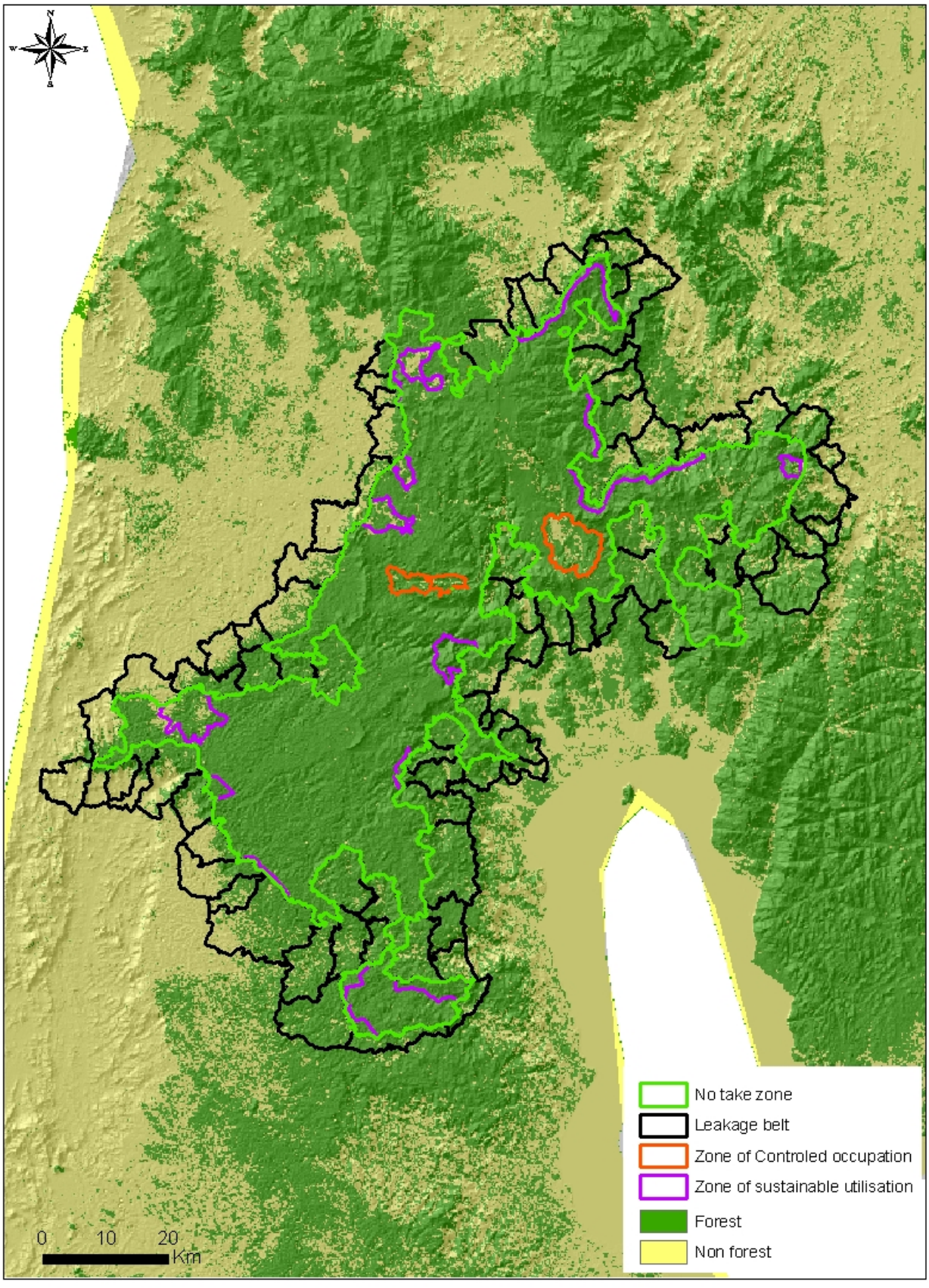
[3] Lowry, P.P., II, G. E. Schatz, J.-F .Leroy & A.-E. Wolf. 1999. Endemic families of Madagascar. III. A Synoptic revisoin of Schizolaena (Sarcolaenaceae) Adansona, ser .3,(21): 183-212

[4] Schatz, G.E., R.Egereau & P.P Lowry II. 1999a A revision of Malagasy endemic genus Chouxia (Sapindaceae). Adansonia 3 (21) :51-62

[5] Schatz,G . E.,P.P Lowry II & A.-E. Wolf . 1999b. Endemic families of Madagascar. IV A synoptic revision of Asteropeia (Asteropeiaceae). Adansonia 3 (21) : 255-268

[6] Meyers, D. 2001. Projet Forets de Makira. Report to MEF – IRG/PAGE – USAID. Report and Appendices

Figure 4: Map of the Makira project zone



Climate Information

G1.4. Current carbon stocks within the project area

Carbon pools:

The carbon pools considered are: Above-ground live tree biomass, below-ground biomass and dead wood and litter. Justification for the selection and exclusion of the different carbon pools are presented in Table 2.

Table 2: Carbon pools considered in the Makira Project

Carbon Pool	Included?	Justification/Explanation
Above-ground tree biomass	Included	Stock changes in this pool are always significant. Non-tree biomass conservatively excluded.
Below-ground biomass	Included	A significant stock and source of CO_2 emissions following deforestation.
Standing and Lying dead wood	Included	Significant stock and source of emissions.
Litter	Excluded	Not significant and conservatively excluded
Long-term wood products	Excluded	Not significant and conservatively excluded
Soil organic carbon	Excluded	Conservatively excluded

Stratification:

The methodological stratification module X–STR of the ADP VCS0007 methodology has been used to stratify the total area subject to deforestation in the Project Area and Leakage Belt area. To identify the classes of land use and land cover existing in the reference area, leakage belt and the project area, the following data sets have been used:

- The Atlas of the Vegetation of Madagascar by Royal Botanic Gardens Kew[7]
- The official national categorization of habitat zones, which includes: 'low-altitude forest' defined as (0-800 meters) and 'mid-altitude forest' (800-1500 meters[8],IEFN 1997)
- The national analysis of forest cover change between 1990, 2000 and 2005[9]
- ENSOMOSAIC very high resolution aerial photography from 2007

After superimposition of these datasets, an initial stratification distinguished the following 5 strata (4 forest strata and one non-forest stratum):

- Low-altitude dense humid forest
- Low-altitude degraded humid forest
- Mid-altitude dense humid forest

7 Moat, J. and Smith, P., 2007. Atlas of the Vegetation of Madagascar

8 Inventaire Ecologique Forestier National (1997) Cartographic Institution of Madagascar (FTM).

9 MEFT, USAID et CI, 2009. Evolution de la couverture de forets naturelles à Madagascar, 1990-2000-2005

- Mid-altitude degraded humid forest
- Non-forest (savoka, fallows, cropland and agro forestry).

Biomass measurements were conducted to estimate the biomass of the forest and non-forest classes. The plot survey design and sampling protocol (see annexes I and II) were provided by Winrock International (Walker et al., 2009), which are based on IPCC guidelines on LULUCF methodology. Initial measurements of above-ground biomass (living biomass in trees as well as lying and standing dead wood), and calculations of below-ground biomass were made in each of the five classes with 10 sampling plots in each (a total of 50 plots). The location of all preliminary measurement plots were identified in GIS and then uploaded to GPS units. Ten plots per strata were purposely located in relatively accessible locations areas and were not randomly distributed.

Analyses of pilot data collected from the 40 pilot plots (10 plots in each of the four forest classes) indicated that there is no significant statistical difference in estimated carbon stocks (SAS proc GLM) between low-altitude intact (FIB) and degraded (FDB) forests nor was there significant statistical difference between mid-altitude intact (FIM) and degraded (FDM) forests (see annex I).

From these results it was decided to remove the designation 'degraded' from the forest classifications, effectively combining FIB and FDB into one forest class and FIM and FDM into a second forest class. Based on these considerations, the total number of strata was reduced to the following three:

- Low-altitude forest
- Mid-altitude forest
- Savoka (post-deforestation stratum)

Upon further classifying the two forest classes based on potential for transition from forest to non-forest, the number of sampling plots was calculated in a way to minimize calculation errors for carbon stock estimation. Given the difficult terrain of the project area, a clustered sampling approach was identified. Thirty-three field measurement points were identified: 22 points selected in the predetermined 'high risk' for transition from forest to non-forest (low altitude forest) and 11 points in the predetermined 'low risk' for transition from forest to non-forest (mid altitude forest).

At each field measurement point 4 subplots were identified for a total of 132 data collection points. For the nonforest stratum 30 plots were identified and included actively cultivated cropland with annual crops; cropland recently left to fallow; young non-active field (recent fallow land), mature fallows non-active field (old fallow land); and agro forestry field (e.g. vanilla, clove, coffee). The location of all the 33 of the field measurement points in the two forest classes and the 30 plots in the non-forest class were identified in GIS randomly by using Hawth tools in ARCGIS and then uploaded to GPS units.

Carbon stocks for the different carbon pools have been estimated as follows:

o *Carbon stocks in above ground tree biomass (C_{AB_tree}):*

In accordance with the applied methodology, carbon stocks in the above ground biomass pool

have been calculated separately for each considered stratum by using an allometric equation relating the parameters measured in the forest inventory to biomass. There were no national forest type or species-specific allometric equations available and consequently one of the pan-tropical equations for dense humid forests proposed by Chave et al.[10] was used. As diameter has not been measured in the field inventory the following equation was finally used for estimating biomass of each individual tree measured in the field inventory:

$$C_{AB\_tree} = \rho * exp\ (-1.499 + 2.148 ln(dbh) + 0.207(ln(dbh))^2 - 0.0281(ln(dbh))^3)$$

On this basis, average aboveground tree biomass per unit area has been estimated for each sample plot and then summed up and converted into carbon dioxide equivalents for each considered stratum (cf. Table 3).

- *Carbon stocks in below ground tree biomass (C_{BB_tree}):*

  Carbon stocks in the below ground tree biomass pool have been estimated based on the data on above ground tree biomass obtained from applying the allometric function and the root to shoot ratio (below ground biomass fraction) proposed by Cairns et al.1997[11]. In a process similar to the one used for aboveground tree biomass, average belowground tree biomass per unit area could then estimated for each sample plot and summed up and converted into carbon dioxide equivalents for each considered stratum (cf. Table 3).

- *Carbon stocks in dead wood (C_{DW}):*
  The dead wood pool comprised two components – standing dead wood that is fully dead (i.e. absence of green leaves and green cambium) and lying dead wood. Measurements of standing dead wood were integrated in the sampling plots for measuring aboveground tree biomass. The same allometric function was used for relatively intact dead trees, while for rotten trees only the main bole was considered. Lying dead wood was assessed using the linear transect method with 100 m transects. The obtained dead wood volumes were then added up and converted into carbon dioxide equivalents per unit area (cf. Table 3).

- *Carbon stocks in aboveground non-tree biomass ($C_{AB\_nontree}$):*
  Above ground non-tree biomass has been estimated only for the post-deforestation stratum following a destructive sampling methodology. The obtained volumes were then converted into carbon dioxide equivalents per unit area in the aboveground non-tree biomass in the post-deforestation stratum.

Based on the data collected through the carbon stock inventories in the two forest strata and the post deforestation stratum, forest carbon stocks for each stratum have been calculated separately using the following equation:

[10] Chave et al. (2005) : Tree allometry and improved estimation of carbon stocks and balance in tropical forests. Oecologia 145: 87-99

[11] Cairns, M.A., Brown, S., Helmer, E.H. and Baumgartner, G.A. (1997): Root biomass allocation in the world's upland forests. Oecologia 111:1-11

$$C_{BSL,i} = C_{AB\_tree,i} + C_{BB\_tree,i} + C_{NT,i} + C_{DW,i}$$

The resulting total carbon stocks for the two main forest strata found in the Makira project and leakage areas can be found in Table 9, along with the weighted average used for the estimation of forest carbon stock changes presented below.

The following table provides the average carbon density by carbon pool for each of the two forest classes and the non-forest class represented in tCO2-e/ha.

Table 3: Land use and land cover classes (weighted value)

Stratum		Description	Average Carbon Stock and ± 95% Confidence Interval [t CO_2e/ha]									
			C_{AB_tree}		C_{BB_tree}		C_{DW}		C_{NT}		C_{BSL}	
ID	Name		Av	± CI	Av	± CI	Av	± CI	Av	± CI	Av	± CI
FOR	Forest	High Defor. Risk	725.35	7.22	134.78	7.37	118.54	10.58	-	-	978.67	12.28
FOR	Forest	Low Defor. Risk	510.51	7.22	99.36	7.52	62.84	11.49	-	-	672.72	12.36
FOR	Forest	Weighted Average	623.91	7.22	118.06	7.44	92.25	11.01	-	-	834.2	12.32
N-FOR	Non Forest	Crop fallows and agroforestry	271.33	7.21	55.12	7.32	17.83	15.78	2.15	10.71	346.43	16.43

C_{BSL} = Average carbon stock in all considered carbon pools; t CO_2e/ha

C_{AB_tree} = Average carbon stock in above-ground tree biomass; t CO_2e/ha

C_{BB_tree} = Average carbon stock in below-ground tree biomass; t CO_2e/ha

C_{NT} = Average carbon stock in non-tree biomass; t CO_2e/ha

C_{DW} = Average carbon stock in dead wood; t CO_2e/ha

Community Information

G1.5. Communities, socio-economic and cultural information

The socioeconomic conditions of Makira are largely determined by the following factors: very poor transport infrastructure, a rural local population that is reliant on farming for their livelihoods, low levels of education, and high population growth rates.

Population / Demography:

The Makira project zone contains a rural population estimated at about 49,000 individuals in 2009. This population is largely characterized by a subsistence-based agricultural economy. This population is spread across more than 120 villages within 63 Fokontany, 21 communes and five districts. The population distribution across the five districts within which the Makira Project falls indicates that Maroantsetra is the most populated district. The annual growth rate of the three regions within

which the project zone sits are estimated at 2.5% for Analanjirofo, 2.8% for SAVA, and 3.3% for Sofia.[12] The growth rate of the population within the project zone is expected to be the same although Meyers 2001 estimates a slightly larger growth rate at 3.2% (Meyers, 2001).

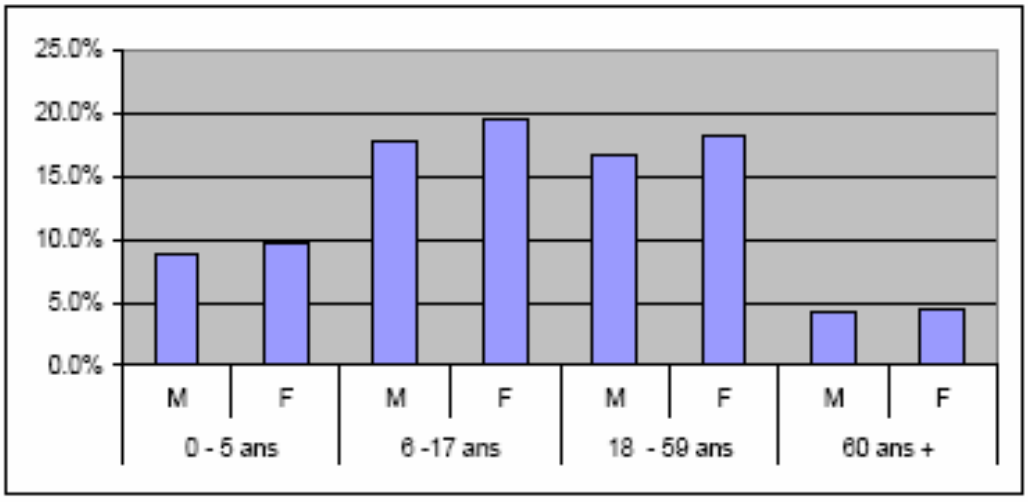
Table 4: Population in the project zone

Region	District	Population
Analanjirofo	Maroantsetra	21,936
Sava	Antalaha	5,327
	Andapa	7,996
Sofia	Befandriana-Nord	9,957
	Mandritsara	3,386
TOTAL		**48,602**

(Sources: Makira Forest Protected Area database)

The population distribution according to age and gender is illustrated in Figure 5; it reveals a "young population" in which 56.1% is under the age of eighteen. Overall, the population of Makira is gender-balanced.

Figure 5: Population distribution in the Makira area, according to age and gender



(Source: Communal Development Plans of the communes surrounding Makira, 2003)

[12] Evolution de la couverture de forêts naturelles à Madagascar 1990-2000-2005. USAID, Conservation International, Ministère de l' Environnement des Forêts et du Tourisme, Mars 2009.

Based on the United Nations' working definition of indigenous people[13], there are no indigenous people in the Makira area. The predominant ethnic groups are the Tsimihety (53.9% of the total population, settled in the North, East and South of Makira) and the Betsimisaraka (42.7%, settled in the East). The remaining ethnic groups (approximately 3.4%) are comprised largely of the Makoa, Sihanaka, and Antaimoro (Ramanandriana, 2004).

The average size of a household (traditionally referred to as "large family" or "Fehitry") ranges between 5 and 6 individuals. The households are predominantly headed by women who manage the family's life through maintaining the household – cooking, cleaning, childcare, but also by ensuring most of the agricultural activities (Ramanandriana, 2004). The oldest male member of a lineage is at the top social and organisational hierarchy and frequently inherits the traditional role of preserving the customs and rituals. A position that confers him respect from the whole community. These male elders (called Tangalamena in the East of Makira and Sojabe in the West and North) play the most crucial role when engagement of communities in conservation and development activities are sought.

Belief systems:

The two predominant belief systems in the Makira area are the animist/ancestors cult and Christianity. The former remains predominant in the region. However, several remote communes have requested the building of a church as part of their development plans. A noteworthy custom of the region is the prohibition of cultivation on Tuesdays and Thursdays, for fear of poor harvests. In keeping with Christian beliefs, the Sabbath is for resting. These customs reduce the number of weekly working days to four. Traditional rituals, on the other hand, do not have a negative impact on natural resources (WCS MAKIRA PROJECT PGES, 2008).

Migration:

There is considerable movement of people within the region where the Makira Project is situated. Migration is of two kinds: "Intra-Zone Migration" and "Extra-zone Migration".

'Intra-zone migration' takes place within the project zone and is thus not considered migration, but rather movements within the same village land where farmers from the village walk to croplands located at the edge of or inside the forest (areas that are considered to still be fertile). Soil preparation for cultivation leads to temporary settlements in these areas, usually along rivers where farmers build shelters called lasy. Sometimes, lasy are also used to escape from social obligations in the village. Depending on the success of the cultivation, the temporary lasy can become permanent settlements.

Extra-zone migration refers to people who move from one district or region to another. All of the

[13] Indigenous communities, peoples and nations are those which, having a historical continuity with pre-invasion and pre-colonial societies that developed on their territories, consider themselves distinct from other sectors of the societies now prevailing on those territories, or parts of them. They form at present non-dominant sectors of society and are determined to preserve, develop and transmit to future generations their ancestral territories, and their ethnic identity, as the basis of their continued existence as peoples, in accordance with their own cultural patterns, social institutions and legal system.

districts of the Makira protected area are affected by this migration, given the importance of the trade of local products between districts. Goods are carried on traders' backs along paths that cut through the forests of Makira. A second driver of this type of migration is the presence of sites with mining and/or forest resources, which attract both itinerant outsiders who exploit the resources, as well as traders who supply them with food and goods. This type of movement usually occurs only in the peripheral zones of the project zone. It is the case of the commune of Rantabe in the South where there is illegal mining (WCS Makira Project PGES, 2008).

Health:

Lack of basic health services and malnutrition are the prime causes of mortality in the project zone. Lack of education on and knowledge of basic hygiene, sanitation, good health practices, disease prevention (including access to medicines and water) all contribute to the high rates of mortality and morbidity in the region. The prevalence of malaria, respiratory infections and diarrhoea is high. Of increasing importance is the increase in sexually transmitted diseases, caused by the lack of education. Twenty four Twenty four communes have a very basic health clinic, but they remain too remote (at least one-and-a-half days of walking) for many villagers to reach. This is the case of remote villages such as Maevarivo, Ambalavanona or Ambohimarina, which are three days walk from Antsakabary, the nearest centre. During a 2006 health survey of 892 households in 21 villages around Makira, 70 % of households reported to have been in moderate to poor health during the past thirty days. 79 % of respondents reported poor health as having a moderate to severe impact on their work productivity. Of the respondents, only 29 % sought treatment from a health clinic, while 62 % either sought no treatment or treated themselves, and 9 % sought traditional treatments (Holmes 2007). Access to potable water is almost non-existent. The Antainambalana River, which bisects the Makira Forests, serves as a latrine despite the fact that it is also the primary source of fresh water for drinking and cooking in the area (Ramanandriana, 2004).

The main causes of morbidity around the Makira area are malnutrition, lack of basic health education, lack of preventive care, consumption of unhealthy food and water and the lack of medicines.

Education:

Almost all the fokontanys have a primary school. However, most of these have a shortage of teachers. As a result, only 37,24% of the school-aged individuals attend school - 47.28% for boys and 30.40% for girls, which is a very low rate compared to the rest of Madagascar (CISCO[14] Maroantsetra, 2010). Aware of the limited infrastructure and opportunity for schooling, villagers at the periphery of the protected area are increasingly requesting the construction of village schools as part of their development strategies.

[14] CISCO or CIrconscription SCOlaire is the regional office of Education

Livelihoods and economy:

The rural populations living around the Makira area are heavily reliant on forest resources for their subsistence and income. They are principally farmers, but a minority also raises cattle or are artisanal miners. 97% of the population of the Makira region consists of farmers (Ramanandriana, 2004). The Tsimihety (the main ethnic group in the Makira) consider that a boy cannot become a man until he clears a parcel of forest and appropriates the land. Women play an important role in bringing income to the households by ensuring most of the agricultural activities in addition to handcraft and basket-making (Ramanandriana, 2004).

Driven by subsistence needs, the communities surrounding Makira put forest resources under sustained pressure, primarily through slash-and-burn clearing of the forests for agriculture and unsustainable extraction of timber and non-timber forest resources. Overall, more than 63 plant species are used for construction (roofing, stilting, walls and boats). The most sought after are Garcinia sp, Dalbergia madagascariensisi, Polyalthia ghesqueriana, Erythroxylon sp, Cryptocaria sp and Sloanea rhodantha. Ravenala madagascariensis is entirely used for housing construction (walls, roof, floor). More than 10 species are used for the construction of boats or pirogues, including Calophyllum paniculatum, Erythroxylon sp, Cryptocaria sp, Cleistanthus perrieri, Weinmannia rutenbergii, Garcinia sp, Dichrostachys sp, Burasaia madagascariensis and Canarium madagascariense. Five species are specifically used for crafts: hardwoods are used for wood sculpture and carpentry, while leaves and bark are for weaving hats, baskets and maps. Local communities also eat parts of more than 13 tree species, including the seeds of Uapaca thouarsii, Beilschmiedia sp, buds of Ravenala madagascariensis, and roots of Dypsis hildebrandtii.

Household economy is based on rice production, whether from slash-and-burn or irrigated fields or paddies. A socio-economic survey undertaken in the project zone in 2005 revealed that on average, one household cultivates slash-and-burn rice on 0.80ha of land and irrigated rice on 0.72 ha of land per year, which yields 319 and 561 kg respectively. Considering the average size of a Makira household is 6.4 individuals and that the average national annual consumption of rice is 120 kg per person, a household from the Makira region needs to produce at least 768 kg of rice in a year in order to fulfil its dietary requirement (Holmes, 2007).

The same socio-economic survey concluded that households are not able meet their subsistence needs if they do not combine subsistence agriculture with cash crops (Holmes, 2007). A 2005 socioeconomic survey of 1,075 households in 24 villages surrounding the Makira forests found that 65% of them cultivated vanilla. The revenue from the sale of cash crops (vanilla, cloves and coffee) in 2005 was approximately $250 per household. The reported average annual expenditure on basic household necessities, health and clothing for the surveyed households was just over $150. Unfortunately, cash crop production is currently threatened by climatic conditions, the aging of plants, poor management, and most dramatically, by the fluctuation of worldwide prices. Under favourable conditions and intensive cultivation, 0.6 kg of vanilla per liana can be produced; in the region, the average yield per liana is 0.15 kg (Ramanandriana, 2004). Large decreases in world prices

for cash crops such as vanilla in 2004 - 2005 led to an increase in slash-and-burn rice cultivation (WCS Makira Project PGES, 2008).

A tight relationship exists between subsistence and market activities in the Antongil Bay landscape, which has important implications for projects seeking to stop deforestation and support alternative livelihoods. For example, during the height of the 2000 - 2001 vanilla market, when vanilla was being purchased for up to $120 per kilo, a considerable drop in tavy (slash-and-burn agriculture) activity in the landscape was observed – based on measurements of smoke associated with tavy fires and evidence of new forest clearings. In 2004 and 2005, however, when vanilla prices decreased dramatically to approximately $5 per kilo, tavy again increased. However, in 2006, tavy activity was again reduced as a result of a high clove production coupled with higher market prices (vanilla costs $20 in 2007) (Holmes, 2007). The relationship between an individual or household, investing in tavy cultivation and the variable market prices of cash crops suggests providing economic alternatives can reduce household investment in tavy, and thus the resulting deforestation. However, as the crash of the vanilla market illustrates, agricultural commodity markets are too volatile. Thus, if alternatives are to provide a robust and longer-term incentive not to expand tavy, they need to generate a more reliable stream of revenue – carbon markets may be one such alternative, if leveraged effectively.

The Makira forests play an important role in the protection of the surrounding watersheds critical to the predominantly agricultural economy of the Antongil landscape, especially to subsistence rice production. In 2003, 95 % of the revenue generated in the landscape came from agriculture, including 41 % from rice and 27 % from cash crops (Holmes, 2007).

Security:

The causes of insecurity and the extent to which it affects local people vary in different areas around Makira. In the West Makira, the theft of cattle is the main causes of insecurity, while in the north and east, the theft of green vanilla is the cause of crime. Theoretically, units of the national police force 'Gendarmerie Nationale' should cover the entire region with their outposts or patrols, but the human and material resources necessary to policing the area are insufficient to ensure better public safety. For example, there is one policeman per 1,800 inhabitants in the Sofia region in the western part of the Makira area.

G1.6. Land use and customary and legal property rights

Land use patterns:

Dense primary forests cover almost two-thirds of the Makira area. The principal land use is the expansion of cropland in order to meet the food needs of a fast-growing population (see Table 5). The other, secondary land uses are illicit small-scale mining and timber logging for international traffic. Agriculture land-uses are mainly for rice and include tavy, tanety, rice paddies, but also for agroforestry, and grasslands for grazing (only on the west side). Table 6 details land uses within a subset of community-managed sites bording Makira.

Tavy is principally used to cultivate rain-fed rice. Used principally for subsistence needs, tavy is typically practiced in upland forested areas, after bottomlands have been fully exploited for paddy rice fields. Forests or fallow are first cut then burned and then rain-fed rice is cultivated. Lands are usually abandoned after a few years of production and farmers move to another place.

Forest conversion is concentrated in the river valleys but is increasingly seen far up rivers. This is a result of decreasing land availability for wet (or paddy) rice in the lowlands. With the population growing at over 3% annually, the current rate of deforestation (0.27 %) can be expected to increase along with the population.

Table 5: Land use cover by District

District	Upland rice (ha)	Irrigated rice (ha)	Cassava (ha)	Vanilla (ha)	Clove (ha)	Coffee (ha)
Andapa	19.437	1.274	1.072	1.283	0	1.172
Antalaha	1.808	377	134	63	0	36
Maroantsetra	12.236	3.799	1.539	501	2.163	582
Mananara Nord	192	17	103	3	32	24
Mandritsara	0	1.044	626	191	35	75
Befandriana Nord	5.794	4.703	2.250	179	24	200
Bealanana	612	153	455	162	0	196
Total	40.078	11.368	6.180	2.383	2.253	2.284

Customary and legal property rights:

As in most part of rural Madagascar, two land tenure systems exist in the Makira project zone: customary land tenure and the formal, national legal system.

Formal legal tenure in Madagascar is based on the state ownership principle: the State owns vacant or unregistered lands. Legally, the State owns the lands in the project zone, which is mostly covered by a continuous block of tropical rain forest. Currently, 372.470 ha of Makira forests are under temporary protection status and are in the process of being considered for a definitive protection status (a gazetted protected area). The protected area of Makira belongs to the State of Madagascar, but its management has been delegated to WCS. In addition to the core PA, the project zone includes 335,173 ha of surrounding landscape that local communities have traditionally used. The management of this 'protection zone' of the PA is devolved to associations of local communities through legal contracts between the community associations and the Government of Madagascar based on the GCF legislation. These community-managed forest contracts transfers management of the renewable natural resources within the communal areas to the contracted local community, but the land still remains the property of the State.

On the other hand, in the customary land tenure system, the acquisition and transfer of land is based on local rules that take into account customary values and social norms, but not necessarily the national law. Land transfer in the Makira area is mainly done by inheritance (37% of land acquired) through the traditional land tenure system (Ramaharitra, 2007). Land-specific investment comes in three basic forms: initial clearing of land to make it cultivable; installation of new infrastructure; and the maintenance of existing infrastructure.

Table 6: Land use cover within sample community-managed sites

TDG Sites	Amponaomby		Besariaka		Andaparaty		Ambodi-voangy		Marovo-vonana		Ambalamahogo		Anjiahely		Ambinanindrano		Sahajinja Manonga		Andranovolo	
Land use	**area (ha)**	**%**	**area (ha)**	**%**	**area (ha)**	**%**	**area (ha)**	**%**	**area (ha)**	**%**	**area (ha)**	**%**	**area (ha)**	**%**	**area (ha)**	**%**	**area (ha)**	**%**	**area (ha)**	**%**
Forests	2738	60.8	4433	77.2	1272	47.3	1864	71.2	3185	66.1	943	67.6	2332	87.8	2956	63.2	4133	81.0	3982	86.9
Fallows (savoka)	577	12.8	185	3.2	537	20.0	277	10.6	489	10.1	205	14.7	130	4.9	642	13.7	236	4.6	219	4.8
Culture land																				
Subsistence crops	283	6.3	69	1.2	262	9.8	124	4.7	231	4.8	110	7.9	36	1.4	187	4.0	58	1.1	66	1.4
Lowlands	246	5.5	30	0.5	39	1.5	252	9.6	587	12.2	90	6.5	60	2.2	21	0.4	32	0.6	7	0.2
Cash crops	55	1.2	7	0.1	7	0.3	29	1.1	27	0.6	27	1.9	1	0.0	1	0.0	1	0.0	1	0.0
Other cultures	24	0.5	2		7	0.3	4	0.1	19	0.4	10	0.6	0	0.00	6	0.1	2	0.0	9	0.2
Grazing and others	584	13.0	1021	17.8	562	20.9	69	2.6	280	5.8	9	0.6	96	3.6	862	18.4	642	12.6	299	6.50
Total	**4506**	**100**	**5745**	**100**	**2686**	**100**	**2618**	**100**	**4818**	**100**	**1395**	**100**	**2655**	**100**	**4674**	**100**	**5104**	**100**	**4582**	**100**

The formal national tenure system recognises the right of local people to land that they have customarily used. Legally, one can apply for title based on the principle of 'mise en valeur' (improvement) if one can establish occupancy for at least 10 years.

To date there have not been any reported/recorded conflicts or disputes over land tenure within the project zone. The customary tenure systems are generally able to ensure sufficient security of tenure within the local communities.

With the delimitation of a legally protected area, there has been a clear demarcation of village lands done with the full participation and agreement of the local people. The delimitation of the PA takes into account the current uses of land by communities and their needs for territorial expansion over the next five decades.

Land certificate:

In 2006, as part of the land reform policy, the Malagasy Government developed the concept of "land certificate" to help ensure property rights to land users that have no formal land title[15]. This concept applies to all land 'traditionally' occupied, but for which no legal title has been acquired.

It is the responsibility of each district /commune to establish in their administration a "local land office"[16] (LLO) that will be empowered by the Ministry of Territorial Administration and Decentralization to manage the system of non-titled land holdings. The decentralized authorities must develop a local land tenure plan[17] that reflects the situations and delimitation of the various lands in its territory. The LLO then proceeds with recognition of property rights on plots occupied. An act of recognition of property rights, called "land certificate" is issued to the occupant as a result of a process. Applications for recognition of property rights can be made either individually or by groups legally constituted for the need of their members or by individuals.

While a *land certificate* does not exactly have the same legal value as a *land title*, its does provide its owner the same rights on the property in the same capacity as the land title. To this end, the owner may exercise all the legal acts recognized by the laws in force, relating to property titled, such as sales, exchanges, establishment of a mortgage, lease, long lease, or deed of gift. The property may also be transmitted by inheritance.

In addition to empowering the local people to manage their natural resources through the formal transfer of management rights to the local community associations, the Makira Project will also ensure land tenure security for local people through the implementation of a program to formalise their ownership of land. To achieve this, the Makira Project will support local people to formally register and gain land certificate to their land. Such effort will reassure local communities on their ownership to their lands.

[15] Law n°2006-031 of 24 November 2006 and Decree n°2007-1109 of 18 December 2007
[16] Guichet foncier
[17] Plan Local d'Occupation Foncière ou PLOF

Biodiversity Information

G1.7. A description of current biodiversity within the project zone

Species and ecosystem diversity:

A series of biological inventories of various taxonomic groups (including primates, small mammals, carnivores and bats, birds, fish, reptiles and amphibians, ants and butterflies) have been conducted in Makira's forests and surrounding areas. The floral and faunal composition of Makira is still not fully known, but these preliminary inventories recorded at least 222 plant species (including about 43 species of palm, making Makira extraordinarily diverse area in terms of palms), 114 amphibian species, 62 reptile species, 101 bird species, 16 lemur species and subspecies (the highest diversity of lemurs found within any of Madagascar's protected areas) as well as 28 other mammal species (WCS, 2004; GERP, 2006; GERP personal communication, 2010).

Table 7: Species richness and endemism in the Makira area

GROUPS	Species richness	Endemism rate
Plants	222 +	
Mammals (including Primates)	47	45 (96%)
Birds	99	75 (76%)
Reptiles	62	62 (100%)
Amphibians	114	114 (100%)
Butterflies	145	122 (82%)
Freshwater Fish	117	19 (16%)

Major threats:

Among the most encountered threats to the biodiversity of Makira forests are forest clearing for rice cultivation, bush and forest fires, hunting for bushmeat, and small scale selective illegal logging and mining. Subsistence and economic pressures are principal drivers of these threats. Of these threats, the most ubiquitous and destructive to the forests is slash and burn agriculture (tavy). Tavy is a form of slash and burn agriculture that is used to cultivate rain-fed rice rather than irrigated rice. It is typically practiced in upland forested areas, after bottomlands have been fully exploited for paddy rice fields. Although tavy involves the clearing and burning of forests, it can be a sustainable form of agriculture in tropical forests and does not require clearing of old-growth trees as long as fallow periods are long and human population density low. In Madagascar, fallow periods should be at least 15 year (Ferraro 1994); however, limited land availability and increasing human population pressure have resulted in increased clearing of old growth forests and ever-decreasing fallow periods that quickly lead to unproductive lands.

Makira's management plan ranks slash and burnt agriculture as the highest threat to biodiversity and the main driver of deforestation. It is particularly intense on the edges of the forest blocks of the East and South East of Makira (See Figures 6 and 7).

Ongoing and well organized Illicit commercial extraction of quartz from Makira's southern forests outside the project area is promoted by wealthy buyers paying an average of US $2 per kilogram. Quartz mining by locally hired labourers uproots trees and fragments the forest at numerous excavation sites. Extraction typically occurs in remote pristine forest and mobility of the operations makes them difficult to monitoring (Dokolahy, 2004).

Opportunistic as well as targeted bushmeat hunting is driven by both subsistence and market demand. Research has found that twenty-one forest mammal species, including four carnivores, three bats and eleven lemur species are common hunting targets and hunting is largely unsustainable. Secondary effects of hunting include damage to forest structure due to the use of destructive traditional trapping techniques. For example, to trap lemurs, local hunters open a large path of forest clear forest to create a 10 by 200 m strip (locally named *'laly')* to place just one snare. The snare is placed like a "small bridge" that crosses the bare strip and is the only point where animals can cross (Golden 2005, GERP, 2006).

Figure 6: Pressures on the Makira biodiversity: illegal mining, fire, and hunting

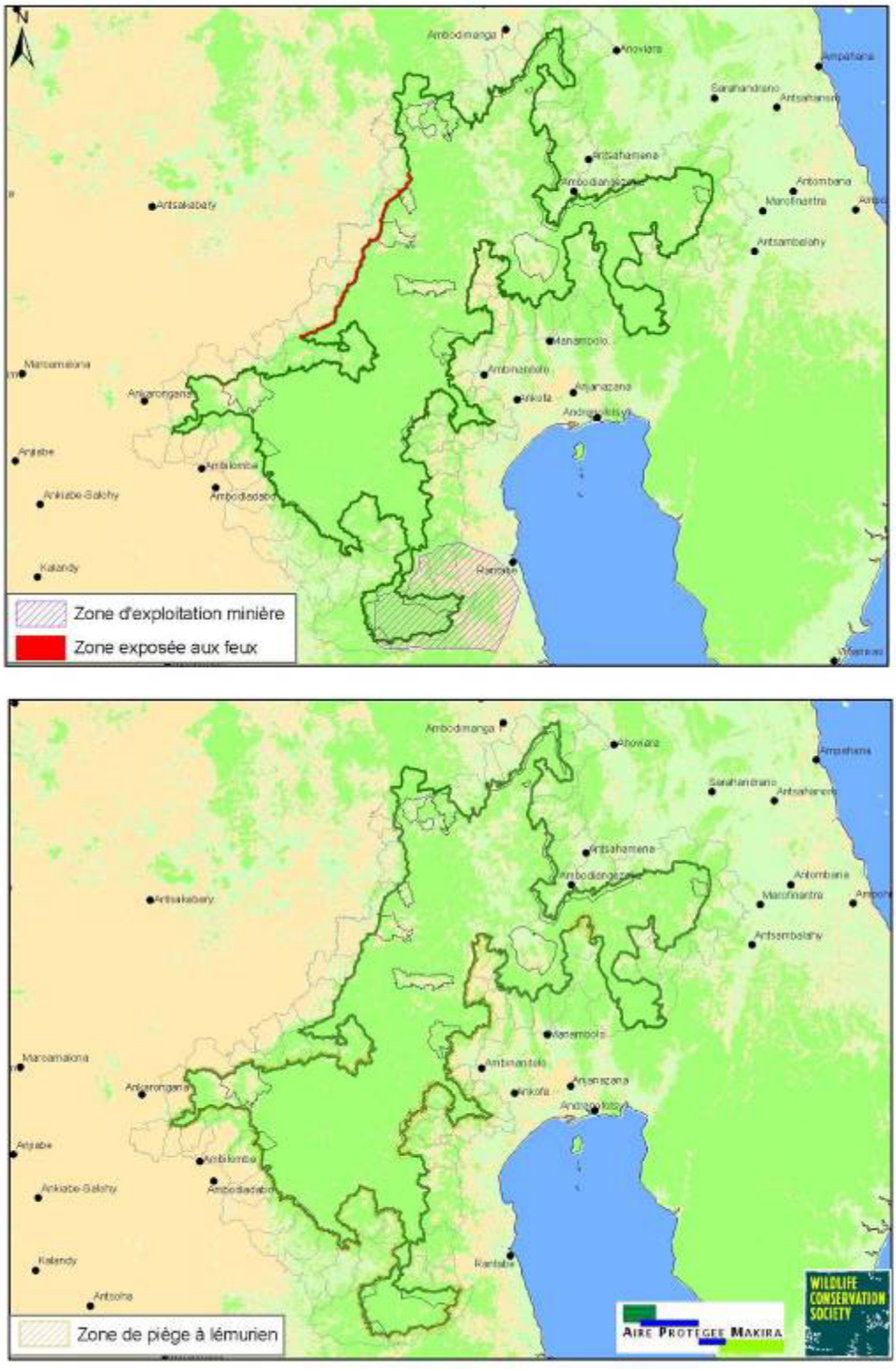
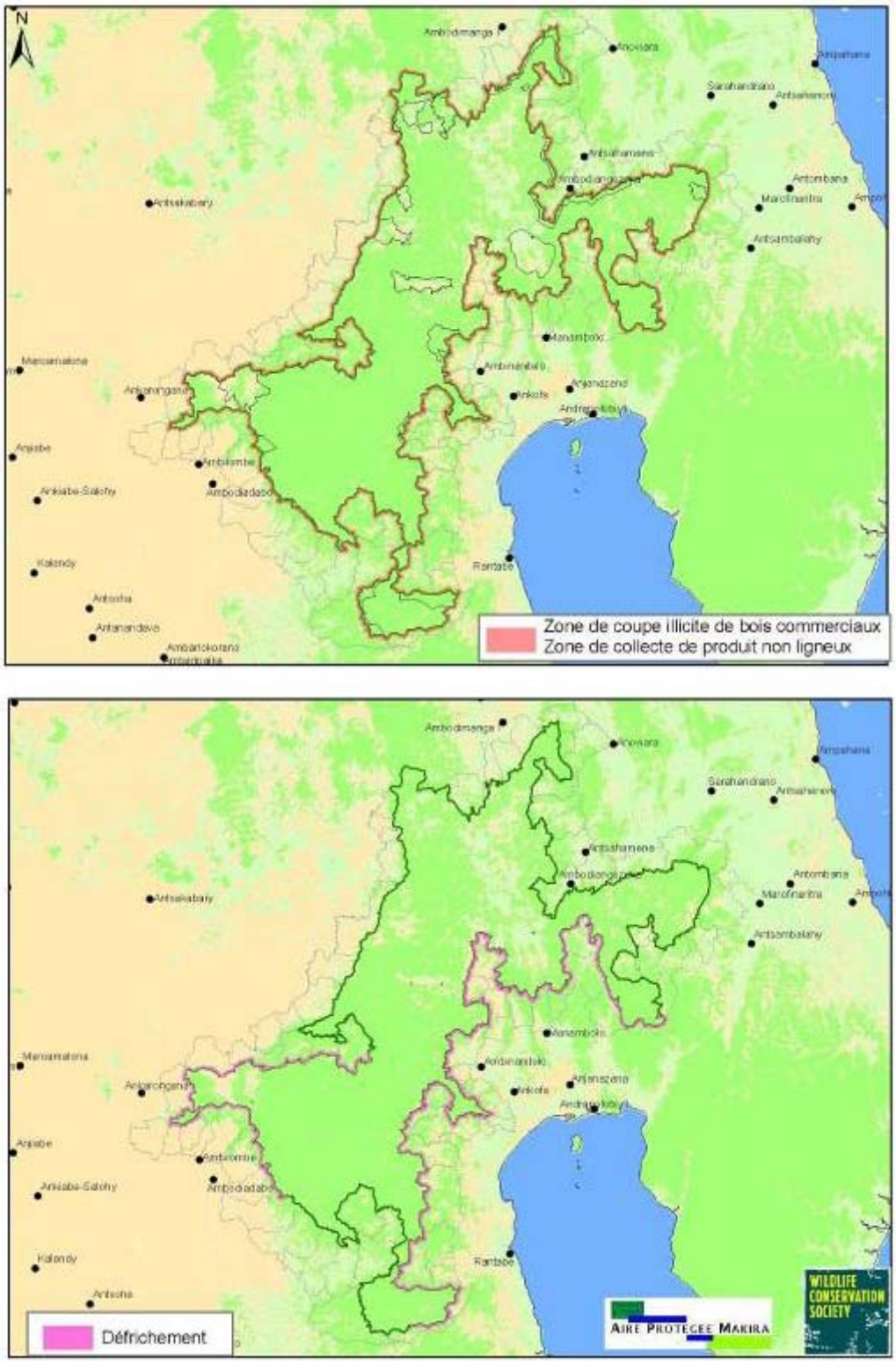


Figure 7: Pressures on the Makira Biodiversity: illegal logging, deforestation, and unsustainable gatherings of nontimber forest products



G1.8. High conservation values in the project zone

Within the Makira forest there are forest areas of both biodiversity and community High Conservation Value (HCV). The biodiversity-related HCVs were HCV 1 and HCV2; those related to the community were HCVs 5 and 6.

G1.8.1. Globally, regionally or nationally significant concentrations of biodiversity (HCV 1)

Fauna:

The Makira forests harbor an impressive faunal diversity – see also Section GL3 – that currently includes 20 of Madagascar's identified 97 lemur species (GERP 2006; Radespiel et al., 2008; Craul et al., 2008; Patel, 2009): currently the greatest diversity of lemurs existing in a single protected area, and the only protected area in which all of the 5 families of living lemurs are represented (GERP pers com, 2011). All Madagascar's lemur species are endemic to the island (Mittermeier et al., 2010). Recent inventories by le Groupe d'Etude et Recherche sur les Primates de Madagascar (GERP) carried out during May-November 2005 have resulted in the discovery of a new species of Microcebus – Microcebus macartherii (Radespiel et al., 2008). Additional surveys in 2007 lead to the discovery of the Silky Sifaka (Propethicus candidus) in the low altitude forests of Makira[18]. The Silky Sifaka was previously know to exist only in the high altitude forests of Marojejy National Park, and is identified as one of worlds 25 most endangered primates (Patel, 2009).

Extensive faunal diversity is also evident from the discovery of a new species of snake from the genus leophidium (Liophidium pattoni sp. n.) that was discovered in 2009 (Veites et al. 2009), as well as the discovery of a species of cichlid fish in the rivers of Makira (Ptychochromis sp. "Makira") (Sparks and Smith, 2004) and the identification of a new species of toad fish (Allenbatrachus meridionalis, Greenfield and Smith, 2004). Further to this, cursory sampling in tributary rivers in the region have led to the discovery of two new Bedotia species, a new Rheocles species, a new Gogo species and two new Ptychochromis species, and it is very likely that more intensive sampling in the rivers of Makira will lead to the discovery of additional undescribed Taxa (P. Loiselle pers com. 2011).

Flora:

Recent inventories carried out by Kew Gardens have led to the identification of 5 new species of palm, of which three species are critically endangered and two species classified as vulnerable (Rakotoarinivo et al., 2009). The results of this inventory identify Makira as a region of very high palm diversity, with a total of 43 species were recorded. With further inventories of the varied geological and elevations zones it is likely that Makira will prove to possess the richest palm diversity in Madagascar (Rakotoarinivo et al., 2009)

[18] Ratelolahy, J.F. and Raivoarisoa, F.J, (2007) Distribution et statut de population de Propithèque Soyeux (Propithecus candidus) dans la forêt de Makira, région d'Anjanaharibe, Nord Est de Madagascar. WCS tecnical Report.

Given its exceptional richness and high endemism rate, summarized in the table below, as well as the high number of IUCN Redlist species, Makira's biodiversity is nationally and internationally recognized as of exceptional biodiversity conservation value.

Table 8: Makira's IUCN Red List flora and fauna species

Taxa	Group	Endangered	Critically Endangered	Vulnerable	Near Threatened
Plants	Palms	*Ravenea albicans; Dypsis bejofo; Lemurophoenix halleuxii; Ravenea albicans; Ravenea julietiae; Ravenea jakatra; Satranala decussilvae*	*Dypsis ceracea; Voanioala gerardii; Dypsis brittiana; Dypsis humilis; Dypsis rakotonasoloi*	*Dypsis Ankirindro; Dypsis coursii; Dypsis fasciculata; Dypsis oreophila; Dypsis paludosa; Dypsis perrieri; Dypsis procera; Dypsis makirae; Marojejya insignis; Masoala madagascariensis; Orania ravaka; Ravenea dransfieldii; Ravenea sambiranensis*	*Dypsis confusa; Dypsis crinita; Ravenea robustior*
Mammals	Primates	*Indri indri* (Indri); *Varecia rubra* (Red Ruffed Lemur)	*Varecia variegata* (Black-and-white Ruffed Lemur); *Propithecus candidus* (Silky Sifaka	*Hapalemur griseus* (Eastern Lesser Bamboo Lemur); *Eulemur rubiventer* (Red-bellied Lemur); *Eulemur albifrons* (White-fronted Brown Lemur)	Daubentonia madagascariensis (Aye-aye)
	Carnivore			*Cryptoprocta ferox* (Fosa); *Fossa fossana* (Malagasy Civet)	*Galidictis fasciata* (Broad-striped Mongoose)
	Rodents			*Nesomys audeberti* (lowland red forest rat)	
	Insectivore			*Microgale dryas* (Tree Shrew Tenrec)	
	Chiropters			*Pteropus rufus* (Fruit Bat); *Emballonura altrata* (Sheath-tailed bat); *Otomops madagascari-ensis* (Free-tailed bat)	
Birds		*Ardeola idae* (Madagascar Pond heron); *Eutriorchis astur* (Madagascar Serpent Eagle)		*Tachybaptus pelzelnii ; Euryceros prevostii ; Oriola bernieri ; Mesitornis unicolor* (Brown Mesite); *Geobiastes squamigerus; Brachypteracias Leptosomus* (Short-legged Ground-Roller)	*Xanthomixis Cinereiceps; Lophotibis cristata; Atelornis crossleyi* (Rufous-headed Ground-roller)*; Accipiter madagascariensis* (Madagascar Sparrowhawk)
Reptiles				*Sanzinia madagasca-riensis* (Tree Boa)	
Amphibians		*Anodonthyla rouxae* (Roux' Bamboo Mycrohylid); *Plethodontohyla Brevipes; Stumpffia pygmaea*			*Mantella laevigata* (Green Mantella); *Mantidactylus elegans; Mantidactylus leucomaculatus*
Fish		Date Deficient	Date Deficient	Date Deficient	Date Deficient
Invertebr.	Butterflies				*Heteropsis ebennis*

G1.8.2. Globally, regionally or nationally significant large landscape-level areas with viable populations of most if not all naturally occurring species exist in natural patterns of distribution and abundance

The Antongil Bay watershed, which includes the Masoala Peninsula as well as the Makira Forest, is considerd to be the most floristically diverse in Madagascar (Missouri Botanical Garden, 2010) and certainly is disproportionately the richest part of island on the whole in terms of Biodiversity richness. In addition, some of the IUCN species are locally endemic to this large landscape that hosts their main naturally occurring, world populations. This locally endemic species include:

Primates:

- Theh Red Ruffed Lemur (Varecia rubra), found only in the forests of Masoala and Makira protected areas
- The newly discovered nocturnal lemur species Microcebus macarthurii (Radespiel et al., 2008), encountered only in Makira forests
- The Silky Sifaka (Propithecus candidus), which exists only in Marojejy (Queslin and Patel, 2008) and Makira (Patel, 2009) protected areas
- The Seal's Sportive Lemur (Lepilemur seali), which is currently only known to exist in the forests of Makira and Anjanaharibe region (Mittermeier et al., 2010).

Snakes:

- Liophidium pattoni sp. n., is only found in Makira (Vieites et al., 2010)

In addition to the above locally endemic species, Makira also protects viable populations of various species endemic to Madagascar, such as the less known Malagasy carnivores species that require large territories to maintain healthy populations. Principal among these area demanding species is the forest carnivore species the fosa, Cryptoprocta ferox. The fosa is an endangered solitary viverrid utilizing both arboreal and terrestrial habitats. It is the primary natural predator of lemurs and a target of hunting for pest control, and recent studies (Hawkins and Racy, 2005)[19] have found that the largest of Madagascar's currently protected areas, Masoala National Park, is still not large enough to support a viable population. Establishment of the Makira Forest Protected Area, which physically links to Masoala, see Figure 1, would provide critical habitat to ensure viable populations of this top predators.

G1.8.3. Threatened or rare ecosystems

Since 30% of the Makira Project is comprised of lowland humid forest (approximately 100,939 ha), it alone protects the largest area of this highly threatened habitat that remains in Madagascar. In addition, Makira is situated between the highly endemic forest areas of North-eastern

[19] Hawkins C. E. and P. A. Racey. 2005. Low population density of a tropical forest carnivore, Cryptoprocta ferox: implications for proptected area management. Oryx 39:1-9.

Madagascar (Marojejy, Masoala, Antsanaharibe and Tsaratanana). This position is ecologically important as Makira serves as a critical "corridor" between these areas, enhancing genetic exchange between populations of various mobile taxa.

G1.8.4. Areas that provide critical ecosystem services

The Makira forests provide watershed protection and modulation of catchment water flows, both of which are vital to the agriculture-based economy of the region. For instance in 2003, 95% of the revenue generated in the landscape came from agriculture, including 41% from rice and 27% from cash cropping (Holmes, 2007). Makira's forests also regulate water supply to lowland areas, and prevent erosion during cyclones, thus reducing sedimentation and reef damage in Antongil Bay. Furthermore, at the "Vodiriana" waterfall on the Makira River is used to generate hydroelectric power for the town of Maroantsetra and is seen as a vital source of renewable power for the economic development of the region. A sustained flow of water with low-sediment loading is essential to the efficient functioning of this hydroelectric plant.

An ecosystem services valuation study carried out in 2008 estimated the total value of ecosystem services provided by the Antongil Bay landscape to be approximately US $2,884.50 billion per annum, with carbon storage, genetic materials, recreation, erosion control and pollination values representing the largest share of these benefits (Masozera, 2008). While watershed services (water supply and water regulation) appear to contribute the least value in the Makira landscape due to gaps in peer-reviewed literature, they are the most important and critical ecosystem services to the local population and the regional economy.

G1.8.5. Areas that are fundamental for meeting the basic needs of local communities

Most local people living within the project zone are dependent on resources gathered in the forests, at minimum for part of the year. Key resources that they gather from the forest include firewood, poles for building, medicinal plants and food. Alternatives to these are still not available to local people. Full details of how local people use forest resources to meet their basic living needs are already given in Section G1.5.

G 1.8.6. Areas that are critical for the traditional cultural identity of local communities (areas of cultural, ecological, economic or religious significance identified in collaboration with the local communities).

The project zone is not critical to the traditional cultural identity of the local communities in that no indigenous peoples (according to the UN definition[20]) live there. The whole community is a mixture of various ethnical groups encountered across the country. No sacred forest and active tombs exist within the Makira forests, and traditional rituals do not have a negative impact on natural resources. Moreover, the process of delimitation of the Makira Park (see Sections G1.6

[20] http://www.un.org/esa/socdev/unpfii/en/declaration.html

and G3.2) included village-by-village discussions concerning, among other issues, sacred areas. This process ensured that any areas of sacred value to local communities would be either excluded from the park or zoned for specified access. The only exception could be the old tomb located in Amparihimolengy, south-west of Makira. While the tomb is no longer active (not used for new burial), a few families continue to come to perform a joro[21] and implore the benediction from their ancestors (WCS Makira Project PGES, 2008). See also Section G3.6.

G2. Baseline Projections

This section of the Project Design Document provides information on the expected conditions in the project zone in the absence of project activities.

G2.1. Most likely land-use scenario in absence of project

Analysis of deforestation and forest degradation in Makira:

The communities living in the periphery of the Makira Forest Protected Area are mostly farmers and their subsistence mainly depends on rice production. For most of the households, forest is first and foremost a stock of arable land, above harvesting forest products, logging, or collecting non-timber forest products.

Currently, the main causes of deforestation and degradation of the Makira forests, as well as the current land uses, are as follows:

Forest conversion for agriculture:

Makira's management plan ranks slash and burn agriculture for rice cultivation (tavy) as the main driver of deforestation. Farmers practice it particularly on the edges of the forest blocks of the East and South East of Makira. Forests or fallows are first cut then burned and then rain-fed rice is cultivated. Usually lands are left after 1 or 2 years of production and farmers move to another place. As explained in Section G1.6 on the customary tenure system, forest conversion for agriculture is a way for local people to gain both legitimate ownership and recognition of land ownership. Clearing forests to extend agricultural lands is common even in forest stands that are part of the government forest estate (such as classified forests) and cannot be properly controlled by the authorities.

Uncontrolled expansion of small-scale and illegal mining:

Makira potentially has important mineral resources spread throughout the project zone, including gold, marble and quartz. Currently, illegal mining activities taking place in the region directly contribute to deforestation and forest degradation. The southern part of Makira is the most

[21] Joro : a simple ceremony to implore benediction from Gods and ancestors during which people make a symbolic offering of honey, rice, alcool, zebu and so on.

impacted. Here quartz is quarried and sold to wealthy, well organized by buyers. Mining for quartz uproots trees and fragments the forest at a number of sites. Mining typically occurs in remote, pristine forest areas and the high mobility of the miners makes monitoring difficult (Dokolahy, 2004). In addition, the local authorities have very limited means to prevent such illegal activities.

Clearing of forests for pastures:

This concerns the western part of the Makira area, where there are local people who raise cattle. In this area, cattle are grazed over extensive areas and a common practice is to burn grasslands, savannah-type areas and forest edges just before the rainy season to ensure renewal of pasture. This practice degrades intact forest edges and can even destroy already degraded stands. Local people also frequently graze cattle within the forest and use it as a place to guard their cattle against theft (it is more difficult to steal livestock in the forest than in hamlets and villages).

Illegal small-scale logging:

Fortunately for the Makira forests, illegal logging is still very localized and isolated. It is thus not considered as an important driver of forest degradation in the Makira area because of the difficulty in accessing much of the area and in transporting timber out. There have, however, been reported cases of small-scale illegal logging during the 2009-2010 outburst of illegal logging of commercially valuable species. Estimates have been made that upwards of 52,000 tons of rosewood (*Dalbergia*) and ebony (*Diospyros*) have been removed from the greater northeastern forest landscape as of 2010: of this estimated 52,000 tons 1/3 or 17,500 tons is considered to have come from Marojejy NP and its environs while 2/3 or 34,500 tons is considered to have come from Masoala NP[22]. The Makira Protected Area landscape has not been left untouched by these events, however, the degree of impact has been considerably less: the current estimates of precious woods removed from the boarder forests of the Makira Protected Area are 560 tons[23]. This figure from Makira likely contributed to the total amount estimated to come from Masoala, as opposed to being additional.

The main underlying drivers of deforestation and degradation to consider for the Makira Project include the following:

Rapid population growth:

Estimated at 3 % annually in the Makira area, a burgeoning population has increased the demand for new arable land and all forest resources.

[22] Randriamalala, H and Z. Liu, 2010, Rosewood of Madagascar: between democracy and conservation. Madagascar Conservation and Development 5:11-22.

[23] Pers Comm. Valina Andriamaholy, National Director, Makira Natural Park.

Open access to forest resources and forest land:

This situation has exacerbated the impacts of population growth on deforestation and degradation.

Poverty and precarious livelihoods of households:

The main sources of household income include agriculture and extraction of forest products. Households cannot meet their basic subsistence needs through tavy on existing cropland because of low productivity. Therefore they need to make up the deficit through growing cash crops such as vanilla and cloves. However, the large fluctuations in the prices of these crops forces farmers in bad years to find other ways of earning more money. Local people have very little access to markets, credit and agricultural extension services. They have no margin of manoeuvre to undertake more sustainable agricultural practices or livelihood strategies that are not linked to forest resources. Consequently they are locked into unsustainable production systems that drive deforestation as the only alternative to many of them is to increase their area of cropland by clearing new forest.

Lack of financial incentives for sustainable resources use:

Households do not necessarily understand the reasons for forest preservation and its potential benefits. In their eyes, forests are potential agricultural lands.

Political, economic, and social instability:

As observed from all previous crises, political instability has often been accompanied by abusive exploitation and destruction of natural resources, particularly by wealthy and politically connected outsiders. The atmosphere of political instability weakens the state authority, which is already largely ineffective in enforcing environmental laws. As a result, natural resources tend to be treated as open access resources to be exploited as quickly as possible with little regard to the law.

Lack of resources at the level of the government Forest administration:

The Office of the Environment and Forests in Maroantsetra, Andapa and Mandritsara are understaffed and must work within limited budgets. Consequently they do not have the material means to regulate forest use and enforce the law.

Using the threats analysis of the Five-S framework for Site Conservation of The Nature Conservancy, the relative importance of the different drivers is estimated as follows (WCS Makira Project PAGS, 2008):

Table 9: Importance of deforestation drivers in the Makira forests

Driver of Deforestation	Agents of deforestation	Contribution to deforestation
Slash and Burnt cultivation (T*avys*)	Local communities	Very High
Small scale illegal mining	Migrant miners	High
Clearing of forests for pastures	Local communities	Medium

Source: WCS Makira Project PAGS, 2008

Alternative land uses scenarios in the absence of the project:

This step serves to identify alternative land use scenarios to the proposed VCS AFOLU project activities that could be the baseline scenario. The most recent VCS additionality[24] tool was used to guide the identification of the most likely land-use scenario in the absence of the Makira Project and to demonstrate additionality from the project. The following are a list of pre-project scenarios and other land uses that constitute plausible alternatives in the absence of the Makira Project:

Scenario 1: Slash and Burn (Tavy) conversion to agriculture and agroforestry

Due to a combination of increasing human populations, limited land availability and the weak farm yields as a result of traditional techniques practice, farmers need to clear more and more forests to produce rice. The slash-and-burn cultivation is a common practice in this area to convert forests into rice paddies fields. This practice is part of the culture of the Betsimisaraka, the main ethnic group in the area. In a later stage, abandoned Tavy are frequently converted into agroforestry systems. Agroforestry caters for many subsistence needs, supplying vegetables, spices, fruits, nuts, medicine, fuel wood, timber, and fiber that can be harvested throughout the year. In the case of coffee and vanilla they can also offer year round income, in addition to rice cultivation as source of income.

Scenario 2: Burning of forest for conversion to land for cattle grazing

On the western side of the Makira project extensive cattle breeding is a common practice and forests are burned to ensure pasture renewal. Farmers rarely control fires, which degrades the forest edges and can under certain circumstances lead to the destruction of important parts of forests.

Scenario 3: Concessions for commercial logging

With growing demand for forest products and declining supply, the Makira forests could be transformed into a "site koloala". Koloala sites have been identified to satisfy the needs for timber and contribute to the economic development through sustainable management and use of forest

[24] "Tool for the Demonstration and Assessment of Additionality in VCS Agriculture, Forestry and Other Land Use (AFOLU) Project Activities (Version 1.0., May 21, 2010)

lands outside current and proposed Protected Areas. In this case the Makira forests could become the subject of authorisation for commercial exploitation of any tree species but especially for hardwoods such as nanto (*Sideroxylon spp*) and hintsy (*Intsia bijuga*), and precious woods such as rosewood (*Dalbergia spp*), "bois de rose" (*Dalbergia spp*) and ebony (*Diospyros spp*).

Scenario 4: Concession for commercial mining of quartz and precious stones

The Makira area includes a variety of geological formations and thus is of interest to both small-scale and industrial mining companies. For example, in 2004, almost the entire area of Makira forests have been the object of a request for an exploration permit by the Ampanihy resource Company for several substances including in particular quartz, gold and diamond (see "carreaux miniers" in figure 15.

Scenario 5: Creation of a protected area outside REDD

The Makira forests are considered one of the last big block of intact natural humid forest in Madagascar and is therefore identified in inter-ministerial order 18 633 as one of the priority zones for biodiversity conservation.

Scenario 6: Unsustainable harvesting of non-timber forest products

Local communities collect various non-timber forest products, including honey, tubers, medicinal plants and so on. While those activities are mostly for local consumption as part of a customary rights of local communities and therefore not destructive, they could become very intense in time of shortage and become unsustainable when practiced with commercial targets. One particular example is the medicinal plant *Prunus Africana*, locally known as Kotofihy, a species that has almost disappeared outside the Makira area. Commercial demand for Kotofihy stems from a bark extract that is used Europe and the United States for prostate treatment and Madagascar is the second largest supplier globally (Andro, 1995[25], (Cunningham et al., 1997[26]). This activity represents an important source of income for local communities and as bark harvesters do not respect the methodology, cut even small trees, and also hunt animals and collect other non-timber forest products, his project could cause degradation in large parts of the western Makira forests.

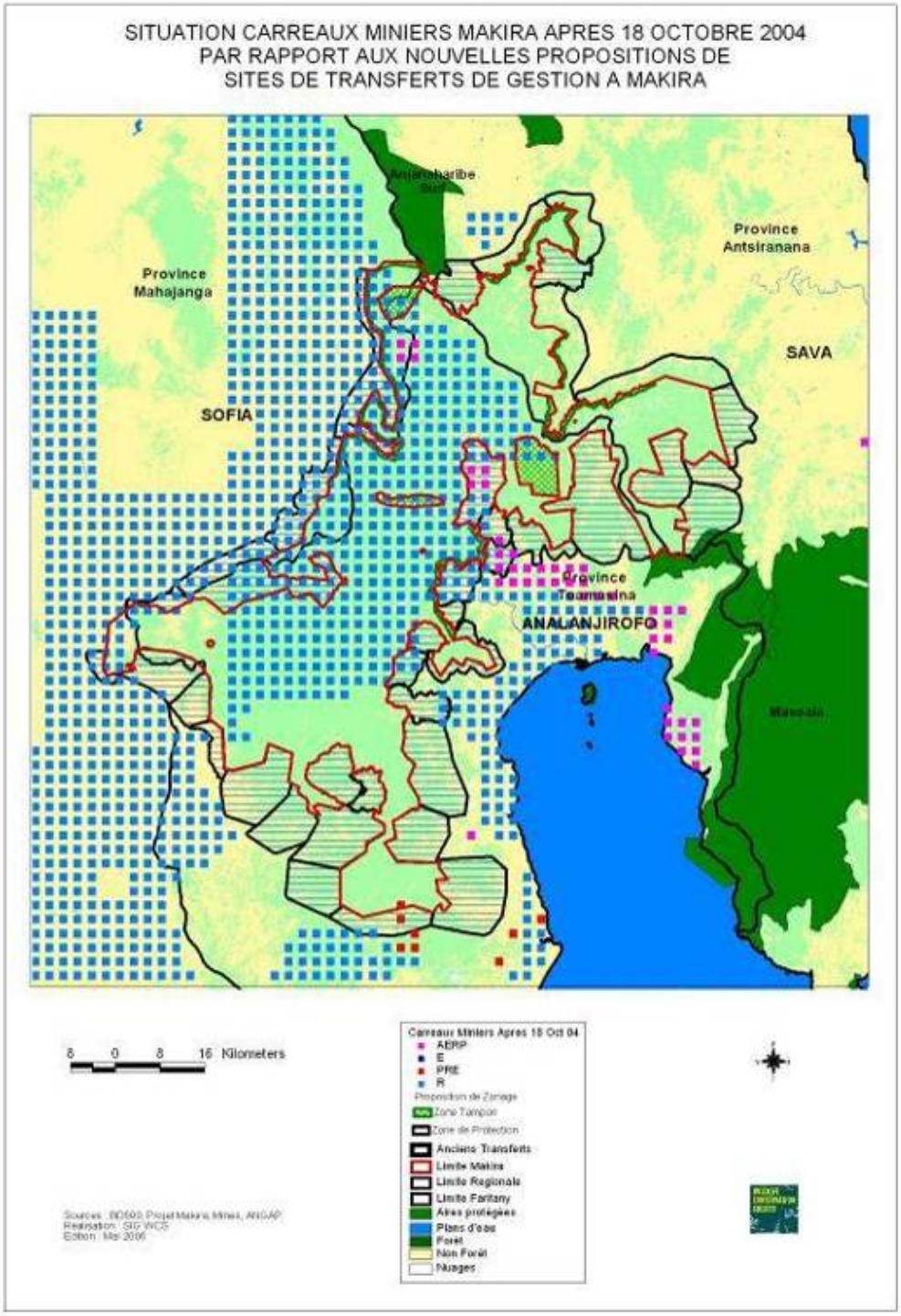
[25] Andro, M. C. and J. P. Riffaud. 1995. Pygeum africana extract for the treatment of patients with benign prostatic hyperplasia: a review of 25 years of published experience. Current Therapeutic Research 56:796-817. Barbour, M. G., J. H. Burk, and W. D. Pitts. 1987. Terrestrial Plant Ecology. Benjamin/Cummings Publishing Co. MA

[26] Cunningham, M., A. B. Cunningham, and U. Schippmann. 1997. Trade in Prunus africana and the implementation of CITES. Results of the R+D-Project 808 05 080. German Federal Agency for Nature Conservation. Bonn, Germany

Scenario 7: Illegal small-scale logging and mining

A final land use scenario that has already taken place in the region is the illicit small-scale commercial extraction of a range of forest products by outsiders, including logging of precious hardwoods for international traffic, and quartz and gold mining.

Figure 8: Requested mining permits in the Makira region in 2004



G2.2. Documentation that project benefits would not happen in absence of project / project 'Additionality'

Plausible alternative land use scenarios to the proposed project activity:

This section analyses how far the credible alternative land use scenarios presented above are consistent with laws and regulations, and if relevant legislation is enforced by the administration and other actors. The analysis does not consider laws, statutes, regulatory frameworks or policies implemented since 11 November 2001 that give comparative advantage to less emissions-intensive technologies or activities relative to more emission-intensive technologies or activities.

Scenario 1: Slash and Burn (Tavy) conversion to agriculture and agroforestry

Tavy is de facto forbidden and usually no permits for deforestation are issued by the regional forest service. However, this regulation is not enforced and one should note that despite the fact that Makira has been a classified forest since 1958, a designation that means it is under the jurisdiction of the MEF, this status has had no influence on how the land has been used. MEFT held the legal authority over most of Makira's forested area, but the ministry had (and still has) inadequate resources (e.g. lack of staffing, materials and equipment) to effectively manage this forest estate. This lack of enforcement capacity is compounded by multiple other factors –inadequate policies, outdated regulations, limited communications, failure in judicial pursuit of offenders, paucity of financial resources to implement environmental policy, subsistence and economic pressures from an expanding human population and lack of regional land use planning – all of which resulted in the increased pressures and threats of deforestation and fragmentation to the Makira forests. Further access to forest resources outside protected areas is completely unregulated. People perceive land within the classified forests to be potentially available for production and have little incentive to address the need for sustainable land use. Much exploitation is being done within natural forests with no permits at all.

As mentioned above, conversion of forests to agricultural lands through tavy is a very common practice in the Makira region and the most important threat to forest lands. In consequence, the risk for conversion of forest to agriculture and agroforestry in absence of the proposed VCS AFOLU project activities is considered very high, particularly in the Southern, Eastern and Northern parts of the project area.

Scenario 2: Burning of forest for conversion to land for cattle grazing

The use of fire to regenerate pastures is not allowed all over Madagascar but is impossible to be enforced by the administration as show the extensive fires occurring every year throughout Madagascar and particularly in the areas where cattle herding is significant.

In absence of the proposed project activities, the risk for an extension of pasture lands by burning the forest is considered relatively high in the western part of the project zone only. In the other parts this risk appears to be relatively low because of the livestock is much less important.

Scenario 3: Concessions for commercial logging

The Makira forest has not been identified as a KoloAla site by the ministerial order 18 633, but this would certainly be a plausible option in the absence of the protected area. In any case, even in the absence of the KoloAla site the forest could be attributed to private operators or local communities for commercial logging.

There are certainly good chances for the transformation of the Makira forests into a KoloAla site if the VCS AFOLU project were not in place. However, as the KoloAla site are also to be managed in a sustainable manner and wood harvesting in the North-Eastern parts of Madagascar is traditionally quite selective, the risk for increased deforestation under this scenario is considered relatively low.

Scenario 4: Concession for commercial mining of quartz and precious stones

In 2008, an inter-ministerial order[27] suspended the issuance of mining permits in existing protected areas, priority sites for new PAs and KoloAla sites, as well as other zones considered important for biodiversity conservation. As the entire Makira forest is among the priority conservation sites in the country, issuance of mining exploration and exploitation permits has to be considered illegal, even if the project area were not integrated into a new protected area.

Scenario 5: Creation of a protected area outside REDD

Creating an new protected area integrated into the national PA network of Madagascar National Parks (MNP) would be absolutely consistent with the national policies promoting the extension of the PA network and also the identification of priority zones for biodiversity protection provided by inter-ministerial order 18 633.

However, this scenario does not seem to be very plausible mainly because the management and funding capabilities of MNP are already stretched and the integration of a protected area the size of Makira seems very unlikely. Also, MNP already manages two protected areas pretty close to Makira (Marojejy and Masoala) and which makes the creation of a new protected area under traditional funding even more unlikely. Finally, there haven't been any other conservation / forest protection measures within the project area prior to the VCS AFOLU project.

[27] Arrêté interministériel 18 633 / 2008 / MEFT / MEM portant mise en protection temporaire globale des sites visés par l'Arrêté interministériel n° 17914 du 18 octobre 2006 et levant la suspension de l'octroi des permis miniers et forestiers pour certains sites

Scenario 6: Unsustainable harvesting of non-timber forest products

Communities living close to forest resources are granted the right to collect non-timber forest products from state owned forests. This does in theory not include the commercial sale of these products, but this regulation is extremely difficult to enforce for the responsible administration. In any case, permits can be issued for the commercial harvesting all these products to local people and foreigners by the forest administration. This is best regulated for the kotofihy bark mentioned above because *Prunus africana* is one of the species included in annex 2 of the International Convention on the International Trade of Endangered Species (CITES).

The risk for this scenario to happen in absence of the proposed project is therefore considered relatively high. However, collection and harvesting of non-timber forest products has usually only very limited impact on the remaining resources, leading to a certain degradation but not to deforestation.

Scenario 7: Illegal small-scale logging and mining

This activity is of course illegal but the recent evolution around illegal harvesting of precious timber in the North-East of Madagascar shows clearly how difficult it is for the forest administration to enforce these regulations and laws. With a growing demand for precious timber on the national and some international markets the risk for this scenario to happen in absence of the VCS AFOLU project appear to be relatively high.

The list of plausible alternative land use scenarios to the VCS AFOLU project activity that are in compliance with mandatory legislation and regulations taking into account their enforcement in the region is as follows:

- Tavy conversion to agricultural and agroforestry land
- Burning for pastures extension
- Legal commercial logging
- Unsustainable harvesting of non-timber forest products
- Illegal small-scale logging and mining

The most plausible baseline would be a mixture of different land uses including slash and burn agriculture, unsustainable illegal harvesting of timber and non-timber forest products, burning of forest land for cattle grazing, illicit commercial exploitation of the forests' hardwood species, and illicit commercial mining of quartz and precious stones. Food competition, induced by population increase and the livelihoods needs associated with it (for shelter, medicine and fuel, plant species used by the lemurs collected and used by humans) exerts specific pressure on the flora.

Without the project, all these pressures would have continued – as this is common practice - and increased proportionally to the human population growth rate that averages 3% annually; deforestation rates in the absence of the project were estimated at 1,500 hectares per year[28].

Investment analysis:

As described in Section 1.4, the activities of the Makira project revolve around four components:

- Creation and management of the Makira protected area
- Development of co-management structures for the Makira protected area
- Building structures and capacities for local sustainable resources management in the surrounding community managed areas
- Support rural development and alternative revenue creation.

It is expected that the Makira VCS AFOLU project will not generate any financial or economic benefits other than the carbon revenues generated through the emission reductions. In accordance with the requirements of the used additionality tool, we therefore proceed only to a simple cost analysis in the sections below.

As for the project, costs as shown in the Makira Project 10 Year Financial Plan (available for validation), the annual average expenditure for the project implementation is estimated at US$1,200,000 of which:

- 23% (US$ 280,000) would be spent on research and protection. This includes patrolling, research and inventories, ecological monitoring, and so on;
- 66% (US$ 800,000) on support to community development and outreach activities including community-based natural resources management, capacity building, alternative sustainable livelihoods, promotion of income generating activities, information, environmental education, communication, ecotourism, and population health;
- 11% (US$ 130,000) on project administration.

It is considered that these investments in the management of the Makira protected area and the surrounding community managed areas will not generate any benefit to the investor for the following reasons:

- Income from eco-tourism seems to be the only plausible potential economic benefit from the creation of the Makira protected area. However, the project activities do not support the development of eco-tourism activities in the Makira forest through the creation of appropriate infrastructure or increased marketing. Eco-tourism is promoted in the surrounding community managed areas but the project promoter would not benefit from these activities.

[28] Meyers David. 2001. Makira Forest Project, Madagascar. Report to the Ministry of Environment. MEF-IRG/PAGE-USAID

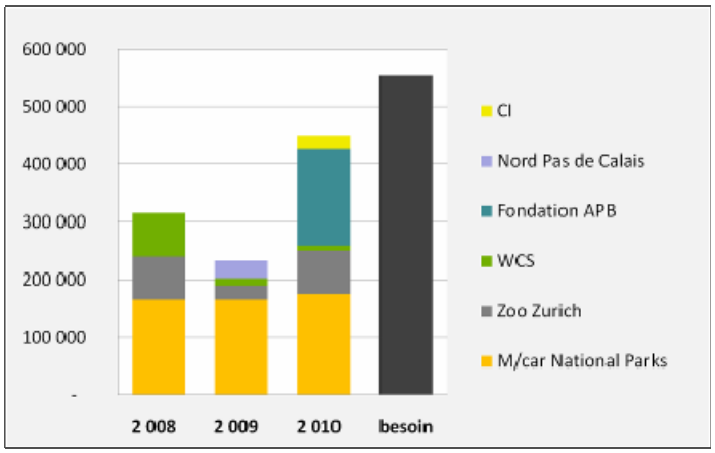
- The main activity for reducing emissions from deforestation and forest degradation is the creation of a new protected area including a zone of integral protection as well as several zones for local use and local communities. As the boundaries of the project area correspond exactly with those of the new protected area it can be argued that the other activities of the project, particularly the support to local communities for alternative revenue creation, are not directly linked to reducing deforestation in the project area but instead related to leakage management in the leakage belt. In any case, potential financial and economic benefits from the implementation of project activities will go mostly to local communities and not to the project proponent as return on investment.
- Finally, the proponent of the Makira project, the Wildlife Conservation society, is a not for profit organization and the project is designed in a way where all benefits will be reinvested in the implementation of the project activities.

Common Practices analysis:

Not dissimilar to most developing countries, the Government of Madagascar has a very limited budget to support environmental actions. Recent studies estimate that Madagascar's current protected areas system is still under-financed by an estimated US $3-10 million annually. Hence, the project would not have been financially possible in the absence of carbon financing. IN fact, as mentioned in Section 1.4, from the outset, the Makira project has been developed as a pilot REDD project in the country, The project was initiated with a long-term sustainable financing objective, and specifically as a pilot carbon project in Madagascar, it was designed so that all of its components and activities would concur directly or indirectly towards the GHG emissions reduction objective.

In the entire country, there is currently no other project of the same scale. The only one that could be considered common practice is Masoala National Park, the largest National Park in Madagascar (230,000 ha compared to 372,470 ha for Makira). It is located in the same landscape and has the same socio-economic context as Makira. Created in 1997, this Park is still currently suffering from a lack of funding. The annual revenues from tourism of about US$ 14'000 are very far from sufficient to meet the Park's running costs estimated by MNP at more than US$ 550'000 per year. Even with the different grants and funding supports from various financial partners, the Park still functions far below the standard.

Figure 9: Evolution of Masoala National Park funding from 2008-2010



(Source: extract from a presentation given by the Park Director in 2010)

G2.3. Calculation of estimated carbon stock changes in absence of project

Carbon stocks:

As already mentioned above, the carbon pools considered by the Maira project are aboveground and belowground tree biomass, dead wood biomass and (for the post deforestation stratum only) aboveground non-tree biomass. Results of the carbon inventory and the carbon stock estimates in these pools are preseted in detail in Section 1.4 and Table 2.

As for the sources of greenhouse gas emissions included in the project, only CO_2 emissions from biomass burning are included in the baseline scenario and will be counted as carbon stock changes. Other gases from biomass burning as well as other greenhouse gas sources are considered not significant and have been conservatively excluded from the baseline (cf. Table 8).

Table 10: Emission sources and greenhouse gases under baseline and project scenario

Source		Gas	Included?	Justification/Explanation
Baseline	Biomass burning	CO_2	Included	Main source of GHG emissions in baseline
		CH_4	Excluded	Non significant and conservatively excluded
		N_2O	Excluded	Non significant and conservatively excluded
Project	Biomass burning	CO_2	Excluded	Counted as carbon stock change under the baseline scenario
		CH_4	Included	Conservatively excluded from the baseline scenario but included if fire occurs in the project scenario
		N_2O	Included	Conservatively excluded from the baseline scenario but included if fire occurs in the project scenario
	Combustion of fossile fuel	CO_2	Excluded	Not a significant source
		CH_4	Excluded	Not a significant source
		N_2O	Excluded	Not a significant source
	Use of fertilizers	CO_2	Excluded	Not a significant source
		CH_4	Excluded	Not a significant source
		N_2O	Excluded	Not a significant source

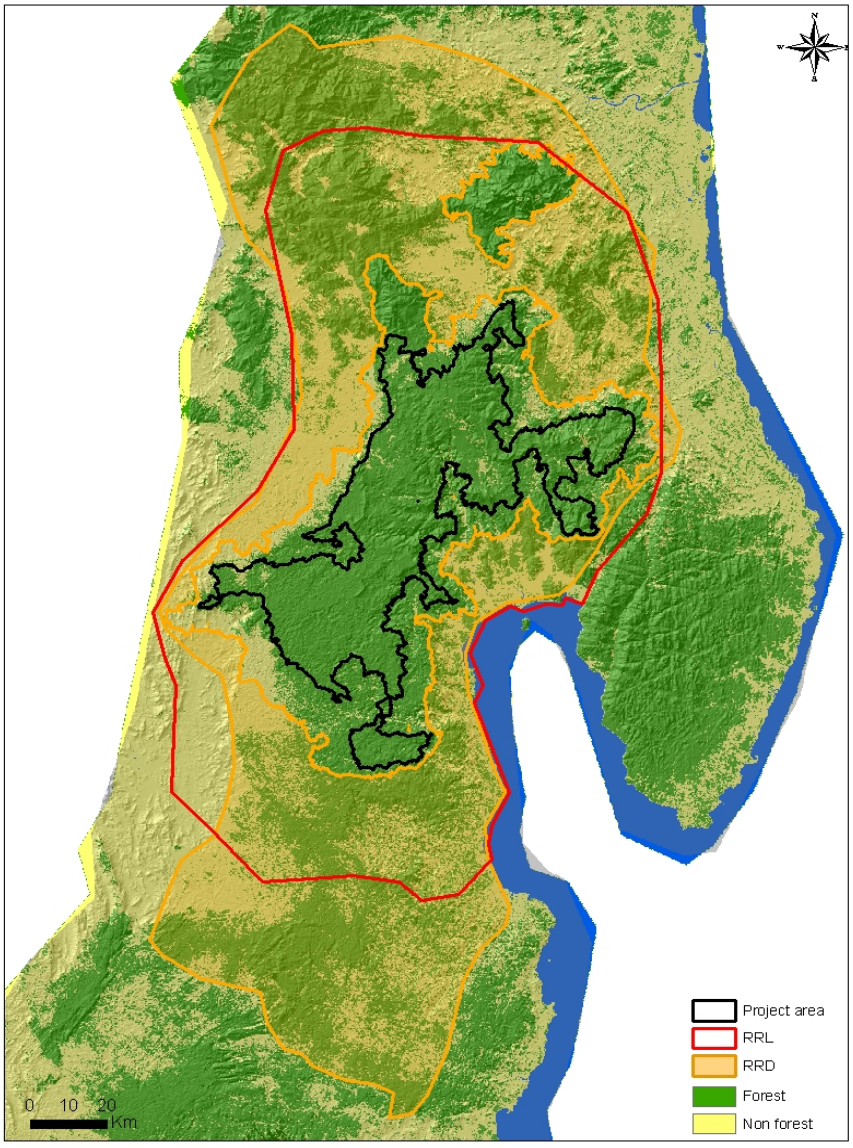
Project boundaries:

For the estimation of carbon stock changes in absence of the project (baseline carbon stock changes) it was essential to define the spatial and temporal boundaries of the Makira project.

Spatial boundaries:

For all climate related aspects in the PDD, the forests inside the protected area constitute the project area, while the forests in the protection zone managed by local communities constitutes the leakage belt. Non-forest areas in the project zone (protected area or protection zones) are considered leakage management areas. In addition, one reference area for evaluating deforestation (RRD) and one reference area for localisation of future deforestation (RRL) have been identified based on the applied methodology for VCS certification and are presented in figure 10 below.

Figure 10: Map of climate related project area and reference areas



The following sections discuss the criteria that have been applied for the selection of the different areas:

(i) **Project Area (PA):**

According to VCS guidelines, the project area is defined as the area or areas of land under the control of the project participants on which the project proponent will undertake the project activities. Thus for the Makira PA project, the project area is comprised of all the forests within the Core Protected Area and excludes forests in the rotection zone managed by local communities at the beginning of the project (cf. figure 4). The total area of the Makira project area at the start of the project period is 361,880 hectares (cf. Table 1).

(ii) **Leakage Belt (LB):**

Activities that deforestation agents would implement inside the project area in the absence of the REDD project activity could be displaced outside the project boundary as a consequence of the implementation of the REDD project activity. In order to take into account these displaced emissions in the calculations of the overall emission reductions of the project, it is therefore required to define a leakage belt in which the impact of activities displaced from the project area will be estimated (ex-ante) and monitored (ex-post).

In the case of the Makira project the leakage belt is made up of the protection zone constituted by the community management areas around the protected area (cf. figure 4) and covers a total area of 335,173 ha of which 245,176 ha were forested in 2005 at the beginning of the project period (cf. Table 1). This delimitation of the leakage belt complies as follows with the criteria set by the applied methodology:

- With a total area of 335,173 ha the forests in the leakage area represents more than 90% of the project area and therefore fulfil the minimum area requirements mentioned in the applied methodology.
- As the leakage belt is composed by the community managed zones surrounding the project area it's forests are the forests closest to the project area.
- Delimitation of the community forest management zones were based on the accessibility of the forests to the local communities and the forest can thus be considered accessible and reachable by baseline deforestation agents.
- Landscape aspects (forest types, soils, slope and elevation), accessibility aspects (proximity of navigable rivers and roads and distribution of settlemetns), social factors and relevant policies and regulations seem to be similar in the project are and the leakage belt, although the fact that the leakage belt surrounds the project area leads to certain differences mainly concerning altitudinal range and inconsequence also forest types in the leakage belt.

(iii) **Reference area for projecting rates of deforestation (RRD):**

The reference area for projecting rates of deforestation is the spatial delineation of the analytic domain from which information about regional rates of deforestation was obtained, projected into the future and will be monitored. In the case of the Makira project, the RRD is

contiguous with the project area and extending to the north and to the south of it along the main forest corridor. The RRD does not include the community-managed areas surrounding the protected area as shown in figure 4. The reference region chosen for the Makira project is considered representative of the general patterns of unplanned deforestation that are influencing the project area. In other words, the forests in the reference area for deforestation were under similar deforestation pressures at the beginning of the historic reference (1996) period as the project area at the beginning of the project period (2005). More specifically, the following criteria have been used for guiding its delimitation:

- The chosen RRD covers a total area of 949,795 ha (cf. Table 1) and was entirely forested at the start of the historical reference period. It therefore complies with the minimum size requirements for the RRD defined by the applied methodology.
- The main agents of deforestation in the Makira are small-scale subsistence farmers living at the forest edge. This is especially the case in the east of the project area, while in the west conversion of forests for cattle grazing also plays a certain role. As the selected RRD is constituted by parts of the same forest corridor to the north and to the south of Makira, it contains this same East-West gradient and it can therefore be expected that the main agents of deforestation in the RRD at the start of the historic reference period were similar to those expected to cause deforestation in the project area during the project period.
- The proportion of deforestation agents resident in the area versus immigrant deforestation agents seems to have been similar in the RRD in 1996 and in the project area.
- Resources management rights seem to have been similar in the RRD at the start of the historic reference period to what they are currently in the project area. Especially there were no forest management transfers in the refernce area in 1996 as was the case in the project area and urrounding protection zone at the beginning of the Makira project. Also, all existin proteted areas have been excluded from the RRD.
- Landscape aspects (forest types, soils, slope and elevation), accessibility aspects (proximity of navigable rivers and roads and distribution of settlements), social factors and relevant policies and regulations seem to have been similar in the RRD in 1996 to the current situation in the project area.

(iv) **Reference area for projecting location of deforestation:**

The reference area for projecting location of deforestation is the spatial domain from which information about spatial patterns of deforestation was obtained and projected into the future. In the case of the Makira project, the chosen RRL is similar to the RRD but also includes the project area as well as the leakage belt, in accordance with the applied methodology (cf. figure 6). This reference area for projecting location of deforestation fulfils the following requirements imposed by the applied methodology:

- With a total of 1,085,652 ha at the start of the historic reference period, the forested area inside the RRL is about 15% bigger than the reference area for projecting deforestation, corresponding with the 25% maximum threshold mentioned by the applied methodology (cf. Table 3).
- At the start of the historic reference period, the chosen RRL included more than 5% non-forested areas and more than 50% forests.
- The RRL includes the entire project area as well as the leakage belt (cf. Section 2.3.1.5) and contains the same proportion of forests suitable for conversion to the land-use practices of the deforestation agents as the project area.
- The RRL does not include areas of forests situated in the Masoala and Marojejy National Parks, as well as in the Anjanaharibe Sud protected area.

(v) **Leakage management areas:**

Leakage management areas are the zones where the Makira project will implement measures to reduce the risk of displacement of deforestation and forest degradation activities from the project area to and outside of the leakage belt (cf. Section 3.2). These areas are constituted by the non-forested areas inside the project area (mainly in the zones of controlled occupation and sustainable of the Makira Protected Area) and inside the leakage belt.

Total areas, areas of forest lands and non-forest lands in the different spatial boundaries of the Makira Project are presented in Table 11 below.

Table 11: Main zones and areas of the Makira project

Zone	**Total area [ha]**	**Forest [ha]**	**Non forest** (savannah, agricul-ture, villages, etc.) **[ha]**	**Forest cover**
Zone of Strict Protection Noyau Dur	331,993	329,311	2,682	99%
Zone of Controlled Occupation (ZOC)	11,875	7,237	4,638	61%
Zone of Sustainable Use (ZUD)	28,602	25,332	3,002	89%
Protected area (2005) (Entire protected area)	**372,470**	**361,880**	**10,590**	97%
Leakage Belt (2005) (Management Transfers)	335,173	245,576	89,597	73%
Entire Project Zone	**707,644**	**607,456**	**100,187**	86%
RRD (1996)	**949,795**	**949,795**	**0**	100%
RRL (1996)	**1,671,153**	**1,085,652**	**419,006**	65%

Temporal boundaries:

The temporal boundaries for the Makira project are as follows:

(i) **Historical reference period:**
The historical reference period is the temporal domain from which information on historical deforestation is extracted, analyzed and projected into the future. The historical reference period for the Makira project is defined by the three spatial data points used to estimate historical deforestation in the reference area (see baseline scenario section below). It extends over a period of nine years, starting in August 1996 and ending in October 2005.

(ii) **Project start date:**
The project start date is in January 2005 when a baseline study to estimate the carbon potential of the Makira forest has been finalized. The project end date is December 2034.

(iii) **Project crediting period:**
The project crediting period is the period of time for which the net GHG emissions reductions or removals will be verified, which under the VCS is equivalent to the project lifetime. The total crediting period for the Makira project is 30 years, defined by the project start and end dates.

(iv) **Review of Project baseline:**
The project baseline will be revisited every 10 years (2015 and 2025). A baseline revision shall be triggered whenever forest scarcity is encountered relative to the baseline rate of deforestation.

(v) **Verification and monitoring:**
Issuance of Verified Carbon Units (VCUs) is subject to monitoring and verification. In the Makira project, verification will occur at the end of each monitoring period, each five years from the project start date (2010, 2015, 2020, 2025, 2030 and 2035). Monitoring of land use change in the protected area and the leakage belt will be conducted biannually, combined with annual aerial assessments of deforestation (cf. Section 4.3).

Estimation of annual areas of unplanned baseline deforestation:

Estimation of annual areas of unplanned baseline deforestation has been implemented in four steps, which are detailed in tection s below.

Analysis of historical deforestation:

Analysis of historic deforestation in the reference area was based on data from a national study on the evolution of the natural forest cover of Madagascar between published in 2009[29]. Although the time period of this study was 1990-2000-2005, this was possible because the earliest data

[29] MEFT, USAID et CI, 2009. Evolution de la couverture de forets naturelles de Madagascar. 1990-2000-2005

used for the Makira area was in fact from 1996 and not 1990 as mentioned in the title of the study. In the same context, the medium date of the two scenes used for the 2000 point in time was in fact April 2001. The study used a series of medium resolution (28.5mx28.5m) Landsat satellite images of which two scenes (158-70 and 158-71) cover the reference and project areas of the Makira project. For these two scenes, images from three different points in time prior to the start of the Makira project and no less than 3 years apart were available and have been used for the deforestation analysis. However, due to the frequent heavy cloud cover in the Makira and Masoala area, it was not always possible to find two suitable scenes with exactly the same acquisition date (cf. Table 10).

Table 12: Data used for historical LU/LC change analysis

Satellite	Sensor	Resolution		Coverage (km^2)	Acquisition date (dd/mm/yyyy)	Scene identifier	
		Spatial	Spectral			Path/latit.	Row/long.
Landsat-5	Thematic Mapper	28.5m	6 channel visible and near-infrared	8,300	22/06/1996 ??/10/2000 14/05/2006	158	70
Landsat-5	Thematic Mapper	28.5m	6 channel visible and near-infrared	8,300	22/06/1996 15/10/2001 08/03/2005	158	71

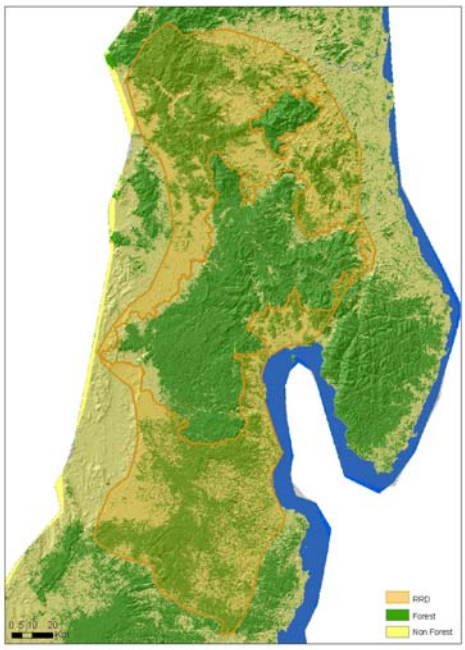
These images went through an image treatment, classification and filteringprocess in order to produce forest cover maps for all three points in time with identified forests being natural, closed-canopy forest over 5 m in height and in patches of over one hectare. We used already treated iimages from the national study but did our own classification of the two multi-date composits and filtering because the national study applied a forest definition slightly different from the national one (higher canopy cover and bigger minimum area). All forests in this analysis therefore meet the Madagascar national definition of forest, i.e. has over 30% canopy cover, over 5 m in height and in patches of over 1 hectare (UNFCCC 2008).

Based on these forest cover maps, three different deforestation maps have been produced for the reference period: map of deforestation between 1996 and 2001; map of deforestation between 1996 and 2005 (covered by clouds in 2000); and a map of deforestation between 2001 and 2005 (cf. figure 11).

The estimation of areas deforested between two points in time in the reference area has been conducted based on the three forest maps and the three deforestation maps using the ArcGIS software. If the acquisition date of the two scenes was not the same (2001 and 2005), the median date of the two was used as point in time of observation. Areas deforested between 1996 and 2005 but under cloud cover have been distributed over the two time periods according to the deforestation rates for the two periods calculated based on cloud free areas.

Figure 11: Forest cover and deforestation maps produced for the entire RRD (cf. annex 5 for bigger scale maps)

Forest 1996



Forest 2001

Forest 2005

Deforestation 96-01

Deforestation 01-05

Deforestation 96-05 (clouded in 2001)

Estimation of annual areas of historic deforestation in the RRD:

The modelled annual area of deforestation in the reference area for deforestation (RRD) has been calculated over the reference period based on the figures provided in Table 7. As mentioned above only three points in time over the whole reference period were available (1996, 2001 and 2005) and the numbers in Table 11 suggest that deforestation between 1996 and 2001 was higher than between 2001 and 2005.

Table 13: Estimation of historical deforestation in the reference area for deforestation (RRD)

Description	**1996**	**2001**	**2005**
Date	06/1996	04/2001	10/2005
Period between points in time [yr]		4.70	4.50
Total deforested area cloud free [ha]	0	15,466	19,990
Deforested area cloud free per period [ha]		15,466	4,524
Part of total deforestation per period		77%	23%
Deforested area 1996-2005 [ha]		10,612	3,104
Total deforested area [ha]	0	26,067	33,783
Total deforested area per period [ha]		26,067	7,716
Annual deforested area per period [ha]		5,546	1,715
Annual deforestation rate per period		0.58%	0.19%
Overall total deforested area [ha]		33,783	
Overall annual deforested area [ha]		3,672	
Overall annual deforestation rate		0.38%	

However, it has to be noted that about 40% of the total area deforested between 1996 and 2005 could not be observed in 2001 because of cloud cover and therefore had to be attributed to the two time periods following the observed deforestation rates for areas that were cloud free at all three points in time. This means that the apparent difference between the two deforestation rates is uncertain and therefore, the arithmetic mean over the historic reference period has been used for determining the annual area of unplanned deforestation following the following equation:

$$\textit{Annual Deforestation in RRD} = \textit{33,783 ha / 9.2 yrs}$$

$$= \textbf{\textit{3,672 ha/yr}}$$

Estimation of annual areas of unplanned baseline deforestation in the RRL:

The projected annual area of unplanned baseline deforestation in the RRL was estimated as follows:

$$\textit{Annual Deforestation in RRL} = \textit{3,672 ha/yr (1,085,652 ha / 949,795 ha)}$$

$$= \textit{3,672 ha/yr * 1.1430}$$

$$= \textbf{\textit{4,197 ha/yr}}$$

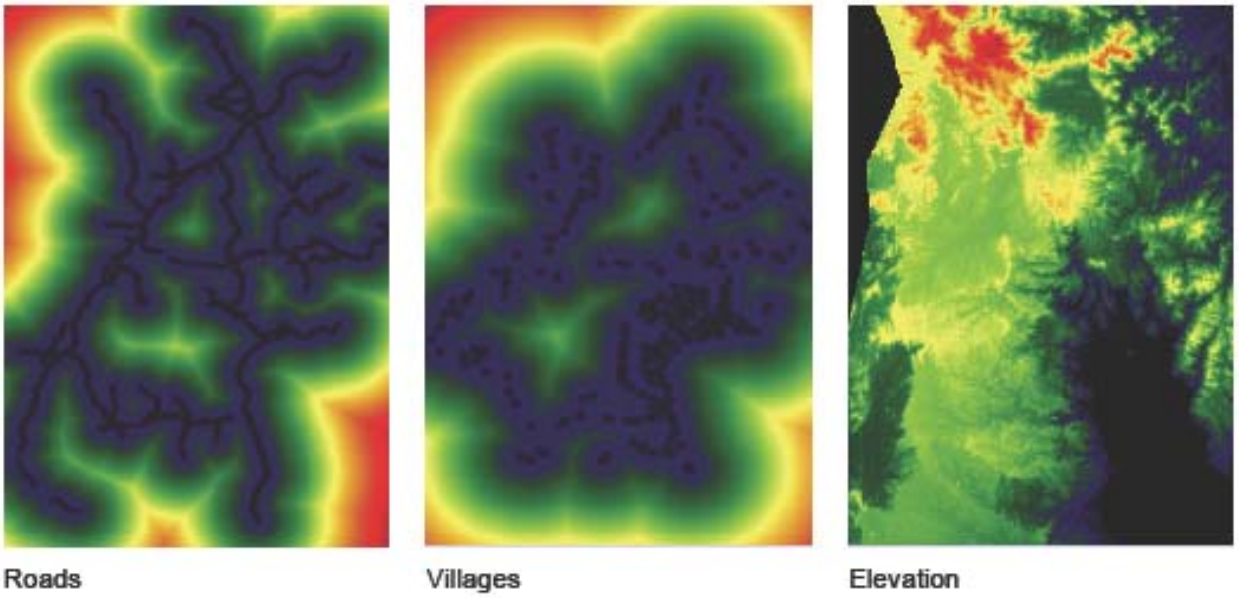
Estimation of annual areas of unplanned baseline deforestation in the project area:

It has already been shown above that less than 25% of the Makira project area boundary is within 50 m of the land that has been anthropogenically deforested over the last 10 years and therefore analysis of the location of projected unplanned deforestation was required to determine the annual area of unplanned baseline deforestation in the project area.

In accordance with the VCS guidelines for AFOLU projects a calibration/validation process has been applied using the IDRSI Land Change Modeler (LCM) software. LCM was used due to its relative ease of use, transparency and non-reliance on independence among driver variables, as it is based on a neural network rather than on multiple regressions. The objective of this process is to develop a deforestation model that determines with the required precision which forest areas inside the RRL would be deforested during the project period, or at least during the first baseline period, without the intervention of the project.

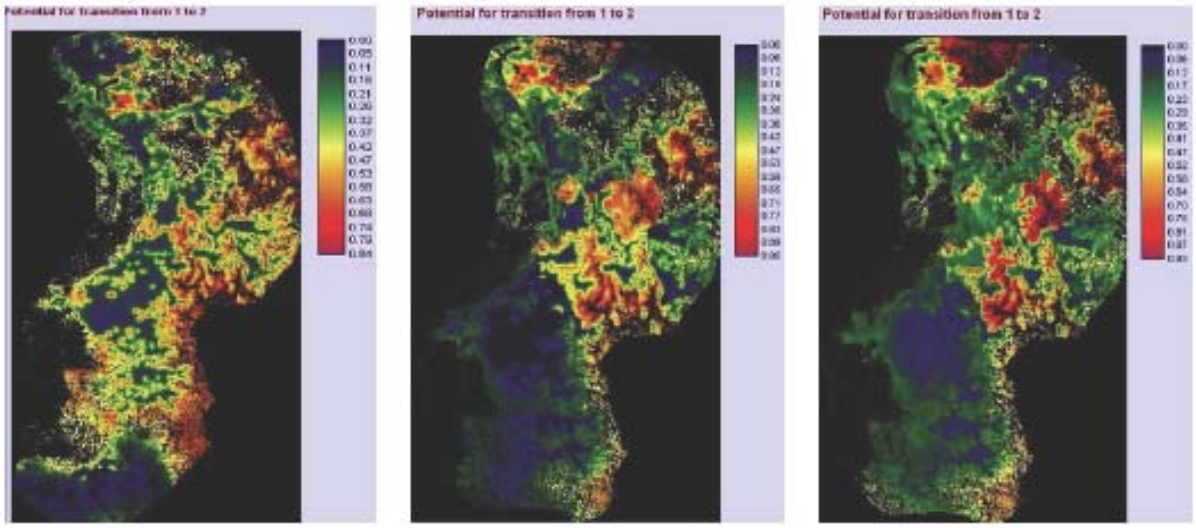
The deforestation model was developed and calibrated using the forest cover maps of the RRL for the start (1996) and the end (2001) of the calibration period, as well as a number of factor maps containing spatial information on some of the main drivers of deforestation described in Section 2.1 (cf. figure 12).

Figure 12: Three examples of deforestation factor maps



The calibration of the deforestation model using different combinations of factor maps resulted in a number of deforestation risk maps, one for each calibrated deforestation model. Figure 13 shows three deforestation risk maps developed in the modelling process based on different factor combinations.

Figure 13: Three examples of deforestation risk maps



The validation process consisted in selecting the model thet showed the best fit when compared with real deforestation data for the validation period. Based on the different deforestation risk maps we developed maps of projected deforetation in the RRL for the 2001-2005 validation period and compared these different maps with the map of observed deforestation in that period. The goodness of fit of each model was evaluated by calculating its Figure of Merit (FOM)[30].

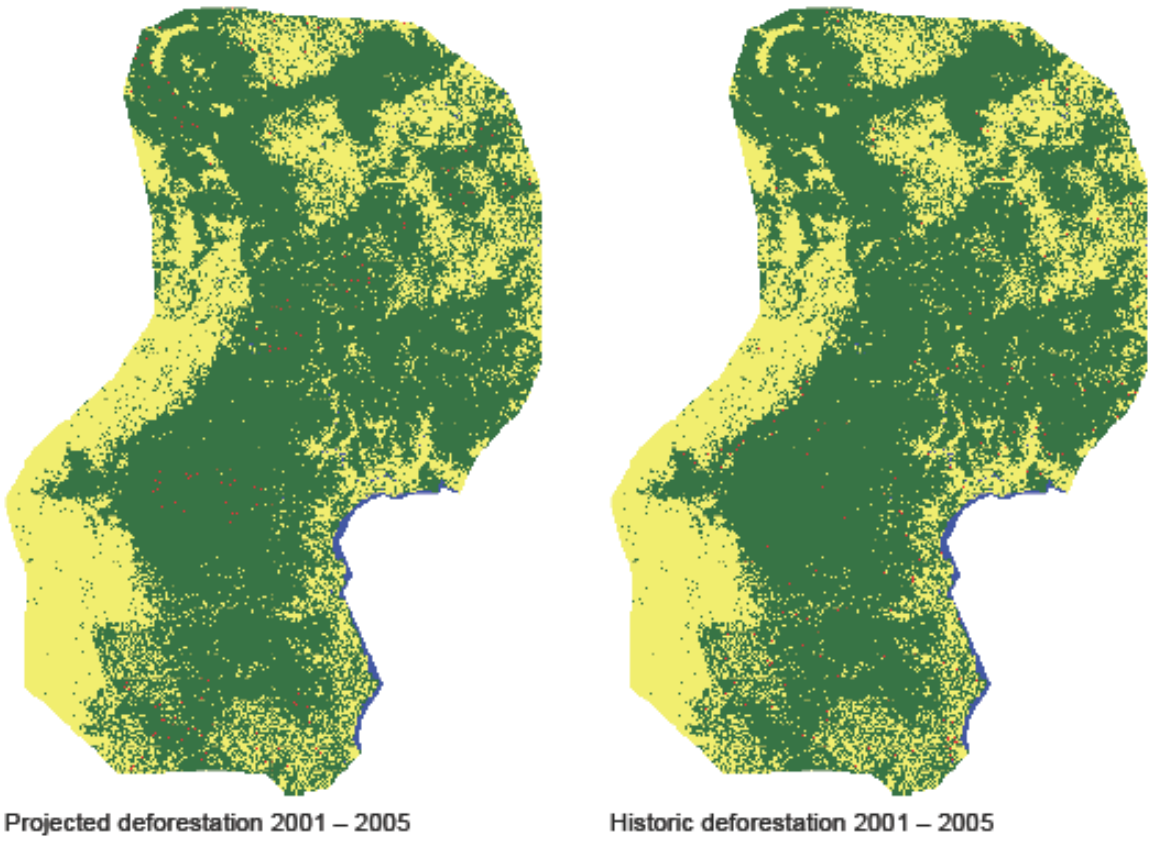
The model showing the best fit between observation and prediction (cf. figure 14) had a FOM of less than 10%, which is below the minimum threshold for frontier deforestation of 40% of the applied methodology. However, it has to be noted that the development of the deforestation model was based essentially on areas that could be observed in all three points in time of the historic reference period, and areas covered by clouds in 2001 have not been used. As this seemed to be the main reason for the insufficient FOM, the developed model has been used to predict baseline deforestation in the RRL over the 30 years of the project period.

[30] Pontius et al. (2008) : Comparing input, output, and validation maps for several models of land change. Annals of Regional Science, 42(1): 11-47

The validated model used the following deforestation factors:

- **Landscape factors:** Elevation
- **Accessibility factors:** Distance to roads, distance to rivers
- **Anthropogenic factors:** Distance to forest edge, distance to villages
- **Actual land tenure and management:** Deforestation evidence likelihood in protected areas and communes

Figure 14: Projected and observed deforestation in the RRL for the validation period



The validated model was then used with the LCM software to develop projections for unplanned baseline deforestation in the RRL over the entire project period (cf figure 15). Based on these projections the ARCGIS software was used to determine the areas of unplanned baseline deforestation in the project area and in the leakage belt (cf. Table 14).

In order to estimate baseline emissions from carbon stock changes over the entire project period, these numbers on baseline deforestation have been combined with the emission factor. Emission factors could be estimated by calculating the difference between the carbon stocks befores and after deforestation discussed already in Section 1.3:

Carbon stock in forest stratum 1:	978.67 t CO_2-e/ha
Carbon stock in forest stratum 2:	672.72 t CO_2-e/ha
Weighted average carbon stock in forest stratum:	834.20 t CO_2-e/ha
Carbon stock in post deforestation stratum:	346.43 t CO_2-e/ha
Emission factor:	**487.77 t CO_2-e/ha**

Application of this emission factor to the annual areas of unplanned baseline deforestation in the project area and in the leakage belt produced the annual baseline emissions from carbon stock changes in the project area and in the leakage belt presented in Table 15.

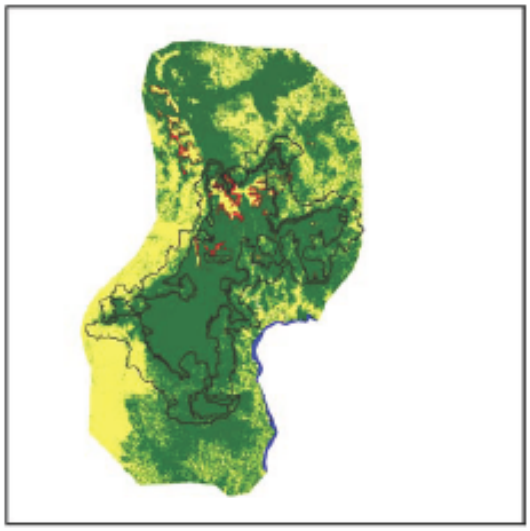
Table 14: Annual baseline deforestation in the project area and in the leakage belt

Year	Total deforested area [ha]		Year	Total deforested area [ha]	
	Project area	Leakage belt		Project area	Leakage belt
2005	2,924	264	2020	2,616	778
2006	2,924	264	2021	2,616	778
2007	2,924	264	2022	2,616	778
2008	2,924	264	2023	2,616	778
2009	2,924	264	2024	2,616	778
2010	3,016	460	2025	2,453	915
2011	3,016	460	2026	2,453	915
2012	3,016	460	2027	2,453	915
2013	3,016	460	2028	2,453	915
2014	3,016	460	2029	2,453	915
2015	2,843	633	2030	2,189	1,022
2016	2,843	633	2031	2,189	1,022
2017	2,843	633	2032	2,189	1,022
2018	2,843	633	2033	2,189	1,022
2019	2,843	633	2034	2,189	1,022
			Total	**80,210**	**20,358**

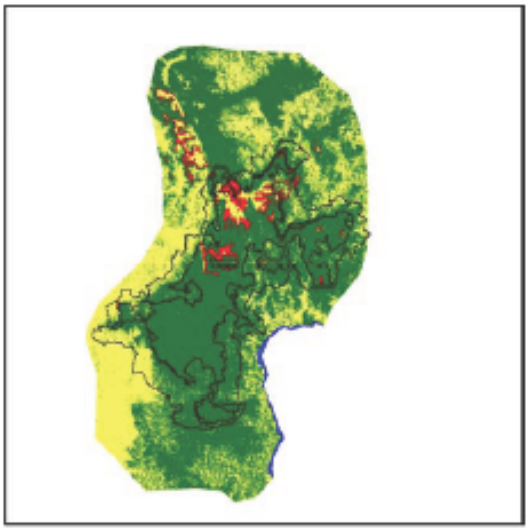
Table 15: Annual emissions from baseline carbon stock changes in the project area and in the leakage belt during the entire project period of the Makira project

Year	Carbon stock changes [t CO_2-e]		Year	Carbon stock changes [t CO_2-e]	
	Project area	Leakage belt		Project area	Leakage belt
2005	1,426,066	128,564	2020	1,276,187	379,393
2006	1,426,066	128,564	2021	1,276,187	379,393
2007	1,426,066	128,564	2022	1,276,187	379,393
2008	1,426,066	128,564	2023	1,276,187	379,393
2009	1,426,066	128,564	2024	1,276,187	379,393
2010	1,471,200	224,537	2025	1,196,727	446,183
2011	1,471,200	224,537	2026	1,196,727	446,183
2012	1,471,200	224,537	2027	1,196,727	446,183
2013	1,471,200	224,537	2028	1,196,727	446,183
2014	1,471,200	224,537	2029	1,196,727	446,183
2015	13,86,796	308,791	2030	1,067,846	498,567
2016	13,86,796	308,791	2031	1,067,846	498,567
2017	13,86,796	308,791	2032	1,067,846	498,567
2018	13,86,796	308,791	2033	1,067,846	498,567
2019	13,86,796	308,791	2034	1,067,846	498,567

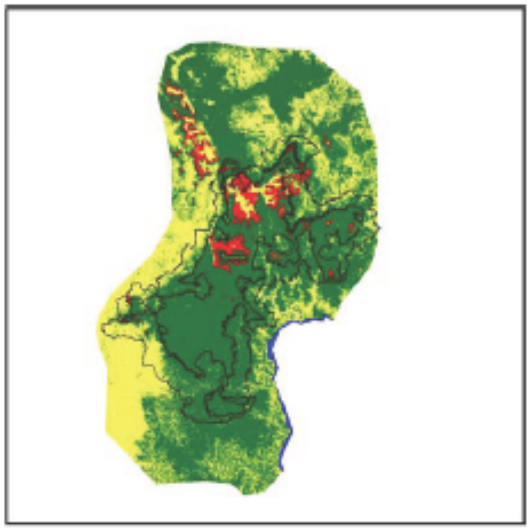
Figure 15: Projected deforestation in the RRL over the entire project period



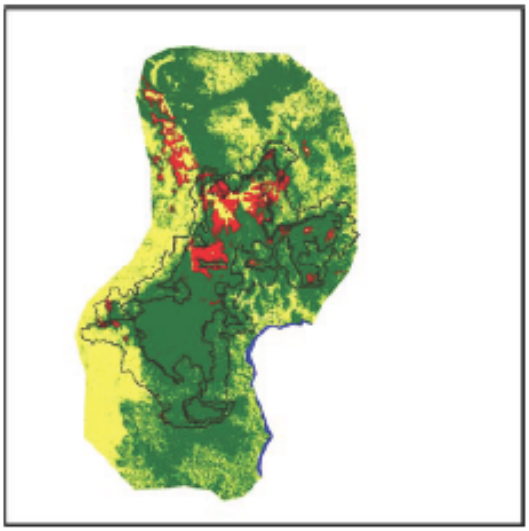
Deforestation 2005 - 2009



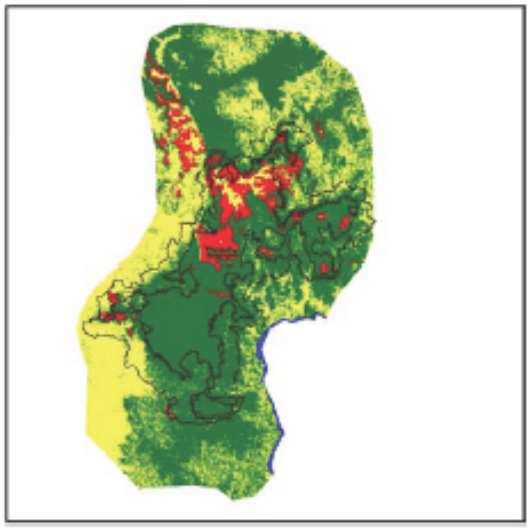
Deforestation 2005 - 2014



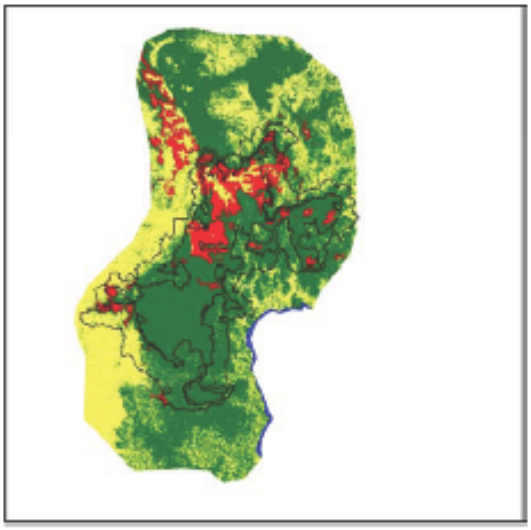
Deforestation 2005 - 2019



Deforestation 2005 - 2024



Deforestation 2005 - 2029



Deforestation 2005 - 2034

G2.4. 'Without Project' scenario effects on project zone communities

In the absence of the Makira Project, the multiple existing land uses would continue. These include: slash and burnt agriculture, over-exploitation of timber and non-timber forest products, burning of forest land for cattle grazing, legal and/or illicit commercial exploitation of the forests' hardwood species and mining of quartz and precious stones. It is expected that in the long term these would lead to landscape-level degradation of the environment and loss of ecosystem services.

Considering these multiple land uses, the main forces that will influence the future socioeconomic conditions of the communities surrounding Makira are population growth, immigration and resource availability. In addition, the possible improvement to the national road between the towns of Maroantsetra and Mananara would impact on the communities by improving access to regional markets and increasing availability of manufactured goods. This national road, currently in an extremely poor state of repair, passes within less than 2 km of the limit of the project area at its closes point. It remains unclear as to if and when work to rehabilitate this road will take place.

The 'without project' scenario will likely diminish the region's capacity to deliver environmental services on which local communities rely. In the following table the likely impacts of the without project scenario on the local communities is assessed against the five main capital assets of the «Sustainable Livelihoods Framework » approach.

HUMAN CAPITAL	
Health	Given the remoteness of basic health facilities (at least half a day's walk to reach a health center - Ramanandriana, 2004) and the isolation of the villages on the outskirts, level of health education will remain low and medical care insufficient. The lack of any family planning initiatives will lead to a high growth of population. Already in 2003-2004, there is a relatively high natural growth rate of 3.2% compared to the national rate (2.8%)[31].
Education	The population of the community has a low level of education. About 40% of the head of the family have never been at school and those that were at school have not gone further than the primary school level (Ramanandriana, 2004). There are primary schools in most of the villages, but priority is given to subsistence activities. The rate of school enrolment was 39.8% in 2003 (Ramanandriana, 2004). Children help their parents in the farming activities and move around between their home and the farm fields; too busy to be able to properly attend school. Without the project, the level of education within the communities will remain low and illiteracy high.
Knowledge and skills	Maintained skills related to traditional practices including hunting, slash and burn cultivation, collecting of forest products, fishing, cattle raising. No or limited access/opportunities to new knowledge and skills.
NATURAL CAPITAL	
Land and production	Continued clearing and degradation of forests caused by the practice of slash and burn agriculture and cattle grazing. In the long term, the destruction of the upstream forests will cause an impoverishment of the agriculture land and increased erosion. In fact, as it is already observed at some places in the eastern part of Makira during the rainy season, there is a silting-up of the lowland areas, including rice fields, rivers and blockages of irrigation channels due to erosion from upstream deforestation (Ramanandriana, 2004). The decrease in productive land will result in less production and food shortage; it will also lead to a loss of household income.

[31] Monography of Analanjirofo, 2005

Water & aquatic resources	The Makira forests are crossed by about several permanent and temporary rivers and occur in an area of high rainfall. These streams, that constitute the main sources of both drinkable and irrigation waters for the surrounding of Makira forests, have their sources in the Makira forests. However, local people are already experiencing the drying up of some water sources during the dry season due to the destruction of some parts of forests. This is already the case in west Makira in communes such as Ambilombe, Antsakabary and Ankarongana. This affects not only agriculture production, but also will results in impoverished and unhealthy communities. Local population have already observed a progressive decrease in water streams level over timem (Ramanandriana, 2004) High sedimentation due to upstream deforestation for tavy has also degraded coastal and marine habitats in the Antongil Bay.
Wildlife, timber and NTPF products	The unsustainable collection of various forests products will result in the long term in the disappearance of some subsistence resources, such as forest fruit, medicinal plants, roofing, building materials, firewood, and materials for traditional crafts, etc. Several species of useful plants (example: Bilahy) have now become rare in the area as a result of free access and overexploitation. In the absence of any official protection of the forests, there is no doubt that people from the area as well as outsiders will go into the forests in a rush to exploit available resources, particularly precious woods, semi-precious stones and minerals. In the long term, there will most likely be an exhaustion of timber and other non-timber forest products. These will affect not only the consumption of these goods by the communities but also their sources of income.
Environmental services	The Makira forest is very large and presently still conserves its primary characteristics, providing multiple ecosystem services to the broader surrounding communities, including water regulation, maintenance of micro-climates and at a global scale, carbon storage. In the long term, broad-scale deforestation and forest degradation will destroy the capacity of the Makira forest to continue providing these ecosystem services and this will negatively impact people living in the broader landscape.
SOCIAL CAPITAL	
Networks and connections	Without the Makira Project, the lack of any land use planning and natural resource management would mean that there is open access to valuable resources. Experience shows that this can bring a rush of new migrants to exploit resources in the area, causing social insecurity and overexploitation of natural resources. Conflicts arise, especially between local residents and new migrants. Experience from the recent burst of illegal logging in the neighbouring Masoala Park shows several negative social impacts on the surrounding local communities, including disregard and disdain for local culture, mores and customs, but also increased insecurity. In addition, without any encouragement and support towards land property titling, people rights in terms of land property will continuously be threatened and remain insecure. Without the Makira Project, local people will be organized into a few informal associations (religious and sports), but they will be ill prepared to deal with an influx of more powerful outsiders and will have no capacity to protect their land and resources.
Formal and informal groups	While several associations do exist in the Makira region, people are individualistic in general. The groups that exist are mainly religious, sport and farmer associations; almost all are informal.
Mechanisms for participation in decision-making	Local authorities and representatives of Government are presently (and will continue to be) managers of the local resources. Local communities are rarely part of any decision making process and have to accept the consequences and impacts of decisions made at a higher level and very often from a long distance away. This is often a source of community conflict, especially between local residents and new migrants or non-residents. The assistance and participation of women in decision-making assemblies is minimal.
PHYSICAL CAPITAL	
Infrastructure - Transport - Roads, Vehicles	Transport is mainly by foot or bicycles on trails through the forest and rivers by canoe or motorboat. There are no roads suitable for vehicles.
Infrastructure - Secure shelter & buildings	Community infrastructures are mainly comprised of family houses, communal buildings and schools, some health centres and village churches. Most of the housing and communal buildings are built of wood and other local materials.
Infrastructure - Water supply & sanitation	The water consumed in the community comes mainly from rivers and is untreated. Sanitation services are limited to some villages near main towns.
Infrastructure - Energy	Electricity facilities are limited only to villages near main towns. Woods gathered in the forest are used for cooking.

Communications	Communication infrastructures are limited to villages near main towns.
FINANCIAL CAPITAL	
Incomes	Without the Makira Project, people will continue their present livelihood activities. Due to high population growth, the decrease in productivity of cropland and the influx of outsiders attracted by valuable resources, the available resources will be overexploited. (timber and non-timber products) for their own consumptions but also for sale; trying to earn as much money as they can but their gain will be limited because of non availability of or difficulty to access to markets. The main sources of income will be the sale of agriculture and livestock products, including rice, vanilla, cloves and so on. Additional income will be obtained from the sale of forest products (bushmeat, NTPF and timbers). Therefore sources of income will remain limited, erratic and not sustainable.
Savings	Except from storage of agricultural products (rice) at the level of some households, which is a form of savings, saving money is not in the culture of Makira communities.
Credit/debt - formal, informal, NGOs	Without the Makira Project, given the remoteness of Makira from towns, it is very unlikely that a microfinance program will be developed in the area and that people will have access to credit. This is the case throughout rural Madagascar, where very few communities have access to credit. Access to markets will continue to be difficult, exacerbating the difficulty of gaining any form of credit.
Wages	The only activities that could potentially create new employment would be mining and logging. If conducted in accordance with the laws mining and logging coul contribution to the economic development of the Makira area. These activities could increase the income and possibly improve the welfare of local communities. Unfortunately, the most likely scenario will be one of illegal and small-scale exploitation. This would have negative impacts not limited to the natural environment, but also to local communities, particularly by creating social conflicts that sometimes lead to violence, and by damaging natural resources that local communities are so reliant on. Very few people benefit from the illegal exploitation of timber and mineral resources. A recent study on the economic impacts of illegal logging shows that there are few benefits to local communities and that the vast majority of profits go to small, organized groups of outsiders. The opportunities created are short-lived and exploiters often hire migrant workers for these jobs leading to conflicts between residents and migrants.

G2.5. 'Without Project' scenario effects on project zone biodiversity

Under the most likely 'without project' scenario, severe negative impacts on biodiversity in the project zone can be expected. Since the Makira forest hosts an estimated 50% of the island's endemic plant and animal species, these negative impacts would become of national importance. Without the Makira Projectcurrent land uses like tavy (slash and burnt cultivation), bush meat hunting, illegal logging, cattle grazing, timber and non-timber products harvesting, and mining will continue, causing the following impacts:

Habitat loss and fragmentation:

In the absence of the Makira Project, with the population growth, the lack of control and the inexistence of sustainable management within the project zone mean that tavy, forest clearing for various needs will continue, with an annual loss of natural forest estimated at 2,000 to 3,000 ha for the protected area and 250 to 1,000 ha in the community manged zones (cf. Table 12). In addition, because of free access, uncontrolled human movements will increase and existing trails within the forest will be possibly broadened. As results, forest degradation through illegal logging and mining activities will most likely increase and and further contribute to important habitat loss. The process will create forest fragmentation mainly because of slash and burn cultivation, and illegal logging and mining.

The impact of the consequent habitat loss alone is known to be drastic for Madagascar endemic taxa (Irwin et al., in press)[32]. The most sensitive forest areas within the project area would be the first impacted as the critical corridors and least-common forest habitats are in proximity to human settlements. Continuous forest fragmentation into small forests patches could result in cascade effects for the most susceptible flora and fauna, leading to loss of associated biological interactions and dependent species. In the long term, the north-eastern forest blocks and existing Protected Areas would become isolated within a hostile landscape and the flow of populations and genetic diversity would be halted.

Species loss:

In Madagascar, forest fragmentation and edge effects are known to cause strong endemic faunal population declines, including lemurs (Ganzhorn et al., 2007)[33], small mammals (Ganzhorn et al., 2003)[34] birds (Watson et al., 2004)[35], and amphibians (Vallan, 2000)[36]. Without the Makira Project, the continuous loss of habitat would directly lead to the loss of endemic fauna, most manifest in the vertebrates.

Regarding flora, the current political instability that has caused the recent illegal exploitation of rosewood in Northeast Madagascar (GW and EIA, 2009; Randriamalala and Zhou, 2010) reflects the absence of and control and the frequent change in regulations likely in the without project scenario. Obviously, such illegal selective logging will reduce drastically the density of these luxury hardwoods. These species are endangered, slow-growing tree species that in addition may play an important role as refugia for various other taxa. Illegal logging will disrupt the natural age distribution of trees, leading to a substantial loss of natural ecosystem functioning and the potential loss of both trees and other dependent species. The physical damage caused by this type of illegal logging is known to be multiple. They include clearing for loggers' camps, tracks to extract the timber, and the hunting of bushmeat (Shuurman and Lowry II, 2009). Illicit logging will

[32] Irwin, T. M., Wright P. T., Birkinshaw C., Fisher, B. L.,. Gardner, C. J., Glos, J., Goodman, S. M., Loiselle, P., Rabeson, P., Raharison J.-L., Raherilalao, M. J., Rakotondravony, D., Raselimanana, A., Ratsimbazafy,. Sparks, J.J. S., Wilmé, L.,. Ganzhorn, J.-U. in press. Patterns of species change in anthropogenically disturbed forests of Madagascar. Biological Conservation.

[33] Ganzhorn, J. U., Andrianasolo, T., Andrianjazalahatra,T., Donati, G., Fietz, J., Lahann, P., Norscia, I., Rakotondranary, J., Rakotondratsima, B. M., Ralison, J. M., Ramarokoto, R. E. A. F., Randriamanga, S., Rasarimanana, S., Rakotosamimanana, B., Ramanamanjato, J.-B., Randria, G., Rasolofoharivelo, M. T., Razanahoera-Rakotomalala, M., Schmid, J. & Sommer, S. 2007a. Lemurs in evergreen littoral forest fragments. In Biodiversity, ecology and conservation of littoral ecosystems in southeastern Madagascar, Tolagnaro (Fort Dauphin), eds. J. U. Ganzhorn, S. M. Goodman & M. Vincelette, pp. 223-235. Smithsonian Institution/Monitoring and Assessment of Biodiversity Program Series #11, Washington, D.C.

[34] Ganzhorn, J. U., Goodman, S. M. & Dehgan, A. 2003. Effects of fragmentation and small mammals and lemurs. In The natural history of Madagascar, eds. S. M. Goodman & J. P. Benstead, pp. 1228-1234. The University of Chicago Press, Chicago.

[35] Watson, J. E. M., Whittaker, R. J. & Dawson, T. P. 2004. Avifaunal responses to habitat fragmentation in the threatened littoral forests of south-eastern Madagascar. Journal of Biogeography, 31: 1791-1807.

[36] Vallan, D. 2000. Influence of forest fragmentation on amphibian diversity in the nature reserve of Ambohitantely, highland Madagascar. Biological Conservation, 96: 31-43.

reduce key habitat and refugia, and will place pressure on already-sensitive and stressed flora and fauna. In the long term the forests will be continuously degraded, leading to the irremediable loss of key species.

Consideration of illegal logging on project risk assessment is detailed in Section G3.5 below.

Poaching and targeted species population decline:

Continued bushmeat hunting in the absence of the management and livelihood alternatives implemented by the Makira Project will reduce the natural populations of targeted species, such as the diurnal lemurs' species endemic to Makira, by up to 60% (Golden, 2009). Since lemurs and other frugivorous faunal taxa play a critical role in seed dispersal and natural forest regeneration, the reduction of their population will slow down natural regeneration and forest re-growth. A disruption of the natural age distribution of tree species dependent on these seed dispersers would reduce key habitats and refugia for the flora and fauna that in turn dependent on them.

Erosion:

The hilly topography of the Makira landscape combined with the fragility of the ferralitic topsoil makes the area particularly vulnerable to erosion. Continued forest clearing will expose the fragile topsoil to rainfall, accelerating erosion and sediment in the numerous streams and rivers. In the long term this will lead to widespread sedimentation in the entire Antongil Bay watershed. The impacts of increased erosion and hyper-sedimentation would include loss of marshes, the degradation of aquatic habitats and the loss of aquatic biodiversity. It would also lead to the increased conversion of other habitats to cropland to as farmers try to compensate for the loss of irrigated rice field from sedimentation.

G3. Project Design and Goals

This section of the Project Design Document provides information on the Makira Forest Protected Area Project design and goals so as to minimize risk to the climate, community and biodiversity benefits resulting from the project. The section further considers how these climate, community and biodiversity benefits will be maintained beyond the life of the project.

G3.1. Project's major climate, community and biodiversity objectives

The Makira Project aims to generate substantial community, biodiversity conservation and carbon sequestration benefits through the creation and carbon financing of a new, co-managed protected area. The Makira Project strives to become a model for integrated community development, biodiversity conservation and sustainable natural resource management in Madagascar.

Using carbon financing from avoided deforestation, the Makira Project will protect one of the largest remaining blocks of rainforest in Madagascar, maintain ecosystem functions and services, conserve habitats and rare and threatened biodiversity, and create sustainable livelihoods for

local communities. The Makira Project aims to realize multiple benefits through innovative governance and the equitable sharing of carbon revenue between the Government of Madagascar and the local communities.

Climate objectives:

The Makira Project aims to avoid the emission of a total of 35,186,680 tonnes of CO_2-e over the 30-year project period by reducing carbon stock changes from deforestation in the roject area. This will be achieved through the sustainable management of 707,643 hectares of forest and mixed forest and agricultural lands within the Makira protected area and its protection zone.

Biodiversity objectives:

The Makira Project aims to: i) maintain the ecological integrity of the Makira landscape and its connectivity with the other protected areas of north-eastern Madagascar; ii) ensure the maintenance of ecological services; and iii) ensure the survival of the globally threatened species present in the area (estimated to represent approximately 50% of Madagascar's endemic plants and animals).

Community objectives:

The protection of the Makira forests will ensure the continued provision of ecosystem services that are vital to the local and regional economies. The integration of the development needs of the local communities into conservation actions is of critical importance to the successful conservation of the forest. Consequently the Makira Project will empower the surrounding local communities to manage their natural resources sustainably by supporting the establishment of forest mangement transfer (GCF) contracts in the protection zone surrounding the protected area. At the same time the Makira Project will address food security and subsistence needs by working with local people to implement improved production practices, improve community land stewardship and promote economic alternatives to unsustainable and destructive use of forest resources. Equally, the Makira Project will ensure that any benefits flowing from the protected area, in particular carbon revenues, are equitably and transparently shared with the communities of the protection zone.

The Makira project addresses the main drivers and underlying causes of deforestation and forest degradation discussed in section in the following ways:

Extension of slash and burn agriculture (tavy):

The Makira project addresses tavy through the creation of the Makira protected area, but also through a zoning process for the protected area (integral protection, controlled occupation and sustainable use zones) as well as the surrounding community managed areas, integrating local communities and other local and regional stakeholders. These simplified land use plans are

integrated into regional and communal development strategies like the communal and regional development plans (PCD) and their enforcement is facilitated by activities aiming at increasing agricultural production and promoting alternative sources of revenue in the community management zones. Experience throughout Makira shows that deforestation is generally much lower in well managed protected areas and that transfer of forest management to local communities can have a positive impact on conversion of forest to agiculture.

Clearing for pastures:

This driver of degradation of forest edges and deforestation is addressed by the Makira project in a similar way as tavy, mostly by integrating pastures into the integrated land use planning and supporting the development of alternative sources of income.

Illegal small-scale logging:

Illegal logging is addressed by the Makira project by integrating local communities into the management of forest resources. In the protected area this is achieved by the co-management system, while in the surrounding protection zone forest management is entirely transferred to local communities through the GCF process. Experience in several regions of Madagascar has shown that forest management transfer leads to improved control of access to transferred forests by the managing communities and thus to a reduction of illegal logging. The fact that during the 2009 political crises illegal logging was significantly lower in the Makira forests than in the neighbouring protected areas of Masoala and Marojejy also seems to confirm this experience.

Small scale or illegal mining:

Similarly to illegal logging, the problems of illegal mining activities are addressed by transferring forest management rights to local communities.

Underlying causes:

Underlying these direct causes are factors such as open access to forest resources, rapid population growth, poverty and insecurity that are driving unsustainable resource use. In the buffer zones around Makira, farmers resort to planting cash crops such as vanilla and cloves to complement their subsistence household income. Mixed household incomes can, however, increase the farmer's economic security, as cash crop prices fluctuate forcing them to increase forest clearing for tavy in years of lower market price. Further exacerbating this unsustainable land use is political instability and lack of financial incentives for sustainable resource use. The Makira project focuses its interventions at improving farmer welfare and empowerment to address these underlining causes of forest clearance.

G3.2. Project activities

In order to achieve the above mentioned objectives and to address the main drivers of deforestation and forest degradation in the project zone, the Makira project has been implementing since 2001 a number of activities falling under the following components:

(i) Creation and sustainable management of the Makira protected area

(ii) Building structures and capacities for local sustainable resource management

(iii) Development of co-management structures for the Makira protected area

(iv) Support rural development and alternative revenue creation

(v) Creation of equitable benefit sharing mechanisms

These components are presented in more detail in the following sections.

Creation and sustainable management of the Makira protected area:

As requested by the national procedure related to the creation of protected areas in Madagascar, a formal team for the delimitation of the conservation site of Makira was created in early 2005. In consultation with regional and local authorities, three official orders were issued to indicate the structure and members of the delimitation team for each of the three concerned regions, namely Analanjirofo, SAVA and Sofia region. Between 2005 and 2008, the team pursued continuous public consultations with the local communities of each 63 Fokontany of the 21 Communes, within the 5 Districts of the 3 Regions affected by the Makira project. The ultimate objective of these consultations was to agree on the delimitation of the future protected area, based on the initial proposed delimitation. To that end, the team presented the initial proposed delimitation and documented reactions from the consulted stakeholders and to identify on the ground, with a GPS, the agreed upon or revised limits.

In a multi-stakeholders meeting ("réunion de la commission multipartite") with the members of the delimitation team and the Mayors of all concerned communes, local communities' claims and complaints were expressed, evaluated, responded to and subsequently accounted for in the final delimitation of the protected area. This process led to a three-part zoning system covering a 372,470 hectare Core Protected Area and a 343,840-hectare buffer zone of community managed land. To delimit the zones, WCS conducted a three-year consultation process, engaging villagers and authorities from every single village within the greater landscape. The three main zones of the Makira Protected Area are defined as follows (see also Section 1.3 above):

- Zone of Strict Protection:
  Designated within the Core Protected Area and in which no commercial or subsistence harvests or removals are allowed.

- Multiple Use Zones:
  Designated within the Core Protected Area as a result of consultations with local populations. The multiple use zones include Controlled Occupation Zones where small resident populations

will remain living within the park, but where immigration is strictly prohibited, and Zones of Sustainable Use that are uninhabited agricultural areas occurring within the Core Protected Area, and where natural resource use for specific subsistence purposes is permitted, but neither commercial mining nor logging are allowed.

- Protection Zone:
  This zone is made up of community based forest management sites (called GCF sites), where management responsibility has been officially devolved to communities living along the perimeter of the forest through a contract between the ministry of forests and elected communal forest authorities. Each GCF site has its own development and zoning plan, which includes i) forest and non-forest areas that are lived in and used by communities and ii) a *buffer* of forest bordering the Core Protected Area that is the community's conservation zone. In November 2010, 41 GCF sites were in place, totalling approximately 145,000 ha; by 2013, 83 GCF sites will be transferred to local communities covering a total area of 335,173 ha.

The following specific activities to support sustainable management and reduce deforestation and forest degradation are currently being implemented:

- Create basic infrastructures for the Makira Protected Area management team, including a management office, equipments, transport, communications and administrative needs.
- Develop and implement management and business plans for the Makira Protected Area supporting protection of the park and ecotourism development in the community-managed areas.
- Develop and implement a research and ecological monitoring programme to improve knowledge essential for the long-term management and protection of the Makira Forests.
- Develop an information management system to help with the management of the Makira Project.
- Work with local communities in the implementation of a participatory ecological monitoring program within the protection zone.
- Develop and implement a reliable control and supervision system to ensure law enforcement within the protected area in close collaboration with local and regional authorities, Gendarmerie, Police and other partners.

Building structures and capacities for local sustainable resource management:

As mentioned above, the Government of Madagascar is the owner of the land included in the Makira project. Based on a long-term partnership, the ministry of forests has officially designated that WCS will manage the Makira protected area through a management delegation contract signed in 2003 (cf. annex VIII). Similarly, the Makira project is supporting local community associations in being appointed to manage natural forests in the Protection Zone following the GCF (Gestion Contractuelle des Forêts de l'état) procedures outlined n more detail below.

Under GCF, contracts are signed between the government and the representative of the COBAs, the Community Management Committee (COGE). In 2004, WCS began working with the Ministry of Environment and communities surrounding the Makira forests to catalyze the formation of community-managed GCF sites (each including a COBA and COGE) within the buffer of mixed forest and agricultural land surrounding the proposed project area. The current successful implementation of 35 GCF contracts and the envisaged 45 demonstrate compliance to the legislation related to transfer of management of renewable natural resources to communities. On the level of the newly created community associations for forest management in the areas surrounding the protected area WCS implemented the following activities:

- Strengthen capacities of community forestry associations to sustainably manage and monitor forest and pasture resources used in the protection zone.
- Develop and implement an Information, education and communication program to support sustainable community development.
- Develop curricula and communication tools for communities linking natural resources, livelihoods, and environmental health.

Development of co-management structures for the Makira protected area:

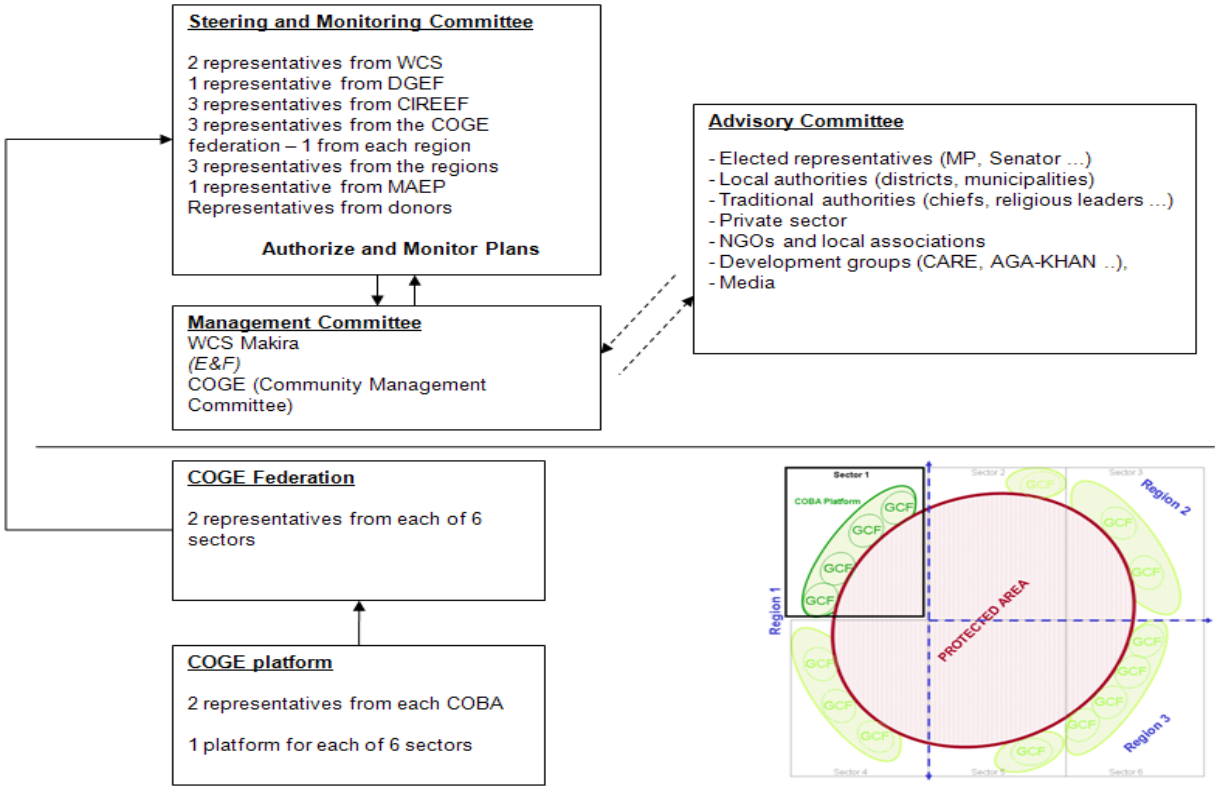
Besides the zoning and delimitation of the Makira protected area and the surrounding protection zone, the multi-stakeholder consultations outlined in the previous section also led to the development of a co-management structure for the Makira protected area. The overall co-management structure includes government, community and NGO representatives and is made up of the following three committees (cf. figure 16):

- The steering and monitoring committee (the decision-making body)
- The management committee
- The advisory committee which includes external actors who influence or are influenced by the protected area

In this co-management structure, the GCF site management committees (known as COGEs) are organized into 6 platforms, with each providing representation to a COGE federation that directly engages in the Makira steering and management committees. The organization of the local communities within the Protection zone is as follows:

- Each community-managed GCF site has a management committee (called COGE) that will identify two representatives to be part of the COGE platform of its sector.
- Each sector will have a COGE platform that discusses issues related to management of their GCF sites in relation to the Makira protected area. Each sector platform will identify two representatives to be part of the COGE Federation. Sector IV will be the sole sector that will have 3 representatives given the large number of GCF and ZOC sites.
- The Federation of COGEs finally, will then select three representatives (one representative per region) to be part of the Makira PA steering committee.

Figure 16: Governance structures for the Makira Protected area and the surrounding protection zone



This structure ensures a proper participation of the local communities in the Makira management and steering committees and thus in all decisions made concerning activities in the different zones of Makira PA, as well as within the Protection Zone. In close collaboration with WCS, the COGEs currently implement the following activities to ensure sustainable management and conservation of forest resources in the project area:

- Work with partners in the identification and development of sustainable financing mechanisms fostering linkages between forest conservation and community livelihoods.
- Work with local decision-makers and communities to establish local resources management and development plans ("Plan Communautaire de Développement" PCD).

- Develop, in partnership with all stakeholders at regional level, a comprehensive land use plan for the larger MaMaBay (Makira PA, Masoala NP and Antongil Bay) landscape, establishing a regional natural resource management strategy.

Support rural development and alternative revenue creation:

The Makira Forest Project includes a significant number of interventions to enhance the welfare of local communities and their management of resources. Activities were based on consultations and socio-economic studies and paid particular attention to improving access and quality of health services and education, addressing need for improved agricultural techniques and creating links to new markets and livelihoods.

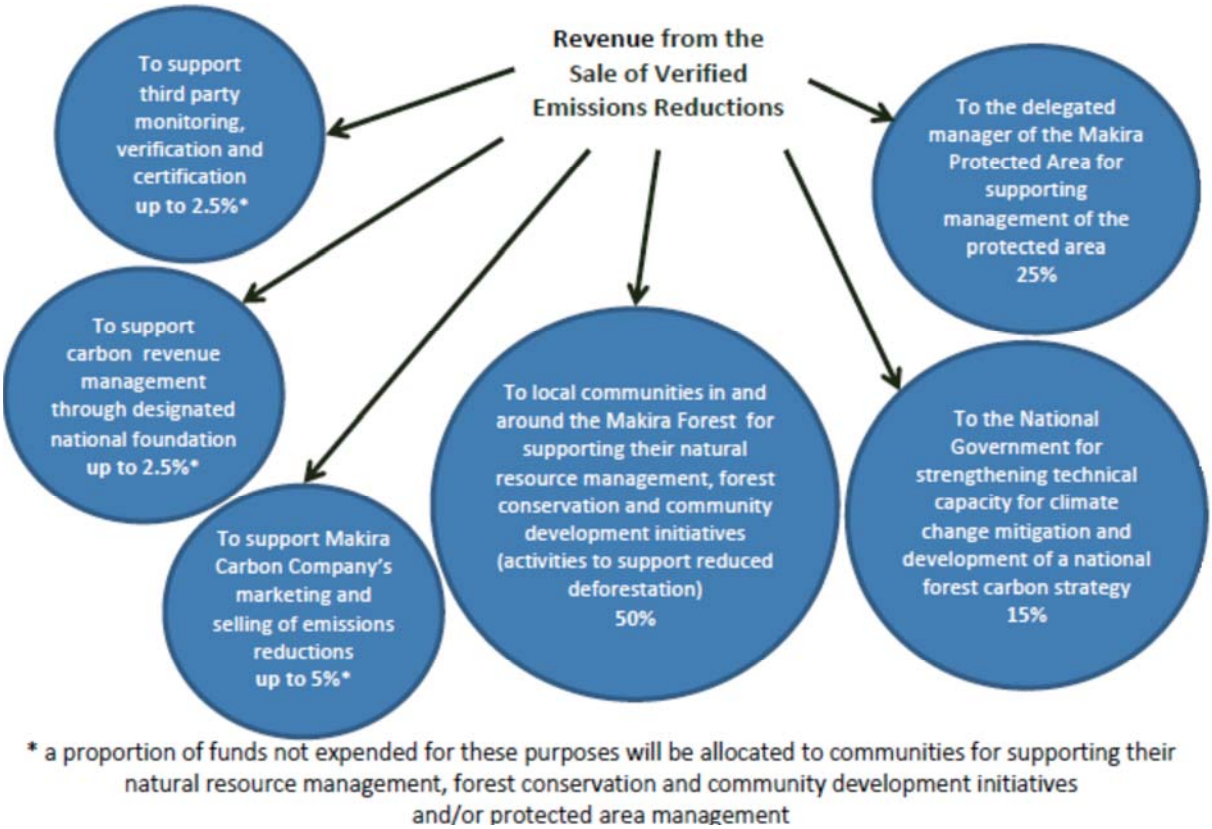
- Identify and promote viable economic alternatives to unsustainable resources use and create incentives motivating communities for improved resource stewardship and governance through conservation contracts and other forms of performance-based payment systems.
- In partnership with organizations that specialize in rural development, implement targeted development activities (agriculture, agroforestry, and natural forest management) at key locations to minimize leakage and to increase overall project success.
- Work with local communities in the identification and implementation of alternative, environmental friendly revenue generating activities and sustainable production techniques
- Work with private sector actors and local communities to develop ecotourism, enhance market access for local communities and promote environmental friendly products, including the development and promotion of fair trade products.
- Catalyse and support the development of a micro-credit program that promotes 'green' investment in local communities;
- Increase the local capacity for various economic development activities in the region. As such, it will support both private sector and NGO initiatives and organizations seeking to promote sustainable forms of economic development in the region. At present there are very few such organizations in the project zone.
- Expand the community development program to include a population, health and environment component (PHE) to improve family health and wellbeing;
- Work with regional authorities to implement a program of formalization of land ownership through formal registration of land.

Creation of equitable benefit sharing mechanisms:

In June 2008, the Government of Madagascar and Makira Carbon Company LLC developed an agreement outlining the carbon revenue sharing and management mechanism for the Makira Project (cf. figure 3). A foundation or similar entity designated by the State will be in charge of the management and disbursement of funds made available under the agreement. Funds management for the 50% of net revenue designated for local communities will be determined by a steering committee within the designated foundation in collaboration and consultation of the

manager of Makira Protected forests. The net proceeds for the sales of Makira emissions offsets will be allocated as indicated in figure 17.

Figure 17: Proposed distribution of revenues from carbon revenues



Community motivation will depend on recognized and tangible benefits

Benefits to communities for forest conservation and management will have to outweigh opportunity costs of management. A strategy of the Makira Project is to ensure food security, subsistence needs and sustained revenue generation. Priority activities include:

1. Improving rice production (staple) through a promotion of improved techniques accompanied by improvement of agricultural infrastructure. Thus currently, an average rice production of 5 to 7 t/ha has been observed among engaged farmers relative to 1.5t/ha observered at the beginning of the project. Every year, there is an increase of 15 to 20% farmers adopting these new techniques.
2. Promote agro-forestry (vanilla, cloves, coffee) since these products have good market values and are of direct interest to the population. This will help increase revenues with cash crops; stabilize land tenure; minimize unwanted exploitation of producers by intermediate businesses. This will be done by examining traditional agro-forestry systems; providing training, diversifying products if desired and exploring means to enhance production with technical assistance.
3. Promotion of various revenue generating activities including fish farming (with an increasing number of fish-farmers with an average of 50kg of fish/farmer annually), bee farming (average 10 beehives / farmer, 6 to 8 litres of honey/beehive), market gardening etc.

G3.3. Project location and boundaries

The general location of the Makira project along with details on the spatial boundaries of its intervention zones are detailed in Section 1.3. The spatial boundaries of areas related to climate aspects are detailed and justified in Section 2.3.

G3.4. Timeframe for the duration of the project and its credits

Temporal boundaries of the Makira project are detailed in Section 2.3.

G3.5. Risks and mitigation measures

Risks potentially affecting the project's GHG emission reductions or removal enhancements:

The VCS approach to risk analysis[37] was used to guide the assessment of risks to the permanence of the avoided GHG emissions. Thus, the Makira Project was evaluated against the risk factors applicable to all AFOLU project types and also against the risk factors specific to avoided unplanned mosaic deforestation.

There is a low risk of failure regarding the implementation of the Makira Project, including financial, technical and management aspects. Risks associated with land tenure disputes, as well as potential rising land opportunity costs that could cause reversal of sequestration and/or protection are judged to be low. Further, the Madagascar Government's full support of the establishment of the Makira Forest Protected Area and the development of the Makira Project are demonstrated through the government's designation of the Makira Forest as a Protected Area in 2005, and the signing of an agreement between the Government and the Makira Carbon Company in June 2008 that allows for the sale of Makira's forest carbon credits (see also Section G3.11.): a copy of this agreement can be made available upon request and with concent of Madagascar Government).

Land ownership / land management type:

It is clearly understood by all stakeholders that the State of Madagascar owns the forested land within the project area. During the delimitation of the protected area, the project team made sure to exclude all agricultural lands that local people are already exploiting. Human setllements and agriculture land that could not be excluded outside the limit were delimited in consultation with local communities, respectively into Controlled-Occupied Zone (ZOC) and Controlled Use zone (ZUD). For these zones of controlled occupation and/or use, a management and zoning plan has been developed for each site and management rules decided together in consultation with the concerned families/communities. The Government of Madagascar through the Ministry of Environment and Forests has officially devolved the management of the Makira protected area to WCS and the protection zone to the associations of local communities (COBAs). Therefore the risks associated with land ownership and land management type are considered very low.

[37] VCS document: Tool for AFOLU Non-Permanence Risk Analysis and Buffer Determination (18 November 2008)

Technical capability of the project developer/implementer:

The Wildlife Conservation Society (WCS), founded in 1895 is an internationally recognized organization dedicated to preserving the Earth's wildlife and wild places. WCS currently oversees a portfolio of more than 500 conservation projects in 60 countries in Asia, Africa, Latin America, and North America. WCS works with national governments, universities, non-governmental organizations (NGOs) and dedicated individuals to increase understanding and awareness of the importance of wildlife though the establishment and strengthening of protected areas.

More recently, WCS as engaged in the development of its carbon for conservation initiative. Currently, WCS is working with communities and governments in 18 landscapes and 14 countries to develop sub-national REDD+ demonstration projects and support the development of national REDD strategies. WCS believes that work at sub-national and national levels should be linked in such a way that national REDD strategies are informed by on-the-ground experience obtained through demonstration projects. WCS only works on sub-national REDD+ demonstration projects in landscapes where we have or plan to have a long-term presence. This long-term presence is a prerequisite to success in order to understand the drivers of deforestation and implement activities that reduce deforestation effectively and ensure permanence with community's consent and participation. Together the WCS portfolio of projects demonstrates how to develop REDD in varied institutional, socio-economic and ecological environments. By working with government, WCS will work to develop national REDD strategies sensitive to local conditions that effectively stem emissions from deforestation and degradation. The technical capacity of WCS justifies a low risk associated with its "ownership" of the Makira Project.

The Makira Project's technical team includes 21 technical experts with relevant educational, training and professional backgrounds. Since 2003, WCS has successfully managed the Makira Project, which confers a low risk to the issue of technical capability and to that of management capacity.

Net revenues/financial returns from the project to all relevant stakeholders:

The risk associated with inequitable financial returns from the Makira Project is considered low. Based on an agreement between the Government of Madagascar and the Makira Carbon Company LLC, signed in 2008, 50% of the net carbon revenues will be allocated to support local communities in and around the Makira Project (see also Section G3.11.). The allocation of this revenue will be determined in consultation between representatives of affected communities, a steering committee within the designated foundation and the delegated manager of the Makira Protected Area.

Population surrounding the project area:

Except for the district of Maroantsetra, which has a population density of 95.4 hab/km2[38], the population density for the five other districts of Makira are low: Andapa (32.6 hab/km²)[39], Antalaha (30.2 hab/km²), Befandriana Nord (17.5 hab/ Km²) and Mandritsara (20.1/km2)[40]. There is no risk of them exceeding 150 habitants/km2 during the next 30 years.

Makira Project financial plan:

A Makira endowment fund will be created specifically to manage the carbon revenues accruing from the Makira Project. The Makira Project is currently developing al business plan and financial strategy for the long-term management of carbon revenues. The creation of an entity dedicated to managing the finances of the Makira Project according to a clearly defined strategy will considerably reduce the financial risks of the Makira Project.

Financial Capacity:

Since 2003, WCS has successfully drawn financial resources from various bilateral, multilateral and private sources to create the Makira Forest Protected Area and implement its conservation and development activities. While revenues from the sale of carbon credits are expected to be sufficient to cover the Makira Project costs, the Makira Project will be able to make up for shortfalls that may arise because of fluctuations in the market price of carbon credits by drawing on similar support. The financial capacity risk is low to medium because of this "demonstrable backing from established financial institutions, NGOs and governments".

The ex ante estimation of the GHG emission reductions that the Makira Project activity will achieve shows that the carbon revenues will constitute a major and fundamental source of revenue, hence the low to medium risk associated with Future Income.

Infrastructure and Future/Current Opportunity Costs:

As for economic risk, for several years the government has promise to repair the national road that links the town of Fénerive-Est (which is the administrative centre of the Analanjirofo region) to Maroantsetra. This road is currently in a serious state of disrepair, but is still regularly used as it is the only major road linking Maroantsetra to Madagascar's major urban centres. We assume that the resurfacing and repair of this road would increase its use, and thus bring increased access to regional markets and market goods.

[38] Monographie de la region d'Analanjirofo, 2005

[39] Monographie de la région de SAVA, 2003, Ministère de l'agriculture, de l'élevage et de la pêche, Unité de Politique de Développement Rural.

[40] Monographie de la région de Sofia, June 2003, Ministère de l'agriculture, de l'élevage et de la pêche, Unité de Politique

As has been detailed in Sections G2.1 and G2.2, the protection of the Makira forest through the establishment of the Makira Forest Protected Area replace identified baseline scenarios involving a number of land uses. Presently the major driver of deforestation is the expansion of agriculture to meet the needs of a fast-growing population. Illicit small-scale mining and timber logging for international traffic also occur. Legitimate commercial forest exploitation and mining were also plausible future land uses prior to the establishment of the Makira Project.

The future opportunity costs of foregoing commercial mining and forest exploitation are not considered for several reasons: The project area is gazetted as a national protected area; the Makira Project has the formal support of the government of Madagascar; legal mining activities in region of the Makira Project are still limited to the acquisition of prospection permits by interested actors; the Makira Project proponent has negotiated a definitive stop to prospection and mining with the holders of permits and they have accepted to relinquish their permits..

No data is currently available to determine the exact opportunity costs of foregoing current land uses in the area that cause deforestation including: slash-and-burn agriculture, the use of fire to renew pasture on the western edge of the Makira forest, and illicit logging and mining. However, given the expected carbon revenues that the Makira Project will generate, as well as the communities strong interest and engagement in the Makira Project, the 50% of carbon revenues that local stakeholders will receive over 30 years is likely to be more lucrative and sustainable than revenue generated from alternative land uses. The security of these economic benefits from carbon credits' sales, coupled with on-going governance, targeted development, education, and welfare outreach efforts, should out-weigh the economic opportunity cost of forest protection. The Makira Project is judged to have a low risk because of its long-term commitment with no harvesting of timber. However, the risk could become Medium to High when considering the politically unstable context.

Political stability and natural disasters:

Of risks considered to impact the Makira Project those that may substantially affect the Makira project's GHG emission reductions are related to political instability and natural disaster, namely illegal logging activities due to the current political crisis and cyclone damage.

Cyclones: The northeastern region of Madagascar is prone to periodic cyclones during the rainy season. Strong winds and flooding associated with cyclones can damage areas of forests, break trees and cause severe soil loss on erosion-prone hillsides. Cyclones also damage public infrastructure, houses and crops, contributing to the impoverishment of rural families. Meteorological trend data for Madagascar suggests that prevalence of cyclones hitting Madagascar will increase in the face of changing global climate.

Illegal logging activities: Experience in Madagascar has shown that when there is a socio-political crisis, natural resources tend to be treated as open access resources with a general anarchy and noncompliance to the law. In the north-eastern region of Madagascar where the Makira Project

will take place, political instability has often resulted in a burst of illegal logging of precious woods, particularly the different varieties of ebony and rosewood. During the last political crisis in 2009, thousands of people logged rosewood within neighbouring Masoala National Park. In addition to the local extirpation of precious hardwood species, the illegal logging also damaged many other elements of biodiversity through clearing forest to establish temporary settlements; these 'knock on effects' include increased poaching bushmeat and increased extraction of non-timber forest products. Though the local community associations are officially recognized as the managers of the forest resources within the Protection Zone, during political instability local governance will be weakened and local people will not have the power to prevent the exploitation of forests within their community-managed forest contracts.

Given the well-established assistance provided by WCS to the local communities with land use management and improving agricultural productivity, the local impacts of political instability will be minimised. The Makira Project constitutes and will continue to constitute a national and local conservation success story. Moreover, the numerous support letters from the mayors of all the communes affected by the Makira Project attest to the local political authorities' support for the Makira Project.

Additional risks to community benefits:

In terms of potential impacts of the Makira Project to local communities, the Makira Project will not negatively affect local communities' livelihoods as people will still be able to continue all of their existing economic activities; except for illegal activities. However there are also other potential risks to consider that could be associated with social conflicts, which could happen if generated carbon revenue is not equitably shared. This risk will be minimized through development of transparent mechanisms for equitable revenue distribution (see Section G3.11).

Mitigation measures:

Carbon permanence:

To safeguard against impermanence and insure against the Makira Project risks, the Makira Project will set aside an appropriate amount of credits into the VCS's AFOLU Pooled Buffer Account (upon VCS validation and verification of the Makira Project). For Makira, this risk buffer is currently calculated at 20% of the estimated Verified Emissions Reductions. The overall risk assessment shows the Makira Project to be of medium risk; this is mainly due to potential natural disaster (cyclones) and illegal logging

While there is little that can be done to address increased cyclone frequency, illegal logging, will be addressed through an improved and expanded surveillance, control and supervision system for the Park. This will be realized in concert with continued and strengthened law enforcement efforts through collaboration with the forces of order, the authorities, communities and the different stakeholders at all levels at the local, regional, national levels.

Community risks:

In addition to good governance of the Makira Protected Area, it is essential that there are adequate resources available to the local communities for them to meet their household economic needs. Thus, as a foundation to the Makira protected area, the Makira Project has established a greenbelt of community-managed sites to ensure that all current and future natural resource needs of the communities are firstly, met and secondly, formally transferred to their control. The definition of the boundaries of the forest to be protected within the Core Protected Area, as well as what areas and natural resources will be transferred to community management, takes into full account both the communities' current needs and their projected needs over the next 50 years. The determination o of these boundaries was completed with the full participation and agreement of local communities. Further, the communities will receive significant continued capacity building support from WCS to help them to sustainably manage their resources and to provide for their needs.

A significant component of the Makira Project activities focus on developing alternative livelihoods for local communities. Through diversifying local peoples' sources of income to improve livelihood strategies, the Makira Project will further mitigate potential negative impacts of forest conservation.

G3.6. Measures to ensure maintenance or enhancement of the HCV value

Madagascar's legislation governing protected areas (COAP) prohibits extraction of any biodiversity and mining inside the protected areas. In the surrounding green belts, the community-based forest resource management (GCF) contracts between the community associations (COBA) and MEF will prevent over-harvesting and allow natural resources and biodiversity to be maintained within the protected area boundaries. The foundation for management and protection of the periphery of Makira will be participatory patrols and monitoring undertaken by the COBAS. Joint quarterly field patrols with MEF will reinforce the surveillance and control of the project area. Law enforcement and monitoring both within the protected area and the protection zone coupled with the other project activities as described in Section G3.2 will ensure maintenance and enhancement of the varirous HCV values inside the project zone including the whole Makira landscape biodiversity, threatened or rare ecosystems, fauna and flora, the ecosystem services but also the basic natural resources needs of the local communities.

As for the traditional rituals, and particularly the case of Amparihimolengy, the area was put as "Zone as Sustainable Use" to allow people to use this site and perform a joro.

G3.7. Measures to enhance permanence of project benefits

The Makira Project activities and their implementation are designed to ensure the sustainability of its impacts beyond the Project lifetime:

- The establishment of a permanent Protected Area;

- The use of revenue generated from forest carbon credit sales to make the necessary long-term investments in developing sustainable livelihoods within the project area to ensure social and economic sustainability into the future;
- The creation of an endowment fund to ensure long lasting-funding for the management of Makira protected area and support programs for the surrounding communities;
- The engagement of the local communities in the co-management of the protected area;
- The transfer of management to local communities within the Protection Zone;
- The development of social, economic, health and agricultural infrastructure,
- The implementation of an information, education and communication program that promotes linkages between the environment and other sectors such as water, energy, health and education.

Permanence:

Makira has had temporary status as a protected area since December 2005, and the application for permanent protected area status is currently being reviewed by the MEF's Directorate for Protected Area Systems. Makira will soon be designated as a Natural Park under the System of Protected Areas of Madagascar (IUCN Category II for the Core Protected Area).

The risk of impermanence can be considered with regard to poor resource management, weak or weaken governance, natural disaster, and human drivers such as fire and slash and burn agriculture. In considering the Makira Forest Protected Area, permanence is being addressed through institutional and financial mechanisms.

Further to its imminent status as a protected area, Makira will be managed under a co-management governance structure with the local communities (see also Section G3.8.). The risk of impermanence of Makira emissions reductions is also addressed via the engagement of community in resource management through GCF contracts. These transfer of resource management contracts formally engage the communities in sustainable forest resource management based on a validated management plan, and hold the communities accountable for mismanagement.

Furthermore, the redistribution of forest carbon revenue among the local communities will serve as an incentive to effective resource management efforts. Through the revenue distribution mechanism, 50% of all forest carbon revenue generated from the Makira Forest Protected Area will flow back to local communities. This revenue will provide those incentives necessary to allow these community members to improve land use practices, engage in sustainable alternative revenue-generating activities and support alternative livelihoods activities: promoting a permanent transition away from destructive land use practices – reducing the risk of deforestation.

The generated forest carbon revenues will also allow for the establishment of a principal long-term financing mechanism that will serve beyond the life of the Makira Project and ensure that

adequate human resources and infrastructure exist to properly manage the protected area system.

G3.8. Stakeholder consultations and involvement

Stakeholder analysis:

Potential stakeholders involved with the implementation of the Makira Project include:

(i) Local communities for we can distinguish three subgroups

- People who live in the controlled occupied areas (ZOC) inside the Core Protected Area. There are about one thousand living in Makira and they are entirely dependent on the resources within the Protected Area. Those people are the most highly affected by the Makira Project and are referred to as the PAP Major;
- People who live within the Protection Zone surrounding the Core Protected Area. They are less affected by the Makira Project (PAP Minor) and are almost unaffected by the creation of the Core Protected Area as its limits were determined in full consultation with them so as to exclude their settlements, and the forest resources and the land that they use and are projected to use over the next 50 years. However the creation of the park will likely affect their life style and habits;
- People who live outside the Protection Zone (and consequently the CCBS project zone): In general, these populations are not directly affected by the creation of the Protected Area;

(ii) Regional, district and communal administrative authorities;

(iii) The regional and national representatives of the Ministry of the Environment, Water and Forests, in particular the forestry department;

(iv) Other representatives of technical public services;

(v) Local associations and NGOs;

(vi) Regional, national and international associations and NGOs;

(vii) Persons illicitly logging and mining.

The following table is an analysis of the profile of the various potential stakeholder groups with an identification of their interests and inter-actions with other groups, and their likely reaction to Makira Project interventions or external pressures.

Table 16: Stakeholder Analysis Profile Matrix

Stakeholder or Stakeholder Sub-group	Interests in the Project	Effect of Project on their Interest(s)	Capacity and Motivation to Participate	Relationship with Other Stakeholders (Partnership / Conflict)
Local communities living within the core protected area – PAP major - inside the project zone	Live inside or have agriculture land inside the core protected area Together with the PAP minor, are the main agents of deforestation	- Access to resources limited and controlled - sustainable resource management - improved livelihoods - benefit from carbon revenues	Strong capacity and motivation	Key partners in the project management; especially in the management of the core PA
Local communities living outside of the core protected area but inside the protection zone - PAP minor	Live outside of the border of the core protected area but inside the protection zone where they have villages, cropland and areas of forest that they use Together with the PAP major, are the main agents of deforestation	- Access to resources is limited - sustainable resources management - improved livelihoods - empowerment - benefit from carbon revenues	Strong capacity and motivation	Key partners in the project management; especially in the management of the protection zone
Local communities : living outside of the project zone	These communities are not impacted by the project nor do they are agents of deforestation	Very limited to some social conflict and benefits	Weak	No
Local associations and NGOs	Formed from the local communities amongst the PAP	- Empowerment - Capacity building - benefit from carbon revenues	Strong motivation	Services providers in the implementation of the projects
Local/regional administrative authorities	Part of the communities and local institutions	- Empowerment - benefit from carbon revenues	Strong motivation	Partners in the implementation of the projects
Local/ regional public technical services	Main stakeholders, issued from local communities	- Empowerment - benefit from carbon revenues	Strong motivation	Partners in the implementation of the projects
Illegal mining and logging exploiters	None as the people carrying out these activities are mainly itinerant outsiders who mostly come from other regions	The project will prevent them from continuing illegal logging and mining	Weak	In conflicts with authorities, public services and local communities
Regional, national and international associations, NGOs	-----	------	Strong capacity	Partners in the implementation of the projects

The following table assesses the relative influence and importance of each of the above stakeholder groups. Influence refers to the degree to which a stakeholder has power over the Makira Project, and can therefore facilitate or hinder project interventions. Importance refers to the degree to which achievement of project goals depends upon the involvement of a given stakeholder.

Table 17: Relative Influence and Importance of Key Stakeholders

Influence of Stakeholder	**Importance of Stakeholder to Project Achievement**				
	Unknown	Low	Moderate	Significant	Critical
Low		- Illegal miners and loggers - Local communities living outside of the project zone	Regional, national and international associations and NGOs		
Moderate				- Local associations and NGOs	- PAP majeur - PAP mineur
Significant				Local/ regional public technical services	Local/regional administrative authorities
Highly influential					

Stakeholder consultations and involvement:

Consultations with the stakeholders, from the national to the local level, were initiated as early as 2002, in the context of protected area creation, social and biological inventories. They have been on-going since and have taken place during each phase of the project cycle, from design of the project, delimitation of the project area and zone, work plan elaboration to monitoring of the project's activities.

WCS has several years of close working relationships with the communities and other stakeholders in the project zone and over this time strong mutual trust has been developed. Continuous consultations with all categories of stakeholders, from the national to the local level, were initiated since the beginning of the Makira Project and concern all aspects of the project implementation, especially on the limits and zoning of the protected area, the management measures, identification of potential impacts and compensation measures including support to livelihoods. Minutes and reports on these meetings and consultations with the different stakeholders are available upon request.

Establishing the Makira protected area:

Malagasy law pertaining to the creation of protected areas requires significant community consultation and participation in establishing the boundaries of new protected areas. A formal team for the delimitation of the conservation site of Makira was created in early 2005 by means of

official orders issued by regional and local authorities. Three official orders were issued to indicate the structure and members of the delimitation team for each of the three concerned regions, namely Analanjirofo, SAVA and Sofia. In general, the teams were made up of the following members:

- One representative from the above Districts
- One representative from the involved Communes
- One representative from the Ministry of Environment, Water and Forests
- One representative from the Regional Direction of Rural Development
- One representative from the State Property Department
- One representative from the State Land Topography Department
- One representative from the WCS Makira Project.

The first activity was a meeting with local authorities (Mayors and chief of villagers) to consult them about the Makira Project and get their opinions. From this point on, local communities, authorities and representatives from the Ministry of Environment and Forest were consulted at every step of the project. Other stakeholders were also consulted at various occasions. In fact, as required by the Malagasy laws, local stakeholders including local and regional authorities (traditional and administrative) and communities, representatives of government and other local technical partners from public and private sectors, associations and NGOs were all consulted in determining the limits of the Makira Protected area. During more than three years, from 2005 to 2007, every single village within more than 63 fokontany, 21 communes and 5 districts concerned by the limits of Makira were visited and meetings held with villagers and authorities to discuss, negotiate and validate the concerted limits of the Protected Area.

The final limits were validated at different levels from local, regional and national level and with a wide range of stakeholders. The minutes of the meetings held, describing the tentative boundaries of the Makira protected area were displayed on a board in each village/Fokontany for all inhabitants to consult for one month. During 30 days, a registry book was open to any individual that had any remarks, complaints or further requests concerning the protected area. The final step was then the organization of a multi-stakeholders meeting (referred to as the réunion de la commission multipartite) with the members of the delimitation team and the Mayors of all concerned communes to discuss the complaints registered in the registry book and make final decision. Local communities' claims and complaints were expressed, evaluated, responded to and subsequently accounted for in the final delimitation of the protected area. All final decisions made during the meeting are registered in minutes signed by all participants

Delimitation of multi-use zones:

As a result of these discussions and negotiations, all human settlements and their village lands were excluded from the limits of the core protected area in order to minimize negative impacts on the livelihoods of communities. There are human settlements that lie within the middle of the

forests and which had to be included within the limits of the Protected Area. These were given the status of "Controlled Settlement / Occupation Areas" (ZOC). There are five Controlled Settlement/Occupation (ZOC) areas, covering a total 11,875 ha and including a population of 970 inhabitants (WCS Makira Project PAG, 2009). People can remain living in the ZOC and continue pursuing their livelihoods, but no immigration into the ZOC is allowed.

Similarly, there are uninhabited agricultural areas inside the forests; they are classified as "Zones of Sustainable Use" (ZUD). There are 15 ZUD, covering 28,602 ha and concerning 2,142 inhabitants (WCS Makira Project PAG, 2009). The communities will continue to exercise their right to traditional use and continue farming in these areas. Nevertheless, management rules, reinforced and supplemented by the provisions of Dina and conditions of the community-managed forest contracts (cahier des charges) are developed for these specific areas. A committee representing the population within each of the designated ZOC and ZUD has signed a contract with the delegated protected area manager, WCS. (See appendix XII for a sample agreement for ZOC)

Setting up of community-managed sites:

A buffer zone of mixed forests, agricultural lands, and villages surrounds the Makira Protected Area. It is referred to as the Protection Zone and ensures full and meaningful involvement of local communities in the Makira Project. This zone is made up of several community-based forest resource management (GCF) sites, which are areas where responsibility for forest resource management has been devolved to local communities, living along the perimeter of the forest, through a contract agreement signed between the Ministry in charge of the Forests and elected communal bodies (called Communautés de Base in French or COBA).

In November 2010, 41 GCF sites were in place totalling approximately 145,000 ha and by the end of year 2012, 80 GCF sites will be transferred to local communities, covering approximately 325,000 ha. Each GCF site in place has its own development and zoning plan. Each site has in its zoning plan a forest plot called "conservation zone" that is part of the project area and that the communities are managing - in collaboration with WCS - to generate carbon revenues. WCS is working alongside the communities in the protection zone to provide support to the COBA in managing their natural resources and stabilizing land-use while securing formal natural use rights. Commercial resource exploitation is prohibited within the community-managed areas. These are areas where most of the deforestation has historically occurred and thus where most of the emission reduction credits from avoided deforestation will be generated. These zones are also a crucial part of the strategy to address potential leakage of the Makira Project's carbon benefits.

Co-management of the Makira protected area:

Along with the delimitation and zoning of the Project zone, the other major significant outcome of the consultations was to define a collaborative structure for the co-management of the protected area. This is presented in figure 16 on page 69.

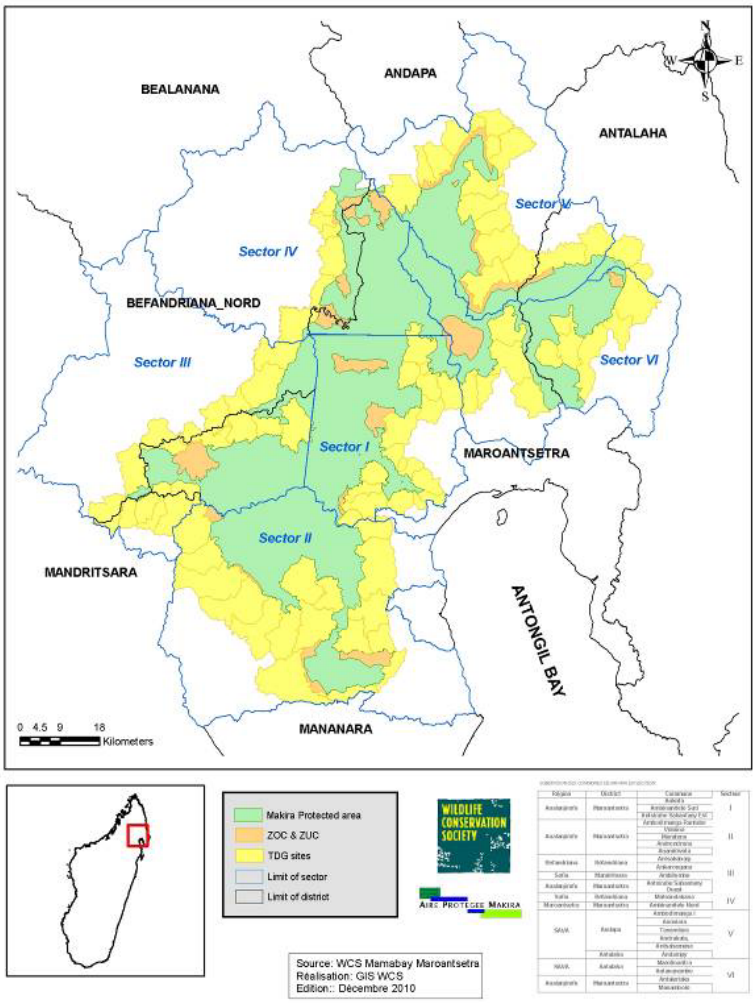
Overall, the co-management structure for the Makira Protected Area is made up of 3 committees:

- The steering and monitoring committee (the decision-making body)
- The management committee
- The advisory committee which includes external actors who influence or are influenced by the protected area

The organization of the local communities within the Protection Zone is as follows:

- Each community-managed GCF site has a management committee, or COGE. Each of the six sectors of the Makira Protected Area (see Figure 15 and Figure 18) will have a platform of COGEs that discuss issues related to management of their GCF sites in relation to the Makira Protected Area
- Each sector platform will identify two (2) representatives to be part of the Federation of COGEs (sector IV will be the sole sector that will have 3 representatives given the large number of GCF and ZOC sites)
- The Federation of COGEs will then select three representatives, one representative per region to be part of the Makira PA steering committee.

Figure 18: Sectors of the Makira Protected Area



The role of the individual COGEs in the management committee will be to participate in all decisions made concerning activities in the different zones of Makira PA, as well as within the Protection Zone. It will be the responsibility of WCS, as designated manager, to work with the COGEs on these management/protection/conservation activities. The COGEs will be expected to respect agreed upon management decisions as they will have had representation in the steering committee.

Support to community development:

Considering the potential different socio-economic impacts of the Makira Protected Area, and based on the recommendations from various partners during the different consultations, and the various requests and wishes as well as complaints from local communities, a series of measures have been and will be taken in order to mitigate, to compensate or to avoid the negative impacts of the protected area. Similarly, measures will be taken to ensure the optimization and / or reinforcement of positive impacts.

Since the beginning of Makira Project, the project proponent has worked with various stakeholders, especially local communities, to identify, design and implement community development actions. In partnership with local communities, a range of development activities have already designed and carried out including: building community management structures, supporting farmer organizations, establishing hydro-agricultural dams, promoting permaculture and other improved production techniques, and developing a microfinance program.

Consulting the local community on the sharing of the potential carbon revenues of the Makira Project poses a number of challenges. The project proponent feels strongly that until the Makira Project is validated and verified, and the carbon revenues are guaranteed, it is inappropriate to raise the hopes of the broader community of being able to benefit from the sale of carbon credits. Premature discussions of carbon revenues would create "false hopes" amongst communities. Worst still, risk people acting on or committing to the project based on the uncertain premise of receiving possible future carbon revenues. However, based on an agreement between the Government of Madagascar and the Makira Carbon Company LLC, signed in 2008, 50% of the carbon revenues will be used to support local communities in and around the Makira Forest in their natural resource management, forest conservation and community development initiatives, through a local management structure to be established in accordance with applicable Malagasy law and operated in collaboration and consultation with the delegated manager of the Makira Protected Area (see also Section G3.11.). It is also clear that the use of such fund will be discussed and decided with the full participation of the local communities.

G3.9. Publication of CCBA public comment period to all stakeholders

In addition to posting the Makira Project design document on the CCBA website (http://www.climatestandards.org), the document will also be posted and open to comments from the public on the WCS website (http://www.wcs.org).

Along with an explanation of the CCBA public comment period and with instructions for submitting comments to CCBA, hard copies of this document will also be made available during the public comment period at WCS's offices in Maroantsetra and Antananarivo to allow local, regional and national stakeholders to raise and address any issues. For that purpose, a French and Malagasy summary of the Makira Project will be made available and explained to the local communities with the assistance of the COBAs.

G3.10. Grievances and conflicts resolution

As was the case during the process of creation of the Protected Area, the Makira Project has always had an open door to anybody who wants to make comments, complaints, requests or advise on all aspects of the Makira Project. This could be done either with the representative of the Makira Project in the field, in Maroantsetra or at the WCS office in Antananarivo. All comments were addressed and feedback provided as soon as possible. The Makira Project has very much benefited from this approach and will continue to maintain these options for input. Written response to comments will be provided within 30 days.

Conflicts and grievances are addressed differently depending on their nature. Some conflicts are handled at local/community level with local traditional or administrative authorities. In keeping with Malagasy culture, conflicts will be as much as possible resolved between the different parties involved by coming to an amicable agreement. This is done during a small private meetings or a gathering of community members depending on the nature of the different parties and the cause of conflict. This approach has proven to be successful in resolving problems at a community level. Other conflicts may necessitate the involvement of the Comité de Pilotage of the Makira Project (Board of Directors), higher authorities, or the mediation by a third independent body or the courts if necessary.

All comments and conflicts will be documented along their resolution.

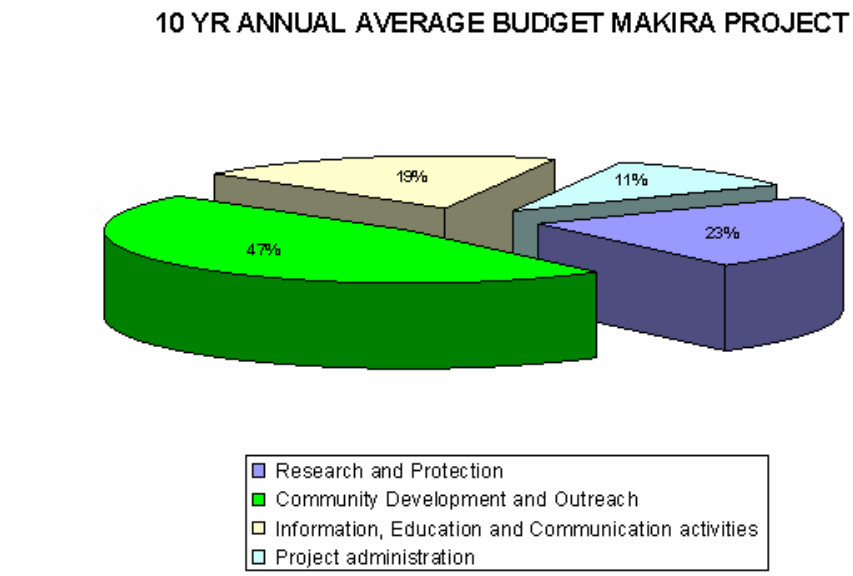
G3.11. Project financing

Investment into the Makira Forest Protected Area Project began in 2001 with support to initiate a feasibility study into establishing the Makira Forest Protected Area based on avoided deforestation financing. Since 2001 the investment in the Makira Forest Protected Area Project exceeds $3 million. These investments in the project were largely based on standard grant agreements between WCS and various donors including foundations, non-governmental organizations, and private sector: approximately 25% has come from the sale of pre-certified carbon credits.

Based on the Makira Project 10 year business plan[41], which has been developed very recently and will be available to the validators, annual average expenditure is estimated to be about US$1,211,400. As presented in figure 20 below of this:

- 23% will support research and protection. This includes patrolling, research and inventories, ecological monitoring;
- 66% will support to community development and outreach activities including community-based natural resources management, capacity building, alternative sustainable livelihoods, promotion of income generating activities, information, environmental education, communication, ecotourism, and population health;
- 11% will support administration of the Protected Area.

Figure 19: Ten-year average annual budget for the Makira Project



Revenue generated from the sale of Makira forest carbon offset credits will provide secure long-term financing for Protected Area management including all monitoring activities, community development supports, education and communications, and capacity building. The new business plan for the Makira project estimates that in the period from 2011 to 2020 between 200,000 and 550,000 t CO_2-e would have to be sold in order to hit break-even each year, assuming a post-certification price of US$8.24 pet t CO_2-e. Based on the current estimates presented in the climate section below this seems very likely.

[41] WCS 2011, The Makira Project Business Plan.

Carbon revenue sharing and management mechanism:

Based on an agreement between the Government of Madagascar and the Makira Carbon Company LLC, June 2008, a foundation or other similar entity designated by the State (the "Designated Foundation") will be in charge of the management and disbursement of funds made available under the agreement as summarized in the following diagram. Funds management for the 50% of net revenue designated for local communities will be determined by a steering committee within the Designated Foundation in collaboration and consultation with the delegated manager of the Makira Protected Area.

The Net Proceeds from sales of Makira emission offsets will be allocated in the following manner (cf. figure 17): (i) 50% to support local communities in and around the Makira Forest in their natural resource management, forest conservation and community development initiatives, through a defined local management structure to be established in accordance with applicable Malagasy law and operated in collaboration and consultation with the delegated manager of the Makira Protected Area; (ii) 25% to the delegated manager of the Makira Protected Area to support the management of the Makira Protected Area pursuant to the Management Delegation Agreement or such other applicable agreement, as the case may be, (iii) 15% to the Ministry, to support a range of activities including strengthening its technical capacity for climate change mitigation and supporting the development of a national carbon strategy and national monitoring capacity, (iv) up to 5% to reimburse the Company for expenses incurred in connection with the marketing and sale of the Allocated Carbon Offsets (and the management of such marketing and sale), (v) up to 2.5% as needed to pay for third party monitoring, verification and certification, with any portion of the 2.5% not so expended to be allocated to (i) or (ii); and (vi) up to 2.5% to the "Designated Foundation" for its overhead costs in association with the management and disbursement of funds made available under the Agreement.

The allocation of the 50% Net Proceeds for communities development referred to in (i) will be determined by the representatives of community in consultation with a steering committee within the Designated Foundation and the delegated manager of the Makira Protected Area.

The structure of the community associations (COBA), democratically established by the communities of Makira, will facilitate the redistribution of the 50% of the net proceeds from these sales to support Makira's local communities' natural resource management and community development initiatives and make it possible and fair. Calculated on a per hectare basis benefits from the sale of these carbon credits flowing back to the communities is tied directly to their successful stewardship of the forest.

G4. Management Capacity and Best Practices

This section of the Project Design Document provides information on the Makira Forest Protected Area Project management team competence and capacity to implement the project.

G4.1. Project proponent

The single identified project proponent for the Makira Project is:

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Country Program Director
Wildlife Conservation Society
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G4.2. Key technical skills

Institutional capacity:

The Wildlife Conservation Society (WCS), founded in 1895 is an internationally recognized organization dedicated to preserving the Earth's wildlife and wild places. WCS currently oversees a portfolio of more than 500 conservation projects in 60 countries in Asia, Africa, Latin America, and North America. WCS works with national governments, universities, non-governmental organizations (NGOs) and dedicated individuals to increase understanding and awareness of the importance of wildlife though the establishment and strengthening of protected areas.

More recently, WCS as engaged in the development of its carbon for conservation initiative. Currently, WCS is working with communities and governments in 18 landscapes and 14 countries to develop sub-national REDD+ demonstration projects and support the development of national REDD strategies. WCS believes that work at sub-national and national levels should be linked in such a way that national REDD strategies are informed by on-the-ground experience obtained through demonstration projects. WCS only works on sub-national REDD+ demonstration projects in landscapes where we have or plan to have a long-term presence. This long-term presence is a prerequisite to success in order to understand the drivers of deforestation and implement activities that reduce deforestation effectively and ensure permanence with community's consent and participation. Together the WCS portfolio of projects demonstrates how to develop REDD in varied institutional, socio-economic and ecological environments. By working with government, WCS will work to develop national REDD strategies sensitive to local conditions that effectively stem emissions from deforestation and degradation. The technical capacity of WCS justifies a low risk associated with its "ownership" of the Makira Project.

WCS also has a conservation support team based at the New York headquarters that provides technical assistance, analysis, training and capacity building to WCS global conservation programs. The conservation support program, established 10 years ago, provides direct technical support in the areas of conservation strategic development, status and impact monitoring, landscape and ecological modelling, education outreach and capacity building.

Project level capacity:

The Makira Project consists of five main components: conservation and research, community development, transfer of resource management, communication and education and a fifth component on the carbon aspects. Each of these components requires a specific set of technical skills and aptitude. WCS and the WCS Makira Project staff have sufficient and appropriate competencies to ensure effective implementation of these components.

Conservation and Research:

This component includes activities related to habitat and biodiversity conservation, research, ecological and carbon monitoring activities. The WCS-Madagascar Program has specific institutional strengths appropriate to this component. Over the past two decades, WCS Madagascar has played an integral role in the establishment and management of six protected areas, including Masoala National Park; the largest Park in Madagascar. WCS is part of the National Commission on the Protected Areas System of Madagascar and remains one of the lead technical partners for the country's national parks department. Well known as a leading field and science based organization the WCS Madagascar technical staff is represented by biologists, forests engineers and anthropologist.

Community Development within the forest's adjacent communities:

This includes diversification of sources of income, improved production techniques, infrastructure development, micro-finance and ecotourism program. To ensure full community supports in the field, WCS is working in tight collaboration with local communities using the farmers-to-farmers approach and demonstration plots so as to popularize new and improved agricultural techniques. Led by an agricultural engineer, an agricultural technician and a geographer, the WCS technical support team is reinforced by several well-trained "field-based technicians" living and working with communities; ensure permanent support and ongoing supervision in the fields. In general, there is one field technician for every two COBAs.

Transfer of Resource Management to local communities within the Protection Zone around the Protected Area:

This includes community socio-organization and capacity building as well as development and supervision of GCF contracts with communities. Led by an agricultural engineer and sociologist with over 10 years of experience working with communities, this component the Project requires significant organizational and communication skills.

Communication and Environmental Education, including health-related activities:

The component aims to empower the local populations to take responsibility for managing resources sustainably so as to maintain environmental quality and assure human wellbeing. Initiative within this component will be realized through a multifaceted approach that addresses development of knowledge, skills, motivation, and values so as to affect behavior and attitudes changes. WCS uses the strategy of integrating health and environmental messaging, and delivering them to the most remote communities through a focus on primary school children. The strategy is in line with the national education goal of ”transformation education” and will work through the school system as well as through more informal opportunities offered by local environmental ”clubs”. This environmental education component complements the ongoing health and family planning program that WCS has engaged in with Population Services International: a program that brings improved health and welfare opportunities to isolated communities through a social marketing mechanism driven by the communities themselves. WCS technical support at the project level includes an Environmental Education and Communication Officer and an environmental health assistant. The WCS National Environmental Education Coordinator based at the head office in Antananarivo further supports the project technical staff.

Carbon measurements and monitoring:

In 2004, WCS Makira technicians (including the Research Officer and the Ecological Monitoring Officer) benefited from collaboration with experts from Winrock International and received on-the-job training on carbon inventory and monitoring including the use of the different materials/equipments, data collection methodologies and data treatment and management. Local community assistants also were trained and regularly participated in carbon measurements related field activities. Laboratory-based aspects of forest carbon assessment, including drying of collected samples, is being carried out in collaboration with Laboratory of the Faculty of Sciences of the University of Antananarivo.

Cross-cutting units:

The database and information management unit which is led by a geographer who is a specialist in Geographic Information Systems and the administrative and finance unit.

The Makira Project’s technical team includes 25 technicians with relevant educational, training and professional backgrounds. This technical staff is supported by an administrative staff of 3 persons. Since 2003, WCS has successfully managed the Makira Project, which confers a low risk to the issue of technical capability and to that of management capacity. The project team is further supported by the national coordinator of the WCS Landscape initiative in the region, and a national technical and administrative staff of 15 individuals under the direction of the WCS Country Program Director. The following table lists the roles and responsibilities of the WCS Makira Project staff.

Title	Number of staff	Role and Responsibilities
National Director	1	Planning, implementation, coordination and supervision of the project; Representation of the project at local and regional level
Community Resource Management Transfers Officer	1	Implementation of forest resource management transfers: structuring of communities, support to the elaboration of the management transfer, training of the management committees, performance monitoring and assistance with the renewal of contracts
Conservation and Research Unit Manager	1	Coordination/Supervision of research and conservation activities (interaction with researchers, organization of surveillance patrols)
Scientific Research Officer	1	Design and implementation of research plan. Collaboration with researchers, contribution in the training of participatory ecological monitoring committees and of project staff. Assisting the ecological monitoring opfficer in performing forest inventories for the evaluation of carbon stocks
Ecological Monitoring Officer	1	Implementation of ecological monitoring within the Park and GCF sites. Monitoring activities at the level of GCF sites includes participatory ecological monitoring implemented in collaboration with local communities, The Ecological monitoring Officer is also in charge of carbon measurements and monitoring
GIS and database Officer	1	Mapping, data processing and management
Environmental Education and Communication Officer	1	Conception, Coordination and Implementation of EE & Communication activities.
Community Development Outreach Officer	1	Coordination, implementation and supervision of Community Development activities; Socio-organizational structuring of local communities, Orientation and training of local associations, Propagation of environmentally-friendly agricultural practices
Ecotourism Assistant	1	Assisting in the development of community-based ecotourism activities
Environmental health Assistant	1	Implementation of the environmental health project: providing orientation to local communities, taking care of relations with Population Services International (partner in the project), local health services and partner NGOs
Sectorial Managers (Chef Secteur)	2 current 6 planned	Supervising activities within the sector, maintaining good relationships with stakeholders (local authorities and communities)
Field Agents	13 current 39 planned	Orientation and training of local communities in natural resources management, in new agricultural and cattle-farming techniques, implementation of environmental education activities and orientation of ecological monitoring committees

G4.3. Training and capacity building of project's employees and communities

While the WCS Makira Project does not have any formal training plan for its employees, the employees do benefit from technical support (see G4.2) and various training opportunities either through WCS New York or through partners. Thus for example in 2008 through its Network of Conservation Educators and Practitioners project, WCS provided trainings to 23 animators and technicians of the Makira Project. Trainees were introduced to biodiversity measurement, to techniques of nature interpretation and tools for assessing threats. Animators were first trained to become trainers of the associations of villagers (COBA) on basics of biodiversity, its components, values and threats using a Malagasy booklet produced by WCS. Two of the Makira Project employees have attended the Beahrs Environmental leadership Program at the University of California Berkeley in 2010. In addition, a series of technical training courses on ecological monitoring and participatory monitoring were provided to the project technical staff in 2010. The

main objectives were to improve technical skill on monitoring targeted species and habitats. These animators will in turn provide training to members of COBAs on participatory monitoring.

On-site training, including site exchanges/visits have also been organized for the Makira Project employees to share their experiences and learn from others. An exchange visit has just recently organized in June 2010 to visit Anjozorobe Reserve (centre-east Madagascar) where a successful community-managed ecotourism project is well established. Another training visit took place in August to Mananara (east Madagascar) on the marketing on bio-vanilla.

With regards to orientation and training for communities, capacity building in the areas of resource management, governance, monitoring, small business and finance has been ongoing since 2004. Further to this, continued training programs are planned as part of the work plan for the management committee members of the community managed GCF sites. The committee members will be trained on social mobilisation, forestry legislation and participatory ecological monitoring. Training will be provided by the WCS Makira technical team, in collaboration with local government representatives from the Ministry of Environment. Further, as indicated above in the staffing structure for the Makira Project, WCS field agents are permanently place to implementation and follow-up community support efforts.

G4.4. Employment policy

WCS had already given priority to members of the communities when constituting the Makira Project team. Technical staff hired from the communities surrounding the protected area include: the head of environmental education and communication, the population health assistant, two field agents for the Eastern part of Makira, two field agents for the westen zone of Makira and the two sector managers of the western zone of Makira. They represent almost 50% of the technical staff. WCS intends to sustain that equal opportunity practice.

G4.5. Relevant laws and regulations covering worker's rights in the host country

Workers' rights are described in the Work Code, Law nº2003–044 of July 28, 2004. Specifically there are six main legal texts covering worker's rights in Madagascar that are relevant to the Makira Project. All of them are respected and applied in the implementation of the Makira Project. Employees are informed of their rights before signing their contract.

1 - Decree nº 63-124 of February 22, 1963: CNaPS (Caisse Nationale de Prévoyance Sociale).
This is about the employee benefit (Social security). The society is affiliated to the CNaPS and each employee should be also registered to the CNaPS.

2 - Law nº 64-019 of December 11, 1964 on the « Médecine d'Entreprise ».
In this law, the employer is required to ensure a medical coverage to the employee. WCS reimburses each employee and his family's medical cost. WCS takes care of employee hospitalization costs.

3 - Arrêté nº 421 of January 26, 1968 fixant le mode d'élection et le statut des délégués du personnel dans les entreprises
This is about worker representatives. Election of worker representatives happens every two years.

Two other texts talk about trial period, notice and overtime:
4 - Decree nº 2007-008 of January *09, 2007 fixant les formes, la durée et autres engagements à l'essai et déterminant les conditions et la durée du préavis de résiliation du contrat de travail à durée indéterminée.*

5 - Decree nº 68-172 of April *18, 1968 modified by the decree nº 72-226 of July 6, 1972 on working hours and overtime regulation.*

G4.6. Employee safety

No major incident of employee safety arising from management efforts and/or from engagement with and support to local communities has occurred to date. The WCS Madagascar Program has policy to ensure employee safety that includes employee medical cards: including information on medical problems of the employee, the name and contact number of his family doctor and the name of persons to contact in case of emergency. If necessary, the first persons to contact in Maroantsetra in case of emergency are the WCS National Program coordinator and the Makira Project National Director. In Antananarivo, the WCS Country Director and Director of Administration and Human Resources are first to be informed of employee safety concerns. A list of contact numbers for emergency services is available in WCS offices in Maroantsetra and Antananarivo including hospitals, police station, Madagascar-based emergency evacuation air services.

While in the field, employees are required to take appropriate safety precautions such use of lifejackets when on the rivers, use of seatbelts when in the project vehicles, use of protective gear when using project motorcycles. Field teams are also required to carry first aid supplies while on mission, and to carry a satellite telephone when situation requires.

G4.7. Financial health of the implementing organisation

The Wildlife Conservation Society (WCS) is founded in 1895 as the New York Zoological Society. WCS is an internationally recognized not-for profit conservation organization dedicated to preserving the Earth's wildlife and wild landscapes and seascapes. WCS currently oversees a portfolio of more than 500 conservation projects in 60 countries in Asia, Africa, Latin America, and North America. The WCS financial report ending fiscal year 2009 (WCS Annual Report, 2009) demonstrates the financial stability of the organization with operating revenue of USD$205.4 million. These operating revenue and support exceeded expenditures by USD$1.5 million, the sixth consecutive year of operating surpluses. Since 2001, WCS and the WCS Madagascar Program has successfully drawn financial resources from various bilateral, multilateral and private sources in the excess of $USD 2 million.

G5. Legal Status and Property Rights

This section of the Project Design Document provides information on the legal framework and regulatory requirements for development of the Makira Forest Protected Area Project.

G5.1. Relevant laws and regulations, international treaties and agreements

National and local laws and regulations:

The following are the principal national and local laws and regulations that provide the legal framework for the development of the Makira Forest Protected Area Project.

- The Malagasy Constitution, Article 37, Article 141, Article 149
- The Malagasy Environmental Charter
- The Decree MECIE on Environmental Impact Assessment (Mise en Compatibilité des Investissements avec l'Environnement)
- The COAP (Code des Aires Protégées) law
- The Decree Nº2001-122 on the implementation of devolved forest resource management to local communities (Décret fixant les conditions de mise en œuvre de la gestion contractualisée des forêts de l'Etat)
- Customary contracts (called Dina) with the local communities and authorities

The Makira Project responds and complies to the relevant national and local environmental laws of Madagascar, namely: the Malagasy Constitution, the Malagasy Environmental Charter, the MECIE (Mise en Compatibilité des Investissements avec l'Environnement) decree, the COAP (Code des Aires Protégées) law, the GELOSE (Gestion Locale des ressources naturelles renouvelables) law, and customary contracts (called Dina) with the local communities and authorities. These different relevnt legislations and regulations are discussed in more detail in the sections below.

Constitution:

According to the Malagasy Constitution, Article 39, "It is every individual's duty to respect the environment. The State, with the participation of the Regions, ensures the protection, the conservation and the enhancement of the environment through appropriate measures."

Environmental Charter (Charte de l'Environnement):

Madagascar's Environmental Charter[42] was adopted in 1990. It defines 'environment', sets down fundamental principles and responsibilities and identifies the mechanisms for implementation, including establishing the 15-year National Environmental Action Plan (NEAP). Article 10 introduces the requirement that projects which could harm the environment should be subject to

[42] Loi n° 90-033 du 21 décembre 1990, modifiée par les lois n° 97-012 du 6 juin 1997 et n° 2004-015 du 19 août 2004, relative à la charte de l'Environnement malagasy

an Environmental Impact Assessment (EIA), taking account of: 1) the technical nature and scale of project impacts; and 2) the sensitivity of the area in which the project is physically located.

The procedure for environmental impact assessment (EIA) was first laid out in Madagascar in 1992, and acquired its present form through the MECIE decree of 1999[43] (revised in 2004 by decree 2004-167). In 1997, an inter-ministerial order was issued (4355/97) defining zones to be considered as 'sensitive', and thus subject to mandatory EIA for all investment projects. 'Sensitive zones' are defined by inter-ministerial Order Nº 4355/97 and include coral reefs, mangroves, small islands, tropical forests, areas subject to erosion, areas subject to desertification, wetlands, nature conservation areas, land around drinking water sources and paleontological, archaeological or historic sites. Each of these has a specific definition.

The order's definition of 'nature conservation areas' is wide and includes protected areas and their designated buffer zones, hunting reserves and sites of biological interest (including sites already delimited, being delimited, classified or being classified). The criteria for 'biological interest' include the existence of migration corridors, breeding or foraging areas, as well as sites harbouring protected species (Part VIII of order 4355/97). Irrespective of site status, promoters discovering species or sites that meet the criteria for biological interest are obliged to implement immediate conservation measures and to inform the authorities. The legislation is based on almost 10 years of experience and may thus be considered relatively mature.

Mise en Compatibilité des Investissements avec l'Environnement (MECIE):

The MECIE decree designates the national environment office (Office National pour l'Environnement, ONE) as the sole and unique authority for new projects screening, EIA determination (whether a full or shorter EIA should be conducted, or neither), EIA evaluation, norm setting, thresholds and limits (e.g. on effluent discharges), award or refusal of a 'certificate of conformity' (environmental permit) and subsequent monitoring of the adopted environmental management plan (also referred to as a 'cahier de charges'). The socio-environmental impact assessment of Makira was finalised and formally approved by ONE in 2008. The approval led to the provision of an environmental permit for the protected area of Makira (See Appendix VI – Makira Environmental permit).

Code des Aires protégées (COAP):

The COAP or Protected Area Law[44] describes the types of protected areas of the Madagascar Protected Area Network (Système des Aires Protégées de Madagascar, SAPM). It also specifically prescribes zoning categories that each protected area manager in Madagascar must comply with

[43] Décret n° 99-954 du 15 décembre 1999, relatif à la Mise en Compatibilité des Investissements avec l'Environnement

[44] Loi n° 2001-5 du 11 février 2003 portant Code de Gestion des Aires Protégées

in the early stages of project identification and implementation. The COAP Law also defines a set of governance principles with which the protected area manager must comply. These are:

- The fair distribution of roles, responsibilities and benefits between the protected area manager and the various stakeholders in the creation and management of the protected area.
- The systematic consultation and dialogue between the protected area manager and the various stakeholders in the creation of the protected area.
- The co-management, notably through the establishment and use of a management plan elaborated with the various stakeholders, as well as a community management agreement as a specific tool for the participation of local communities to the management of the protected area.
- The adoption of protection measure or alternative revenue-generating activities for the various stakeholders to compensate for the restrictions on ownership or use induced by the creation and management of the natural resources of the protected area.
- Transparency and responsibility of the manager of the protected area vis-à-vis the various stakeholders.

In 2005, a Ministerial Order[45] (See Appendix VII) formalized Makira's temporary protection status in compliance with the COAP regulations and twenty other relevant Malagasy laws and regulations. The agreement between the Ministry and WCS, formally recognizes WCS as the delegated manager of Makira and addresses governance issues such as systematic consultation, co-management and adoption of alternative revenue-generation mechanisms as well as equitable redistribution of revenues from carbon sales also tackles all of the above governance issues.

Gestion Locale Sécurisée des Ressources Naturelles Renouvelables (GELOSE):

In 1996, the Government of Madagascar passed GELOSE legislation[46] establishing the authority to devolve natural management control to local communities. The law allows for the delegation of limited tenure and sustainable use rights to a legally recognized local community institution ("Communauté de Base" or COBA), in exchange for a contractual obligation with the Government to conserve and sustainably manage and use the transferred resources.

Forest Legislation (Loi Forestière):

The revised forest legislation[47] defines forests and the different forest regimes and regulates the sustainable use of forest resources. In article 24 it gives provision to the state to delegate management of state owned natural and artificial forests to private or public entities or individuals. This article, together with the aforementioned GELOSE law, provides the basis for devolution of management to local communities through the 2001 decree, the "Gestion

[45] Arrêté Ministériel n° 20.022-2005/MINENVEF

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

[47] Loi n° 97-017 du 8 août 1997 portant révision de la législation forestière

Contractualisée des Forêts de l'Etat" (GCF).[48] All of the management transfers being set up in the Makira Project's protection zone use the GCF process and therefore follow the requirements of the forest legislation and GELOSE, as well as other administrative regulations related to the subject.

Community Regulations (Dina):

A Dina is a traditional convention that binds community members to a set of rules regarding use and conservation of natural resources. Although originally the dina was community specific, it has been adopted as a concept and tool by the state sometime in the 1970s or 1980s to increase the effectiveness of state rules, in particular regarding security issues. For the Makira project, dinas were signed with the local communities to transfer forest resource management (GELOSE and GCF) from the government to the local communities in compliance with the rules of the forestry law. In compliance with the Forestry Law, a dina was signed between the three main stakeholders, the local community associations (COBA) to which the management of forest resources is transferred, the commune and the regional representatives of the Ministry of Environment and Forests, for each GCF site.

Gestion Contractualisée des Forêts de l'Etat

The structuring of a Gestion Contractualisée des Forêts de l'Etat, or GCF contract involves four principal elements:

Contract: signed between the regional authority of the Department of Water and Forest and the elected President of the Community Management Committee for a GCF site. The contract formally gives forest resource management authority to the community management committee.

Dina (law): signed by the regional authority of the Department of Water and Forest, President of com- munity management committee, Chief of implicated Fokontany, Mayor of implicated Commune, Chief of implicated Region, and Head of Regional judiciary. The dina lists all applicable laws pertaining to forest resource management, identifies penalties to be handed down in case of infraction, and clari- fies the responsibilities of the Department of Water and Forest, Fokontany, Commune, and Region in up holding the laws.

Cahier des Charges (contractual conditions): signed by the regional authority of the Department of Water and Forest, President of community management committee, Chief of Fokon- tany, Mayor of Commune. The Cahier des Charge details all allowable resource extraction practices within the GCF site.

Plan d'Aménagement (site development plan): signed by the regional authority of the Depart- ment of Water and Forest, President of community management committee, Chief of Fokontany, Mayor of Commune. The Plan d'Aménagement is based on evaluation of traditional land tenure systems and evaluation of exhibited and necessary subsistence forest resource use practices. The Plan d'Aménagement defines zonation within a GCF site as well as an overview of

48 Décret n° 2001-122 du 14 février 2001 fixant les conditions de mise en oeuvre de la Gestion Contractualisée des Forêts de l'Etat

International treaties and Agreements:

In relation to environmental conservation, Madagascar has ratified the following international treaties and agreements:

- The World Charter for Nature
- The African Convention on the Conservation of Nature and Natural Resources
- The Convention on Biological Diversity
- Convention in International Trade of Endangered Species
- The Convention Concerning the Protection of the World Cultural and Natural Heritage
- RAMSAR Convention
- Convention on the Conservation of Migratory Species of Wild Animals
- UN Convention to combat Desertification
- New York Convention on Climatic Change
- The Vienna Convention for the Protection of the Ozone Layer
- Montreal Protocol on Substances that deplete the Ozone Layer
- The UNEP declaration on Human Environment, Stockholm, 1972
- The United Nations Framework for Climate Change Convention
- Rio Declaration, 1992

G5.2. Demonstration of approval from authorities

The national government has been extremely supportive of this effort and is a partner in the Makira Project through the Ministry of Environment and Forests (MEF). Ownership of the initiative both at the national and the local level have concretely been acquired and multiple written contracts have helped solidify this national and local ownership. Agreements have been developed between the Government of Madagascar and WCS for the management of the Makira protected area and with the Makira Carbon Company for the sale of carbon credits generated by the Makira Project. The Ministry of Environment and Forests have also signed contracts with Local communities to delegate the management of the community-based forest resource management GCF sites in the protection zone to COBAs (See Appendix IX and X). Several supporting letters from national, regional and local authorities are available on request. A sample of supporting letter from the regional authority of Andapa is provided in Appendix XI. These demonstrate widespread adherence to and ownership of the Makira Project.

G5.3. Guarantee that the project will not result in property encroachment

Three legal topographic certificates (Attestastion de repérage Mandritsara/Befandriana Nord, Maroantsetra and Antalaha) attest that the delimitation of the Makira protected area does not trespass on titled properties nor conflict with any other requests for land permits/titles within the three regions. Therefore, there is not any property encroachment. See appendix XIII for a sample

attestation de repérage. As has been described in Section G3.8), a zoning of the entire project zone into different management and use areas was done in close collaboration with all concerned stakeholders. The approach used during the delimitation and zoning of the community-managed areas around Makira also helped clarify land tenure for local people and gave recognition to their customary use of land. The in depth consultation used to define village use areas and to formalise these in the community-based forest resource management contracts (GCF) ensured that the core protected area does not encroach into their customary use areas.

G5.4. Demonstration that project does not require involuntary relocation

The Makira Project does not require the involuntary relocation of people or of the activities important for the livelihoods and culture of the communities. The definition of the different limits of the protected area was defined in full consultation with local people over a period of four years. All human settlements and their village lands were excluded from the limits of the protected area in order to minimize negative impacts on the livelihoods of communities. Human settlements that lie in the interior of the forests and cannot practically be excluded from the protected area; they were given the status of "Controlled Occupation Areas" (ZOC). Similarly, uninhabited agricultural areas that are inside the forests were classified as "Controlled Use Zones" (ZUC). The communities will continue to exercise their right to traditional use and continue farming in both of these use zones.

G5.5. Identification and mitigation of illegal activities

The surrounding local communities have rights to use forests resources for their own subsistence. Illegal activities consist mainly of logging precious woods and mining, which are both mainly carried out by non-residents and are very often a source of conflict between residents and new migrants. The Makira Project is working in collaboration with the Forces of order and local authorities in controlling these illegal activities and ensuring law enforcement. In addition, local communities are empowered through forest resource management contracts (GCF) and supported by WCS in the practice of their management and monitoring responsibilities.

G5.6. Demonstration of land tenure status and title to carbon rights

The protected area of Makira, created through ministerial order 20 022/2005[49], belongs to the Government of Madagascar and will not receive definite title until it obtains a definite protection status. Given the current political context in Madagascar and the uncertain institutional setting associated with it, it is not clear when the Makira Protected Area will receive such a definite status.

As with most natural forests in Madagascar, the government officially owns the forests in Makira and no private ownership can be claimed of forest land. However, starting in 1996 management

[49] Arreté n° 20.022/2005 du décembre 2005 portant création de l'aire protégée en création dénommée "Makira"

of natural resources has been transferred to local communities following the GELOSE processes, and since 2001 management of entire forests including all forest resources can be delegated to local communities organized in associations called COBAs through forest specific community management contracts called "*Gestion Contractualisée des Forêts de l'Etat*" (GCF) signed between the government and the representative of the COBAs.

Forest management has also been delegated to private operators and national and international NGOs as in the case of the Makira protected area, based on article 24 of the forest legislation. In 2003, the Ministry in charge of the Environment and Forest granted WCS exclusive official management delegation of the Makira Protected Area. Following the management delegation contract (cf. annex 3), WCS represents the forest administration as manager of the Makira Protected Area and therefore has control over all the activities that are conducted in it and also has the right to enforce national and regional regulations regarding natural resources and protected area management. The initial management delegation contract was valid until 2008 and the extension of the contract was still pending as of September 2011. This delay is essentially due to the political unrest that started in 2009 but it is currently expected that the new management delegation contract for 30 years will be signed in late 2011.

Concerning the ownership rights for forest carbon and carbon credits, there is currently no clear legislation in Madagascar. As proposed in the Madagascar Readiness Preparatory Proposal (R-PP), the legal foundation for carbon rights will be clarified during the REDD+ strategy development, in compliance with (i) the national context and local realities, and (ii) existing international laws and conventions. At that time, a more detailed analysis will be carried out to assess the links between carbon rights and forest products use under various management regimes: community managed forests, co-management systems, and so on.

Based on a study carried out in 2006 by Wemaëre M. & Rajaonson G.[50], and as discussed in an article by Takacs[51], "carbon is a movable, incorporeal good, and thus under Madagascar law, the owner of the land would also own the trees, and the carbon sequestered therein". For the case of Community-managed forests, Wemaëre & Rajaonson conclude that local communities, to which the management of the natural resources were transferred, do not have the ownership of the sequestered carbon.

However, recognizing the management rights conferred to WCS through the management delegation contract detailed above, the Government of Madagascar signed an agreement with the Makira Carbon Company, a not for profit, private company incorporated by WCS in Delaware, USA, to market all carbon credits generated through avoided deforestation in the Makira

[50] Note sur la nature juridique du carbone et les droits de propriété sur les crédits carbone (Wemaëre M. & Rajaonson G. , 2006)

[51] Takacs, D. 2009. Forest Carbon – Law and Property Rights. Conservation International, Arlington VA, USA.

Protected Area over the next 30 years. This agreement also proposes the mode of sharing of the revenues from the sale of Makira carbon presented in section (cf. figure 17):

(i) 50% to support local communities in and around the Makira Forest in their natural resource management, forest conservation and community development initiatives, through a defined local management structure to be established in accordance with applicable Malagasy . Allocation of funds will be determined by a steering committee within the Designated Foundation in collaboration and consultation with the delegated manager of the Makira Protected Area.

(ii) 25% to the delegated manager of the Makira Protected Area to support the management of the Makira Protected Area pursuant to the Management Delegation Agreement or such other applicable agreement, as the case may be;

(iii) 15% to the Ministry, to support a range of activities including strengthening its technical capacity for climate change mitigation and supporting the development of a national carbon strategy and national monitoring capacity;

(iv) up to 5% to reimburse the Company for expenses incurred in connection with the marketing and sale of the Allocated Carbon Offsets (and the management of such marketing and sale);

(v) up to 2.5% as needed to pay for third party monitoring, verification and certification, with any portion of the 2.5% not so expended to be allocated to (i) or (ii);

(vi) up to 2.5% to the "Designated Foundation" for its overhead costs in association with the management and disbursement of funds made available under the Agreement.

CLIMATE SECTION

CL1. Net Positive Climate Impacts

This section of the Project Design Document provides information on the net positive impacts on atmospheric concentrations of greenhouse gases (GHGs) generated over the Makira Project lifetime that have resulted from land use changes with the project boundaries.

CL1.1. Net change in carbon stocks due to project activities

Estimation of carbon stock changes under the project scenario was based on the same parameters used for the estimation of carbon stock changes under the baseline scenario:

- Changes in land use expressed by the areas of annual unplanned deforestation in the project area and under the project scenario.
- Changes in carbon stocks through forest degradation from wood extraction in the different forest strata defined in Section 2.4 above.

Future deforestation in the project area:

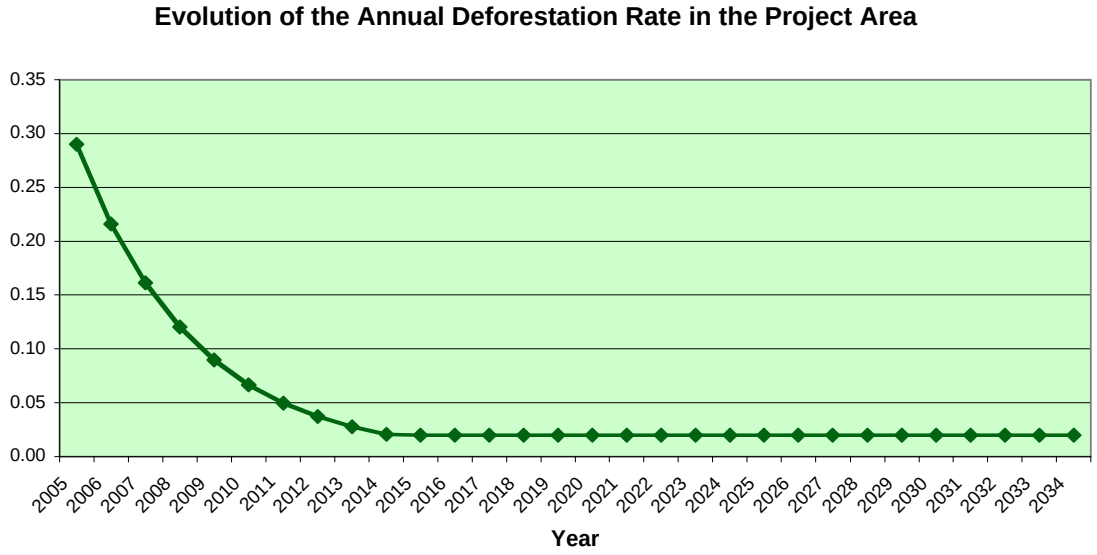
Experience in Madagascar indicates that the creation and effective management of protected areas can substantially reduce deforestation and forest degradation in an area.[52] For the Makira project, it is therefore expected that the activities will lead to a progressive reduction of the annual rate of deforestation from 0.38% (the historic deforestation rate in the reference area for deforestation at the beginning of the project period estimated through analysis of historic deforestation) to 0.02% (cf. figure 20).

The applied rate of deforestation for the with-project case is the observed current deforestation rate in the Masoala National Park. This deforestation rate was chosen for the following reasons: a) Masoala NP is located in the same region as the Makira Project; b) it is under the same political jurisdictions as the Makira Project; c) it has a similar geographical, ecological and social context as the Makira Project; and d) it has been under technical co-management from WCS since its creation.

We assume that the annual rate of deforestation in the project area will remain constant for the remaining twenty years of the project given that activities to reduce emissions from deforestation will be implemented in the project area and leakage belt for the entire project period. Expected annual areas of unplanned deforestation in the project scenario in the project area are preseted in Table 18 for the entire project period.

[52] MEFT, USAID et CI, 2009. Evolution de la couverture de forets naturelles de Madagascar. 1990-2000-2005

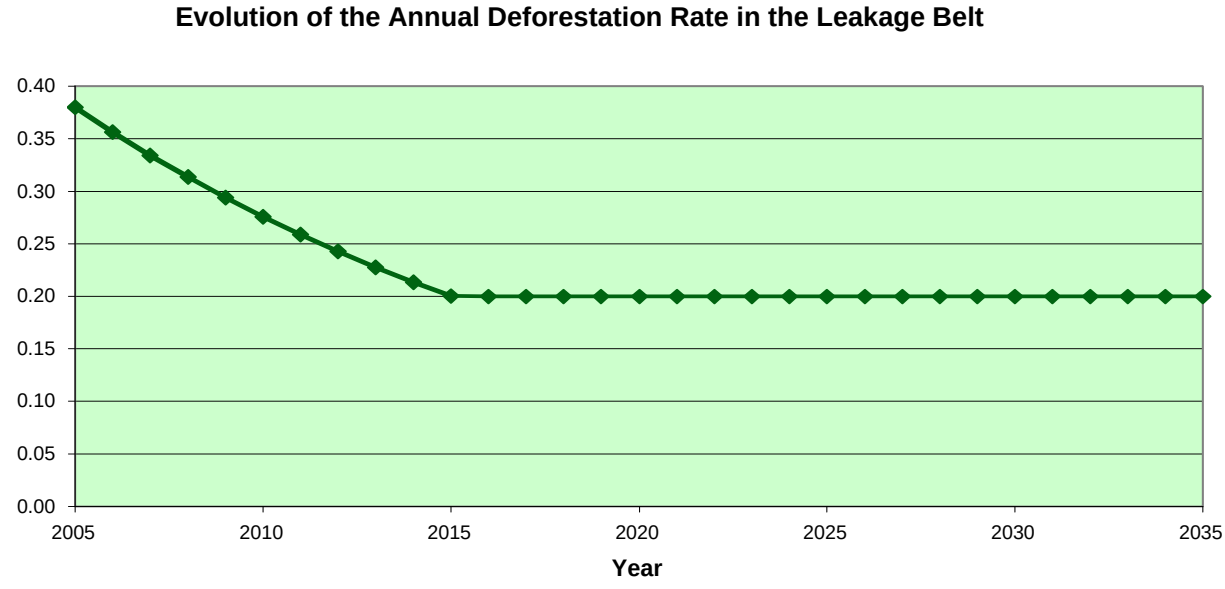
Figure 20: Expected evolution of annual deforestation in the project area



Future deforestation in the leakage belt:

Experience also shows that management transfer can lead to important reductions of deforestation, particularly if combined with long-term technical support to local communities and agricultural improvements that create tangible benefits. As shown in Section 1.8, the Makira project activities are designed to improve community welfare in the Protection Zone; the socio-economic impacts of these activities are expected to be mostly positive. This coupled with the financial benefits from carbon sales ensures that the surrounding communities benefit from the achieved reductions of deforestation. It is therefore expected that the Makira project will also have a positive impact on deforestation rates in the leakage belt.

Figure 21: Expected evolution of annual deforestation in the leakage belt



Based on the analysis of historic deforestation in the reference area for deforestation (RRD) presented in Section 2.4.1, historic deforestation has also been analysed for the sole leakage belt constituted by the forests transferred to local communities. This analysis gave a mean deforestation rate over the entire historic reference period (1996 to 2005) of 0.38% or around 1,000 ha per year for the protection zone surrounding the project area. It seems reasonable to expect that the transfer of forest management responsibilities to local communities in the leakage belt will result in a reduction of unplanned deforestation of about 50% to an annual deforestation rate of 0.2% or 500 ha per year as presented in figure 21.

This leads to the expected annual areas of unplanned deforestation in the leakage belt presented in Table 18 for the entire project period.

Table 18: Annual areas of unplanned deforestation under the project scenario in the project area and in the leakage belt for the entire project period

Year	Total deforested area [ha]		Year	Total deforested area [ha]	
	Project area	Leakage belt		Project area	Leakage belt
2005	1,336	925	2020	70	778
2006	996	868	2021	70	778
2007	742	814	2022	70	778
2008	553	764	2023	70	778
2009	412	716	2024	70	778
2010	307	672	2025	70	915
2011	229	630	2026	70	915
2012	171	591	2027	70	915
2013	127	555	2028	70	915
2014	95	520	2029	70	915
2015	70	633	2030	70	1,022
2016	70	633	2031	70	1,022
2017	70	633	2032	70	1,022
2018	70	633	2033	70	1,022
2019	70	633	2034	70	1,022
			Total	**6,376**	**23,794**

Forest degradation in the project area:

Under the current forest and protected areas legislation, no extractive use of forest products is allowed in category II protected areas like Makira. This is also clearly stated in the ministerial decree giving temporary protection status to the Makira project area. Finally, the creation of zones for sustainable local use of forest products in the management transfer zones in the leakage belt should provide local communities with sufficient wood products in order to prevent them from extracting wood inside the protected area.

There have been reports of illegal logging, especially of precious hardwoods like ebony (*Diospyro spp.*) and rosewood (*Dalbergia spp.*), in most of the protected areas of Northeastern Madagascar,

particularly in the Marojejy and Masoala National Parks. This situation has also been observed in the Makira forests, however, due to the implication of local communities into forest management and control activities, forest degradation through illegal logging seems to be considerably less important in the Makira project area. Illegal logging certainly represents a serious threat to the survival of the concerned species, but its impact on carbon stocks in the project scenario seems to be very low and was neglected.

Carbon stocks in the project area are therefore expected to at least remain stable and the same carbon stock figures presented above for the baseline scenario have been used for estimating the emissions from unplanned deforestation in the project case. This also means that net carbon stock changes as a result from forest degradation are accounted as zero. At the same time, potential carbon stock enhancements in the project area from forest growth and carbon sequestration have been neglected and conservatively excluded from the project scenario.

Based on these assumptions, the total expected carbon stock changes under the project scenarion presented in Table 19 have been calculates separately for the project area and for the leakage belt.

Table 19: Annual carbon stock changes under the project scenario in the project area and in the leakage belt for the entire project period

Year	Carbon stock changes [t CO_2-e]		Year	Carbon stock changes [t CO_2-e]	
	Project area	Leakage belt		Project area	Leakage belt
2005	651,861	451,348	2020	34,308	237,551
2006	485,817	423,366	2021	34,308	237,551
2007	362,068	397,120	2022	34,308	237,551
2008	269,841	372,500	2023	34,308	237,551
2009	201,106	349,407	2024	34,308	237,551
2010	149,879	327,746	2025	34,308	237,551
2011	111,702	307,427	2026	34,308	237,551
2012	83,249	288,368	2027	34,308	237,551
2013	62,043	270,491	2028	34,308	237,551
2014	46,239	253,722	2029	34,308	237,551
2015	34,308	237,992	2030	34,308	237,551
2016	34,308	237,551	2031	34,308	237,551
2017	34,308	237,551	2032	34,308	237,551
2018	34,308	237,551	2033	34,308	237,551
2019	34,308	237,551	2034	34,308	237,551
			Total	**3,109,974**	**8,192,963**

CL1.2. Net change in emissions of non-CO_2 gases

As already mentioned above, only greenhouse gas emissions from biomass burning have been included in the baseline, while emissions from combustion of fossil fuels and use of fertilizers have both been conservatively excluded from the baseline. Greenhouse gas emission from deforestation of tropical forests will be composed mainly of carbon dioxide (CO_2). Other type of greenhouse gases such as methane (CH_4) and nitrous oxide (N_2O) could also be emitted during this

activity but in very low quantities compared to CO_2 and their contributions to the total potential of global warming effect from deforestation are considered insignificant (Houghton, 2005).[53]

Consequently, CO_2 is the only greenhouse gas to be considered in the project case and is counted as carbon stock change. Non-CO_2 emissions from biomass burning, CO_2 emission from fossil fuel combustion, as well as direct N_2O emission as a result of nitrogen application are neglected and therefore project greenhouse gas emissions can be accounted as zero.

CL1.3. Other GHG emissions from project activities

Given the nature of the Makira Project activities, which are oriented toward forest resource protection, other GHG emissions from project activities are considered insignificant compared to CO2 emissions. The project operates two vehicles (Toyota 4x4) that do not exceed 100km per month due to the limited road infrastructure on site. The project operates three 125cc motorcycles. The project operates one metal boat with a 45hp outboard engine. The Makira Project does not intend to promote or increase livestock production nor make any use of chemical materials and fertilisers in promoting improved agricultural practices.

CL1.4. Net climate impact of the project

Over the entire project period of 30 years, the Makira Project is expected to prevent greenhouse gas emissions of more than 36 million tons of carbon dioxide equivalents (cf. Table 20) in the project area, leading to direct net positive impacts on the climate.

Under the business-as-usual or baseline scenario, based on spatial modelling of unplanned deforestation, the total forest loss during the lifetime of the project is estimated at 80,210 hectares (cf. Table 12) equalling more than 20% of the project area and resulting in total baseline emissions of more than 39 million tons of carbon dioxide equivalents (cf. Table 13).

Under the with-project scenario, the total loss of forest in the project area during the project period is expected to be reduced to 6,376 hectares through direct conservation and community development activities. This reduced deforestation will reduce greenhouse gas emissions from carbon stock changes in the project area to slightly more than 3 million tons of carbondioxyde equivalents.

For deductions from total emission reductions due to displacement of carbon stock changes from the project area to the leakage belt refer to Section CL2 below.

[53] Houghton, R. A. 2005. Tropical deforestation as a source of greenhouse gas emissions. In: Moutinho, P. & Schwartzman, S. eds. Tropical deforestation and climate change. Instituto de Pesquisa Ambiental da Amazônia - IPAM; Environmental Defense. Belém, Pará, Brasil. 131 p.

Table 20: Estimated annual baseline and project emissions, and expected emission reductions in the Makira project area for the entire project period

Year	Estimated baseline emissions [t CO_2-e]	Estimated project emissions [t CO_2-e]	Estimated net GHG emission reductions [t CO_2-e]
2005	1,426,066	651,861	774,205
2006	1,426,066	485,817	940,250
2007	1,426,066	362,068	1,063,999
2008	1,426,066	269,841	1,156,226
2009	1,426,066	201,106	1,224,961
2010	1,471,200	149,879	1,321,321
2011	1,471,200	111,702	1,359,499
2012	1,471,200	83,249	1,387,952
2013	1,471,200	62,043	1,409,157
2014	1,471,200	46,239	1,424,961
2015	13,86,796	34,308	1,352,487
2016	13,86,796	34,308	1,352,487
2017	13,86,796	34,308	1,352,487
2018	13,86,796	34,308	1,352,487
2019	13,86,796	34,308	1,352,487
2020	1,276,187	34,308	1,241,879
2021	1,276,187	34,308	1,241,879
2022	1,276,187	34,308	1,241,879
2023	1,276,187	34,308	1,241,879
2024	1,276,187	34,308	1,241,879
2025	1,196,727	34,308	1,162,419
2026	1,196,727	34,308	1,162,419
2027	1,196,727	34,308	1,162,419
2028	1,196,727	34,308	1,162,419
2029	1,196,727	34,308	1,162,419
2030	1,067,846	34,308	1,033,538
2031	1,067,846	34,308	1,033,538
2032	1,067,846	34,308	1,033,538
2033	1,067,846	34,308	1,033,538
2034	1,067,846	34,308	1,033,538
Total	**39,124,117**	**3,109,974**	**36,014,143**

CL1.5. Specification how double counting is avoided

The Government of Madagascar is the clear and uncontested owner of the land on which the Makira Project activities takes place. Consequently the Government of Madagascar is the sole and exclusive owner of the carbon credits generated by the Makira Project (see Section G5.6.). The Government contracted the Makira Carbon Company (MCC) as its exclusive agent to sell these carbon credits; any transaction made by the MCC has to first receive the approval of the Government. The agreement also stipulates that the State will not directly market, sell, distribute, promote, advertise or otherwise deal with the Makira carbon credits; nor will it enter into any agreement with any party (other than the MCC) which confers upon such party the rights to do the same. Therefore, there is no risk that Makira carbon credits will be sold by another entity.

In addition to having the Makira project validated against the CCB Standards, this project will also be validated and verified against the Voluntary Carbon Standard with the objective of generating Voluntary Carbon Units (VCUs) – carbon offsets generated under the VCS program. The Makira Project will be recorded in the VCS Project Database and any VCUs that it generates will be recorded in the VCS Registry System using a designated VCS registry. VCS requires that each of the registries operating under the VCS checks other GHG programs to ensure that the same carbon offset have not been issued elsewhere. Any information about the credit buyer, as well as the amount sold, for the period or verification stage in question, can be traced at any time by anyone, thus ensuring transparency and protecting the buyer from double counting.

In addition the agreement between the Government of Madagascar and the MCC stipulates that an internal registry of the Makira carbon credits will be maintained. The registry will contain: (i) the name of each purchaser of the VCUs generated by Makira, (ii) the number of VCUs purchased by each such purchaser (expressed in metric tons of CO_2 equivalent generated during a designated time period), (iii) the period in which the VCUs were generated, (iv) the price paid by each purchaser for the purchase, and (v) a copy of the purchase agreement relating to each purchase. The registry may be maintained by a third party agent and will be made available to the Government for inspection and copying from time to time upon request.

The project proponent notes that 140,000 tCO_2e of emission reductions from the Makira Project were sold upfront to help finance the establishment of the project. These sales were carried out by the Conservation International Center for Environmental Leadership in Business, and maintained in a project registry. The registry identifies the quantity of sales by vintage and purchaser. Upon validation and first verification of the Makira Project against the VCS, 140,000 VCUs, the number equivalent to the total tCO_2e of emission reductions already sold from the project will be deducted from the total VCUs generated by the Makira Project. The details of the pre-validation transactions will be registered in the VCS Registry System. The Makira Carbon Company will also incorporate the details of any past transactions into the project registry.

CL2. Offsite Climate Impacts ('Leakage')

CL2.1. Determination of leakage type and extent

Activities that deforestation agents would implement inside the project area in the absence of the REDD project activity could be displaced to outside the project area as a consequence of the implementation of the REDD project activity. Where this displacement of activities increases the rate of deforestation, the related carbon stock changes and non-CO_2 emissions must be estimated and counted as leakage.

Types of leakage:

Two types of leakage have to be distinguished:

- Market-effects leakage:
  This type of leakage is related to the displacement of commercial extraction of wood for timber, fuelwood or charcoal from the project area into the leakake belt or to outside the leakage belt. It has been demonstrated above that although illegal small scale logging does exist in the project area, these activities are mostly for local use of forest products and not really market oriented. Illegal artisanal mining also seems to have an impact of forest degradation but the potential for displacement seems to be quite low. For these reasons market-effects leakage has not been considered in the estimations below.
- Activity shifting leakage:
  This type of leakage is related to the displacement of unplanned deforestation to outside the project area due to the interventions of the project. Conversion of forest land for subsistence agriculture seems to be the main driver of deforestation in the Makira project zone and there certainly is a potential for these activities to be displaced due to interventions of the project. The potential extent of leakage has been estimated based on existing CS methodologies and is described in more detail below.

Extent of leakage:

Estimation of deforestation in the leakage belt in the baseline scenario was based on the same methodology as for the estimation of baseline deforestation in the project area described in detail above. Based on the deforestation risk maps developed by modelling future deforestation in the reference area for localization of deforestation (RRL), annual deforested areas have been distributed over the entire RRL for the entire project period of 30 years. This process provided the annual estimates of areas affected by unplanned baseline deforestation in the project area and leakage belt presented in Table 12.

For estimating annual areas of unplanned deforestation in the leakage belt under the project scenario it was expected that at the start of the project about 20% of the baseline deforestation in the project area would be displaced into the leakage belt. This relatively low amount seems to be plausible because the population density inside the project area is relatively low and also because immigrants from outside the project zone are not considered a driving force of unplanned deforestation in the Makira forest area. It was expected that due to the leakage management activities implemented by the project this leakage percentage will be progressively reduced over the first 10 years of the project and resulting numbers for unplanned deforestation in the leakage belt in the with project case are presented in Table 16.

CL2.2. Documentation and quantification of how Leakage will be mitigated

The leakage belt is defined as the land area or land areas surrounding or adjacent to the project area in which baseline activities could be displaced due to the project activities implemented in the project area. As identified through socio-economic surveys, the main agents of deforestation and degradation of the Makira forests are the communities living within the protection zone. In the case of the Makira project, the leakage belt is therefore made up of the community management areas surrounding the Makira Protected Area and for which the communities have signed GCF management contracts. The boundaries of the leakage belt, as well as a discussion of the criteria for its delimitation are presented in more detail above.

In accordance with the Makira management plan, the leakage management area for the Makira project would include non-forested areas in the five "Controlled Occupation Areas" (ZOC), the fifteen uninhabited agricultural "Sustainable Use Zones" (ZUD) and in the surrounding community management zones constituting the "Protection Zone". All efforts aiming at reducing deforestation and limiting the risk of activity displacement leakage will be implemented in these zones.

Leakage is mitigated by the establishment of a series of community-managed GCF sites engaging local communities in sustainable forest resource management based on a validated management plan, and holding them accountable for mismanagement and by the provision of technical support to community management associations (COBAs) who represent the engaged community members COBAs for sustainable land-use practices. It is expected that because of these leakage management activities displacement of carbon stock changes and GHG emissions from unplanned deforestation from inside the project area to the leakage belt and forests outside the intervention zone of the project will be negligible.

Furthermore, the contracts signed by these groups with the MEF have allowed them to legally exclude outsiders from using their resources, further decreasing the potential for deforestation from tavy in the leakage belt. Recent observations from the field suggest that implemented activities have already helped decrease deforestation in the area surrounding Makira and this observation is confirmed by experience in other management transfer sites in Madagascar. It is expected that this reduction of deforestation will be higher than the displacement of deforestation from the project area into the leakage belt and thus more than compensate a potential increase of greenhouse gas emissions from leakage.

CL2.3. Subtracting project related leakage from carbon benefits

In order to estimate greenhouse gas emissions from carbon stock changes due to project related leakage, the difference in annual areas of deforestation in the leakake belt between the baseline and the project scenario have been combined with the corresponding emission factor. This produced the final emission reductions presented in Table 21 below.

Table 21: Estimated annual baseline and project emissions, and expected leakage and emission reductions in the Makira project area for the entire project period

Year	Estimated baseline emissions [t CO_2-e]	Estimated project emissions [t CO_2-e]	Estimated leakage emissions [t CO_2-e]	Estimated net GHG emission reductions [t CO_2-e]
2005	1,426,066	651,861	322,784	451,422
2006	1,426,066	485,817	294,802	645,447
2007	1,426,066	362,068	268,556	795,443
2008	1,426,066	269,841	243,936	912,290
2009	1,426,066	201,106	220,843	1,004,117
2010	1,471,200	149,879	103,208	1,218,113
2011	1,471,200	111,702	82,890	1,276,609
2012	1,471,200	83,249	63,831	1,324,121
2013	1,471,200	62,043	45,953	1,363,204
2014	1,471,200	46,239	29,184	1,395,777
2015	13,86,796	34,308	0	1,352,487
2016	13,86,796	34,308	0	1,352,487
2017	13,86,796	34,308	0	1,352,487
2018	13,86,796	34,308	0	1,352,487
2019	13,86,796	34,308	0	1,352,487
2020	1,276,187	34,308	0	1,241,879
2021	1,276,187	34,308	0	1,241,879
2022	1,276,187	34,308	0	1,241,879
2023	1,276,187	34,308	0	1,241,879
2024	1,276,187	34,308	0	1,241,879
2025	1,196,727	34,308	0	1,162,419
2026	1,196,727	34,308	0	1,162,419
2027	1,196,727	34,308	0	1,162,419
2028	1,196,727	34,308	0	1,162,419
2029	1,196,727	34,308	0	1,162,419
2030	1,067,846	34,308	0	1,033,538
2031	1,067,846	34,308	0	1,033,538
2032	1,067,846	34,308	0	1,033,538
2033	1,067,846	34,308	0	1,033,538
2034	1,067,846	34,308	0	1,033,538
Total	**39,124,117**	**3,109,974**	**1,675,987**	**34,338,156**

CL2.4. Inclusion of non-CO_2 gases in calculations

Given the nature of the Makira Project activities, which are oriented toward forest resource protection, other GHG emissions from project activities are considered insignificant compared to CO_2 emissions. The project operates two vehicles (Toyota 4x4) that do not exceed 100 km per month due to the limited road infrastructure on site. The project operates three 125 cc motorcycles. The project operates one metal boat with a 45 hp outboard engine. The Makira Project does not intend to promote or increase livestock production nor make any use of chemical materials and fertilisers in promoting improved agricultural practices.

In consequence, greenhouse gas emissions as a result of leakage prevention activities in the Makira project zone do not appear to be significant and are accounted as zero.

CL3. Climate Impact Monitoring

CL3.1. Carbon pools to be monitored

The carbon pools to be monitored are the same as the ones used for the baseline assessment in Section 2.3 and presented in Table 8.

CL3.2. Monitoring plan

Monitoring of land-use and land-cover change

The land-use and land cover change (deforestation) monitoring will be carried out through remote sensing analysis in the project area, reference areas (RRD and RRL) and leakage belt. Because the type of deforestation occurring in this project area is removal of tree cover from slash and burn agriculture, it is relatively easy to observe changes in forest cover over even short periods of time using satellite imagery. High-resolution aerial imagery will be purchased and forest cover change monitoring will take place every 2 years. The method for monitoring forest cover change over the project life will be the same as determining the project baseline, with the exception of the use of high resolution arial imagery in combination with the medium resolution satellite data used for developing benchmark forest and baseline deforestation maps (cf. Section 2.2).

Aerial surveys will also be carried out annually during the month of October when prevalence of tavy is highest. The methodology for the forests aerial survey was derived from the long experience of the WCS Conservation Flight Program based in Tanzania East Africa in counting animal numbers from aircraft following set transects. The approach has been further adapted as a result of the first ever forest survey of its kind at Mt. Kenya in 1999.

Based on the remote sensing data outlined above, mapping of deforestation will follow the same procedures as the ones outlines in Section 2.4.1.1. Mapping of deforestation and calculation of the affected areas will allow the following:

- At the end of each monitoring period (2010, 2015, 2020, 2025, 2030 and 2035):
  Calculation of areas deforested during the monitoring period in the project area and the leakage belt.
  Updating of the benchmark forest maps for the project area and for the leakage belt.
  Calculation of the remaining area of forest in the RRL.
- At the time of baseline revision (2015 and 2025):
  Calculation of areas of deforestation in both reference areas (RRD and RRL), the project area and the leakage belt.
  Updating of forest cover benchmark maps for the reference areas (RRD and RRL), the project area and the leakage belt.
  Estimation of the total area of deforestation in the RRD during the historic reference period and of the deforestation rate.

- As Makira is an area frequently covered with clouds, multiple date images will be used in order to reduce the cloud cover in each point in time below 10%. If the clouded areas in two subsequent points in time do not overlap the deforestation rate will be calculated using only the areas not covered by clouds in both points in time. The calculated rate will then be applied to the initial forest cover in order to estimate deforestation between te two points in time.

The net carbon stock change as a result of deforestation will be equal to the area deforested multiplied by the emission per unit area. The emission per unit area is equal to the difference between the stocks before and after deforestation minus any wood products created from timber extraction in the process of deforestation. As mentioned above, carbon stocks in long term wood products are not considered significant in the case of the Makira project and will therefore be accounted as zero.

Monitoring of carbon stocks

In principle, the ex-ante estimated average carbon densities and carbon stock changes should not be significantly changed during the crediting period, as it uses a confident estimation adequate for the project area and because all the forest inside the project area are mature However, as the Makira Project will maintain a continuous program for improvement on information quality, it is our intention to carry out a re-sampling every five years. The methodology used for the 5-year re-sampling will follow the Makira Project SOP developed by Winrock International (cf. Annex I).

Instead of tracking annual emissions through burning and/or decomposition, the applied methodology employs the simplifying assumption that all carbon stocks are emitted in the year deforested and that no stocks are permanently sequestered (beyond 100 years after deforestation). This assumption applies regardless of whether burning is employed as part of the forest conversion process or as part of post conversion land use activities.

For each post-deforestation land use the long-term carbon stock will be estimated using the same carbon pools and the same inventory methodology as for the baseline assessment.

Monitoring of forest degradation

Monitoring degradation through wood extraction:

Although forest degradation from wood extraction is considered insignificant in the case of Makira and has therefore not been included in the baseline, emissions from forest degradation will be monitored using a methodology proposed by the applied VCS methodology.

The key is that the monitoring method results in estimates of any emissions from degradation that may occur in the project area. This degradation and thus reduction of forest carbon stocks will result from either illegal extraction of trees for timber or for fuel and charcoal. As remote methods are not yet capable of measuring biomass stocks and stock changes, a ground-based method proposed by the applied methodology will be used.

The methodology proposes the following steps:

- In order to determine if there is the potential for illegal extraction of trees to occur a participatory rural appraisal (PRA) of the communities inside and surrounding the project area will be completed every 2 years. An output of the PRA shall be a distance of degradation penetration from all access points (access buffer), such as roads and rivers or previously cleared areas, to the project area. If this assessment finds no potential pressure for these activities then degradation will be assumed to be zero and no monitoring of forest degradation will occur.

If the results of the PRA suggest that there is a potential for degradation activities, then limited field sampling will be undertaken:

- The area subject to degradation will be delineated based on the access buffer from all access points, such as roads or previously cleared areas, to the project area, with a width equal to the distance of degradation penetration.
- This area will then be sampled by surveying several transects of known length and width across the access-buffer area to check whether new tree stumps are evident or not. If there is little to no evidence that trees are being harvested then degradation will be assumed to be zero and no monitoring will be triggered.

If the limited sampling does provide evidence that trees are being removed in the buffer area, then a more systematic sampling will be implemented:

- The sampling plan must be designed using plots systematically placed over the buffer zone so that they sample at least 3% of the area of the buffer zone (ADeg,i).
- The diameter of all tree stumps will be measured and conservatively assumed to be the same as the DBH. If the stump is a large buttress, several individuals of the same species will be identified nearby in order to determine a ratio of the diameter at DBH to the diameter of buttress at the same height aboveground as the measured stumps. This ratio will be applied to the measured stumps to estimate the likely DBH of the cut tree.
- The above-and belowground carbon stock of each harvested tree will be estimated using the same allometric regression equation and root to shoot ratio used for estimating the carbon pool in trees in the baseline scenario. The mean above- and belowground carbon stock of the harvested trees is conservatively estimated to be the total emissions and to all enter the atmosphere.
- If species cannot be identified from stumps then it will be assumed that the harvested species is the species most commonly harvested for the specific degradation purpose. A PRA will be used to determine the most commonly harvested species.

Monitoring of degradation through fire

Although non-CO_2 emissions from fires have not been included in the baseline, if fires occur *ex-post* in the project area, the area burned will be delineated. The delineated area burned will then

be used to calculate emissions using the methodology module of the applied VCS methodology. This module includes the greenhouse gases CO_2, CH_4, N_2O but in the case of Makira carbon dioxide has been omitted, as carbon dioxide emissions will be calculated in an alternate way through stock change. The following causes of fire are considered by the module:

- Conversion of forest land to non-forest land using fire
- Periodical burning of grassland or agricultural land after deforestation
- Burning in forest land remaining forest land

Greenhouse gas emissions from biomass burning will be determined based on the IPCC 2006 Inventory Guidelines.

Monitoring carbon stock enhancements

No areas expected to be deforested in the baseline and assumed to accumulate carbon have been identified in the Makira project. Consequently carbon stock enhancements will not be monitored.

Monitoring project emissions

Where significant, non-CO_2 greenhouse gas emissions occurring within the project boundary must be evaluated. For example, where deforestation or degradation occur within the project boundaries or in the leakage belt and fire is used as a means of forest clearance, the non-CO_2 emissions may be significant. For determining which emissions must be included in the calculations as a minimum, the "Tool for testing significance of GHG emissions in A/R CDM project activities" will be used. Emissions will be calculated through applying the modules E-BB, E-FCC and E-NA of the applied methodology.

COMMUNITY SECTION

CM1. Net Positive Community Impacts

This section of the Project Design Document provides information on the net positive impacts on social and economic well-being of communities, and equitable distribution of costs and benefits resulting from the Makira Project.

CM1.1. Impacts on communities

In considering the potential socio-economic impacts of the Makira Project, two main categories of populations can be distinguished within the project zone:

Populations Highly Affected by the Project or PAP Major:
These are people who live within the core protected area within the zones of controlled occupation (ZOC), and for which the impacts of the establishment of the PA are highest. They number almost a thousand and depend almost entirely on resources found within the protected area. The implementation of the protected area will restrict their access to resources within the core protected area and outside of the ZOC; furthermore they must comply with all of the rules governing the protected area, which in particular prohibit slash and burn agriculture on new forest.

Populations Less Affected by the Project or PAP Minor:
These are the people who live in the protection zone surrounding the protected area and engage in the program of community-based resource management (GCF) contracts. They are less affected by the creation of the protected area as its limits were determined to exclude their settlements and the land and forest that they use and are projected to use in the next 50 years. However the creation of the protected area will likely affect their life style and habits.

The populations living outside the protection zone are not considered to be significantly affected by the Makira Project.

Section G3.8. describes the process of community consultation and participation in the project development. Continuous consultations have been carried out with all categories of stakeholders since the beginning of the Makira Project. They participated in all aspects of the project implementation, including the identification of potential impacts, possible compensation measures and the development of livelihoods.
The five main capital assets of the "Sustainable Livelihoods Framework" are used to assess the likely impacts of the Makira Project on communities.

Financial Capital:

Even with the development of the Makira Project, people living in the project zone will still be able to continue using the available resources (land, timber and non-timbers products) for their own consumption within the customary use zone and following the chahier des charges specified in the GCF contract (See Section G5.1.). They will continue receiving income from the sale of agriculture and livestock products, including rice, vanilla, cloves and so on. Additional income could be obtained from the sale of forest products (NTPF and timber).

The principal positive impact social impact from the project is the long-term revenue from the sale of allocated Makira emission offsets. Financial benefits from carbon revenues will be offered to the surrounding local communities as incentives for them to adopt activities/practices that reduce deforestation or forest degradation and/or foster carbon sequestration functions in the landscape. These benefits could be provided either directly through direct payments to communities / households and/or employment opportunities to monitor the community forests, or indirectly through support to continued expansion of and support to formal community-based resource management (GCF) sites. These news sources of revenue will be sustained and over a medium to long-term they will augment household incomes. Any mechanism for management of revenue at and among communities will have to ensure transparency and equity to avoid potential negative social implications such as social conflicts and corruption.

The livelihood activities and investments of the Makira Project aim to stabilize and diversify the sources of income of the rural people impacted by the project. The Makira Project will compensate for lost economic activity due to forest conservation by facilitating new commercial and employment opportunities by providing training, technical assistance, and by promoting alternative livelihoods.

The Makira Project has empowered local communities to manage their natural resources sustainably. This has led to improved land use practices, but also new alternative livelihoods and, from these, new revenue sources. Without the Makira Project, farmers were practicing traditional farming techniques, which proved labour and capital intensive but yielded low productivity and impoverishment of agricultural land beyond the first cycle of slash and burn. The Makira Project is helping households to adopt land use alternatives that counter destructive and unsustainable slash-and burn agriculture. These beneficial activities include:

- Improved intensive rice cultivation
- Soil fertility augmentation through composting
- Improved crop rotation practices
- Village tree nurseries for reforestation
- Identifying and establishing markets for sustainably produced natural products, such as bio-vanilla, bio-clove and eco-silk. One of the activities will be the development of a fair trade bio-vanilla.

Additional positive impacts also include the developing a microfinance program in the project zone to help local communities' access micro-credit and promote savings. Carried out in collaboration with the national credit bureau OTIV, this program was initiated in 2008 has and after information campaigns and trainings in 17 villages, a savings and loan mutual fund was opened in the commune of Ambinanitelo. To date, 298 members including 268 individuals and 30 associations have opened an account for a total savings of 32.501.155 ariary ($20,000) and 69 credits of 46.130.000 ariary ($25,000) were contracted. The funds are generally invested in rice farming, small trade, and school fees for children. Compared to other OTIV offices in Maroantsetra, the rural office in Ambinanitelo is currently among the most developed. The rate of loans recovered amounted to 95 percent, demonstrating the dynamism and confidence of members.

In addition, the Makira Project will develop a community ecotourism program to increase local economic activity. Currently the Makira Project has a pilot community ecotourism site in one Community-based resource management (GCF) site that is preparing to receive tourists in the 201 season. All of these activities will result in higher production and more secure and diverse sources of income in comparison to the without-project scenario.

Social Capital:

The organization of local people into community associations will increase social cohesion and trust within communities. One of the objectives of the Makira Project is to strengthen and empower community-based organizations through the network of community-based resource managed (GCF) sites. Through this network, and in addition to various capacity building activities targeting these associations, local communities will be involved in the negotiations and decision-making process at the level of protected area management. The Makira Project will also improve land tenure security and resources rights, including formal land property titling – this to be carried out with local and regional authorities.

In consultation with local communities, the Makira Project has introduced a formal classification of the project zone into different land use zones. The GCF management contracts will provide communities with management responsibility over their traditional lands; permit greater decision making power over forest resources within a COBA and allow resource rights holders to exclude outsiders from exploiting their resources. This will mean greater land rights security for local communities and reinforce cohesion between the community members because of common interests.

Human Capital:

Makira Project activities are planned to contribute to the development of the knowledge, skills, and capacity of local people through training in across a range of themes, including agroforestry,

sustainable agriculture and community ecotourism. These interventions are coupled with support to environmental education and family health outreach. Improved human capacities will positively impact in the longer-term on local economic productivity and sustainable resource use.

Through its outreach activities the Makira Project has already introduced an improved approach for management of not resources, as well as increased knowledge base (alternative agricultural techniques for instance). It can therefore be argued that in addition to social and economic benefits, the Makira Project will provide a positive psychological impact on local communities who now feel confident in their management of natural resources and collectively empowered to exclude outsiders from practicing destructive activities in their areas. Through these efforts, the Makira Project has pulled what are very rural communities out of an impressive isolation, both in terms of geography and information exchange and awareness. Now local communities have access to basic health, to information and to knowledge, and improved education support; the Makira Project has also permitted timely knowledge sharing among and between neighbouring communities, further emphasising broader community knowledge-sharing of and buy-in to natural resources management.

As mentioned, Makira Project interventions to improve human capital are couched within larger initiatives to improve education and health in the greater landscape. WCS works in direct collaboration with the district-level government education office (CISCO) to develop and implement improved education programming in the greater landscape. To date, under this initiative, WCS has lead in the establishment of 22 environmental youth clubs, training of 60 educators in the network of primary schools in the project zone, and development of teaching tools that have been integrated into the school curriculum. These efforts are complemented by the collaboration between WCS, Population Services International (PSI) and the local representatives of the Ministry of Health to bring improved health and family planning awareness and access to the communities in the landscape. Under this initiative, to date, WCS has succeeded in recruiting and training 60 community agents who council on general health and well-being and market health and family planning products that would otherwise be unavailable to the rural populations.

Physical Capital:

The Makira Project will bring positive changes in community infrastructure and other forms of physical capital, such as infrastructure for water and sanitation, education and communication. The Makira Project has already started developing community infrastructures including community dams, irrigation channel and a school. Several investments in community infrastructure including improvements in water supply, agricultural infrastructure, and schools are planned in the project activities. These will aid in increased food security, improved stewardship and improve access to health and education for local community members.

Natural Capital:

Through the Makira Project over 150,000 ha of forest and forest resources will be under community management though a network of 80 community-based resource management (GCF) sites. This community management will be realized in concert with the development of zoning and land-use planning across the entire project zone, and coupled with landscape-wide programs of forest restoration of important corridors. The cumulative result of these efforts will be long-term maintenance to and improve of environmental services; security of these services would likely not occur in the absence of the project. As discussed in Section G1.8.4., a services valuation study carried out in 2008 estimated the total value of ecosystem services provided by the Antongil Bay landscape to be approximately US $2,884.50 billion per annum, with carbon storage, genetic materials, recreation, erosion control and pollination values representing the largest share of these benefits have calculated. The activities of the Makira Project will contribute to securing the natural capital of the Makira forests for the local communities.

The long-term security of these economic benefits from the sale of carbon credits, coupled with on-going governance, targeted development, education, and welfare outreach efforts, will provide the framework for integrated resource management that protects both biodiversity and promotes human welfare.

CM1.2. Impact on high conservation value

The community-related High Conservation Values identified for Makira are: HCV4, 5 and 6.

HCV4 Provides basic ecosystem services in critical situations (e.g. watershed protection, erosion control):

As presented in Section G1.8.4. the Makira forests provide important ecosystem services through watershed protection and modulation of catchment water flows, both of which are vital to the agriculture-based economy of the region. Through the activities of the Makira Project these HCV services will not be negatively impacts, but rather secured. Deforestation leads to increased erosion, flooding and siltation of drainages, which have disastrous impacts on the local populations. Project activities will directly address this principal threat to HCV services.

HCV5 Fundamental to meeting basic needs of local communities (e.g. subsistence, health):

Local communities make extensive use of forest resources within the project zone to meet shelter, food and medical needs. As has been presented in Sections G1.3 and G3.8 the establishment of the Makira Project, including zonation for human settlement and use, was carried out with full engagement of local communities. Zonation between core protected area and community managed lands was based on meeting subsistence needs of communities over the next 50 years. Within the protected area 15 Zones of Sustainable Use covering 28,602 hectares were created to

further meet specific community resource needs, and 5 Zones of Controlled Occupation were identified where existing human settlements can become permanent, and where harvesting of natural resources for household needs is allowed. As per the COAP law, the Makira Project will maintain this zoning structure. The Makira Project will not compromise the local communities' ability to meet their needs from the forest; furthermore, it will maintain and enhance the High Conservation Value.

By reinforcing the conservation activities within and around the protected area of Makira, the Makira Project will maintain the HCV 4 and HCV 5 related to communities' livelihoods.

HCV6 Critical to local communities' traditional cultural identity (areas of cultural, ecological, economic or religious significance identified in cooperation with such local communities):
The Makira Protected Area boundaries and those of its surrounding Protection Zone were identified based on legitimacy and legality of activities in traditional village territories and the final physical delimitation involved the participation of local communities and local authorities. The limits of the Makira Project are based on extensive socioeconomic inventories and surveys. The limits were set to exclude from the protected area any localities of traditional cultural identify, such as tombs. The Makira Project will not compromise or negatively impact community traditional cultural identity.

CM2. Offsite Stakeholder Impacts

This section of the Project Design Document provides information on possible social and economic impacts that could result in the decreased social and economic well-being of main stakeholders living outside the project zone resulting from the project activities.

CM2.1. Potential negative offsite stakeholder impacts

There are no major and direct negative offsite stakeholder impacts expected as a result of Makira Project activities. By nature of the Makira Project design those communities that have a determined direct reliance on the resources of the protected Makira forests have been integrated into the delimitation and zonation of the protected area so as to reduce any negative impacts. Legitimate and legal traditional practices, and defined village territories, of communities living outside the project zone are not influenced in by Makira Project activities. Nonetheless, some potential negative impacts, though rather non significant, on offsite communities could be identified including:

- Limitation of access to certain resources that exist only inside the Protected Areas or that are rare outside the PA (animals for hunting or some specific plant species or mining resources); which could translate into a reduction of income;

- Limited movement between villages/towns/districts with the closing of some of the foot trails across the protected Makira forests;
- A social conflict because of an apparent non equitable sharing of benefits, either within a community-managed site and/or among sites;
- An increase of exposure to sexually transmitted diseases as a result of ecotourism development;
- A loss of moral and cultural value also due to increase of tourists visitors.

CM2.2. Plan to mitigate negative offsite social and economic impacts

As a result of the community-based approach adopted by the Makira Project, several of the Makira Project livelihood improvement interventions will be extended to communities in the offsite area: these interventions including education, health and micro-finance programs. The net positive benefits from protected, and properly managed, forest resources and the ecosystem services provided also will be of benefit to the offsite stakeholders.

Most directly, WCS is working with the commune, district and regional authorities to ensure that forest conservation is integrated into development plans and that a percentage of 50% of revenue generated from the sale of carbon credits going to communities will flow to these administrative levels so as to promote sustainable development and improved land stewardship practices more broadly across the landscape and region. The community development and outreach activities of the Makira Project are scalable to offsite stakeholders, such as the introduction of improved rain fed rice cultivation and other alternative agricultural techniques, the population, health and environmental program, access to family planning products and awareness-raising campaigns. Through engagement with commune leaders and support to commune-level development plans WCS and the Makira Project will encourage this scaling of interventions. The Makira Project will also capitalize on the role of local leaders, such as the mayors of the communes, as communication “vehicles”. For example, there are 26 communes with limits that overlap the Makira Project; all mayors of these communes are thus directly involved in the project but not the full community base presiding with the commune. The mayors serve as ‘vehicles’ to share the Makira Project experiences and know-how with other stakeholders with the commune as well as with other ‘offsite’ communes.

In addition, the Makira Project has put in place successful media campaigns to raise awareness of environment protection, community health, prevention of sexually transmitted disease, as well as potential revenue generating activities. This mass media program is realized through local radio programming: five stations throughout the region carry WCS programming, and annual thematic festivals are held seasonally. All sectors of the community benefit from these initiatives.

Through these efforts, local communities who are not directly engaged by the Makira Project will benefit from increased awareness and opportunity.

CM2.3. Impacts on the well-being of other stakeholder groups

All relevant stakeholder groups have been considered in the above Sections CM2.1 and CM2.2

CM3. Community Impact Monitoring

This section of the Project Design Document provides information on monitoring of social and economic well-being of stakeholder groups.

CM 3.1. Community monitoring plan

To assess the social and economic impacts of the Makira Project on stakeholder groups an in-depth community needs assessment will be carried out for each community in the project zone prior to any on-the-ground project implementation. Such an assessment is important for identifying gaps between community needs and desired conditions with regard to all five capital assets (as described in Section CM1.1 above). This community-based monitoring plan would broadly cover the indicators summarized in the following table. The listed criteria and indicators were chosen based on community livelihood needs identified during the preliminary socio-economic inventories and surveys. A participatory components will be incorporated into the monitoring approach and include stakeholder discussions, local villagers' focal groups, and household-level interviews. This will help to identify the appropriate principles, criteria, interventions, and indicators. Also note that criteria can be developed for various scales (e.g., household, village, and district levels). The above monitoring table will focus on the household and village level.The monitoring plan will be further refined to examine particular community impacts that may become apparent during the implementation of the Makira Project:

Table 22: Parameters for Makira Project community monitoring Plan

Impacts on community	Objectives	Time frame	Targeted indicators
Financial Capital	Financial capital grows and is equitably distributed.	Measured each two years during the project life	Income and revenue increased equitability within the community
			Proportion of households with increased income above baseline
Social Capital	Maintenance of a set of dynamic rules and norms	Measured each six months during the project life	Number of grievances recorded against the management rules of GCF decline
			Level of adherence of the community to any management policy and frequency of penalties being given for those breaking them
Human Capital	Improved and equitable distribution of human capital	Measured each six months during the project life	Number of household having access to health care increased
			Infant mortality rate decreased
			Reporting of household illnesses related to malnutrition and poor hygene decreased
			Number of children attending school increased
Physical Capital	Physical status of housing is maintained or improved.	Measured each two years during the project life	Number of normalized water supplies increased
			Small scale dam for agriculture improved and created
Natural Capital	Yield and quality of natural resource goods and services is improved.	Measured each six months during the project life	Forests and agricultural areas that are important to meeting basic needs become available
			Percetn of household income from alternative economic activities increased
			Travel distance and/or time to secure basic household necessities (e.g. fuel wood) decreased

CM 3.2. Monitoring plan for HCV related to community well-being

The Makira Project has measured baseline socio-economic variables during the environmental and social impact assessment (PGES) carried out for the creation of the protected area. From these baseline data, concerning both community well-being and biodiversity state, the Makira Project will monitor the effectiveness of the community-based resource management programs implemented in the GCF sites by means of participatory monitoring of key biological indicators – this monitoring program has already been initiated (see Section CL3.2.). The results of this

monitoring will be used to improve planned interventions to maintain ecosystem services. The monitoring plan presented in section CM3.1. reflects the monitoring approach to be adopted for ensuring the maintenance of HCVs 4, 5, and 6. The community needs assessment as presented n Section 3.1. will help to identify gaps between community needs and desired conditions with regard to HCVs 4, 5, and 6.

In addition, detailed participatory land mapping carried out by each community during the Makira Project boundary delimitation has allowed for the identification of HCVs crucial to communities. Since the communities participate in the Makira Project management and monitoring, any changes in the HCVs will be identified and addressed through an adaptive management plan.

CM 3.3. Development of full monitoring plan

Development of a full monitoring plan for protected areas is obligatory under Madagascar's Protected Areas Code (COAP). Based on the official management documents (PAGS and PGES) for the makira Protected Area – already validated by the Direction of Madagascar's Protected Areas System (DSAPM) – the Ministry of Environment will evaluate, on a triennial basis, the effectiveness of the community-based forest resource management (GCF) sites in achieving natural resource use and biodiversity conservation. Since WCS established the network of GCF sites encompassing the protected area, the project proponent will carry out joint monitoring with local communities – as described in Section CL3.2. A full monitoring plan that includes key biodiversity and community welfare indicators will be developed and implemented within twelve months of validation against standards.

All monitoring results will be made public and communicated to the local communities and stakeholder groups. Results will be disseminated in differing degrees of detail via the quarterly project newsletter, through formal technical reporting to government and non-government partners, through upload to and management in the centralized Informantion System for the the Antongil Bay (SIBA) housed in the Maroantsetra Program office, and through upload to the Madagascar Biodiversity Network (REBIOMA) portal.

BIODIVERSITY SECTION

B1. Net Positive Biodiversity Impacts

This section of the Project Design Document provides information on net positive impacts on biodiversity within the project zone and within the project lifetime, as measured against baseline conditions.

B1.1. Estimation of changes in biodiversity as a result of the project

In comparison to the impacts of the "without-project" scenario on the project zone's biodiversity (as presented in Section G 2.5.), the Makira Project activities will result in the following net positive biodiversity benefits.

Habitat loss and fragmentation:

A net positive biodiversity impact of the Makira Project will be the reduction of deforestation in the project zone (see Section CL1.1. for calculation of reduction in deforestation rate as a result of project activities). Reduced deforestation will reduce critical habitat loss, habitat degradation and habitat fragmentation. The net positive impact of this reduced deforestation will be the maintenance of ecosystem service integrity.

Species loss:

A net positive biodiversity impact of the Makira Project will be that the conservation of key habitats: the maintenance of habitat connectivity will greatly enhance the health / viability of populations of threatened flora and fauna. In addition, the creation of a gazetted protected area by the Makira Project, as well as the empowerment of local communities to manage and protect their forest resources, will afford greater legal protection to species within the project zone. A number of the conservation activities carried out within the scope the Makira Project are specifically aimed at reducing threats to endangered species. The net positive result of increased legal protection coupled with improved community awareness will be a reduction in bushmeat hunting for forest species.

The forests are ecologically and biologically important because of the extraordinarily high ecosystem diversity and levels of species endemism. The species diversity and endemism levels of the Makira system are expected to be among the highest in the country and as a result, among the highest in the world. By stopping deforestation the populations of numerous species will be greatly preserved. They include several IUCN concerned species: the area-dependent Madagascar serpent eagle (*Eutriorchis astur*), the Fosa (*Cryptoprocta ferox*), and several varieties of critically-endangered lemurs including the red ruffed lemur (*Varecia rubra*), the Black and white ruffed lemur (*Varecia variegata*), and the Silky sifaka (*Propithecus candidus candidus*).

Poaching and targeted species population decline:

A net positive biodiversity impact of the Makira Project will be reduced hunting of bushmeat. One example of how the Makira Project will increase the populations and long-term viability of threatened species over the baseline is through decreased hunting of bushmeat. This is one of the important current threats to mammals and birds in the Makira landscape. A recent study showed that four diurnal lemur species in particular were hunted, and between 79 and 100% of households interviewed in different communities regularly hunted these species (Golden, 2009).

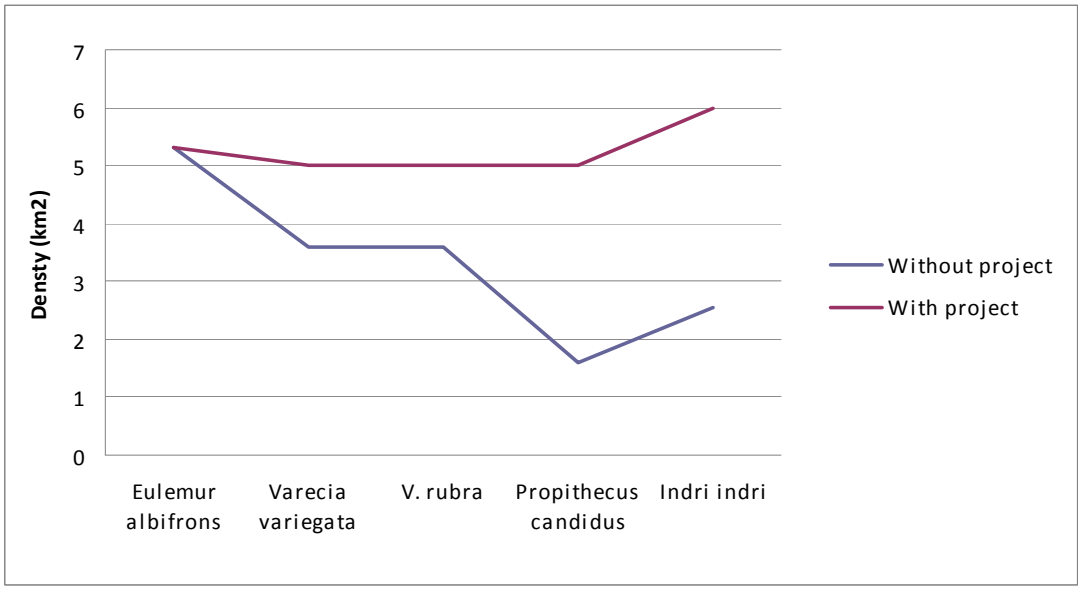
Table 23: The changes in some existing biodiversity attributes in the without- and with-project scenarios

Harvest rate of the most hunted diurnal lemurs of Makira			
Species	**Without the project**	**With the project**	**% of gain from the project**
Eulemur albifrons[1]	1.68 km^2 .yr^{-1}	0.61 km^2 yr^{-1}	63.7%
Hapalemur griseus[1]	1.03 km^2 yr^{-1}	0.38 km^2 yr^{-1}	63.1%
Varecia variegata1	1.03 km^2 yr^{-1}	0.38 km^2 yr^{-1}	63.1%
Indri indri	0.65 km^2 yr^{-1}	0.23 km^2 yr^{-1}	64.6%

Source: Golden, 2009

The following figure shows the net gain in population density that the Makira Project is expected to achieve by target actions to reduce harvesting rates (e.g. removing traps inside the forest). With the exception of *Eulemur albifrons*, the population density of the lemur species is projected to increase during the project lifetime.

Figure 22: Diurnal lemur species density comparisons without and with project scenario



Maintenance of connectivity:

A net positive impact of the Makira Project will be greatly enhance long-term connectivity and altitudinal gradient protection in the eastern rainforests and the northeast, specifically by linking Makira forests to Masoala National Park and Anjanaharibe Sud Special Reserve. The connectivity will allow continued gene flow and greatly increase the long-term availability of habitat in North-eastern Madagascar. This will be especially important to species with large territories, such as Madagascar's largest endemic carnivore, the fosa (*Cryptoprocta ferox*). Connectivity and its consequent maintenance of adequate forest range will be essential to the conservation of a multitude of complex biodiversity communities in Madagascar.54 In particular, this connectivity will allow the migration of some species in the face of climate change, an important way of coping with this threat.

Erosion:

The control of forest loss with the Makira Project will significantly reduce erosion and the negative impacts of this on water courses and the aquatic biodiversity that they support.

The net positive impacts of the Makira Project are summarized in the following table:

Table 24: Threats and net positive impacts on biodiversity of the Makira Project

Threats to the Biodiversity	Management actions	Net positive impacts with the project
Habitat loss and fragmentation	Protecting the overall forests to reduce degradation and clearing	Deforestation rate decreased to 0.06%./yr Maintenance of large, intact natural habitats
Species loss	Education, awareness campaigns, intensive ranger patrols, and habitat protection	No net species loss over life of project
Poaching and targeted species population decline	Education, awareness campaigns, inte nsive ranger patrols, and alternatives	Hunting reduced at least to a sustainable level and possibly to zero
Maintenance of habitat connectivity	Enhance landscape level forest connectivity by maintaining forest corridors Maintain connectivity at a micro-scale by preventing fragmentation controlling existing paths and restoring some sensitive area to avoid their isolation	Connectivity between large remnant patches of forest and other conservation areas of North-East Madagascar is maintained, allowing for regional gene flow, the maintenance of viable populations and the capacity for species to migrate in the face of climate change
Erosion	Education, awareness campaigns, intensive ranger patrols, forest cover protection	Watershed protection services are maintained, allowing riverine, wetland and marine species to be maintained

[54] Ganzhorn, J. U., Goodman, S. M. & Dehgan, A. 2003. Effects of fragmentation and small mammals and lemurs. In The natural history of Madagascar, eds. S. M. Goodman & J. P. Benstead, pp. 1228-1234. The University of Chicago Press, Chicago

B1.2. Impacts on high conservation values

The Makira Project will not negatively affect any of the forest areas having HCVs. To the contrary, given the project's conservation objectives, it is expected to enhance the forest areas of HCVs. In terms of HCV relating to communities, they will be maintained or enhanced through the Makira Project co-managed core protected area and community management areas. Further, this integrative approach has increased community awareness of the long-term economic (including the existence value) and cultural value of their resources.

The Makira Project impacts on the following biodiversity-related HCVs:

HCV1 no negative affects on globally, regionally and nationally significant concentrations of biodiversity values (e.g. endemism, endangered species, refugia) and

HCV2 no negative affects on globally, regionally and nationally significant large landscape-level areas where viable populations of most, if not all, naturally occurring species exist in natural patterns of distribution and abundance.

Maintaining and enhancing forests and other natural ecosystems at a landscape level are key to protecting HCVs 1 and 2 in the project zone. As a result of the size and geographic coverage of the Makira Project, and the regional-scale connectivity it provides to four other conservation areas, it will afford protection to the viable populations of the species relevant to these HCVs. Additionally, maintenance of some HCVs will require education programs for local communities, e.g., to protect habitat important to lemurs, such as low altitude intact forest, and to reduce hunting pressure. Public awareness is also an important part of the Makira Project and will have a positive impact on HCVs.

The community-related HCV identified were:
HCV4 - Provides basic ecosystem services in critical situations (e.g. watershed protection, erosion control)

HCV5 - Fundamental to meeting basic needs of local communities (e.g. subsistence, health)

For HCV4 and HCV5, the net positive impact is that only with the Makira Project will the ecosystem services provided by the Makira forest be maintained and sustained. As previously indicated in Section G1.7., the Makira forest, in combination with the Masoala National Park, constitutes the largest block of eastern rainforest remaining in Madagascar. Because the Makira landscape connects and encompasses both forest and terrestrial freshwater ecosystems, it is able to perform a wide variety of valuable services, including: supply and purification of freshwater, climate regulation, disturbance regulation, pollination and support of recreation and tourism. For

instance, the region experiences heavy monsoon rain and periodic cyclone activity. In the absence of the Makira Project, and resultant reduced levels of deforestation, the forest cover of Makira would shrink and the region would experience greater seasonally flooding.

B1.3. Species to be used by the project

The Protected Area Law (*Code des Aires Protégées* or COAP – See Appendix VI – COAP 2001 version) stipulates in article 45 that the introduction of any unauthorised exogenous animal or plant species constitutes a crime. The Makira Project is under a legal obligation to comply with the COAP law and will not introduce any known invasive species within the project zone. By extension, no GMO will be used to generate GHG emissions reductions or removals. The floristic inventories carried out to date have not identified of potentially invasive species present on site.

B1.4. Possible adverse effects of non-native species used by the project

The Makira Project will not make use of non-native species or of species that have not been used onsite by the local communities to date, including agricultural species.

B1.5. Guarantee that no GMOs will be used to generate GHG emissions reductions or removals

The Makira Project will not use any GMOs to generate GHG emissions reductions or removals.

B2. Offsite Biodiversity Impacts

This section of the Project Design Document provides information on evaluation and mitigation of any negative impacts on biodiversity outside the project zome resulting from project activities.

B2.1. Potential negative offsite biodiversity impacts

No major potential negative offsite biodiversity impacts exist, or are anticipated, as results of the Makira Project. Nonetheless, consideration of potential negative impact on offsite biodiversity could include an overexploitation of forest resources outside the project zone including animal hunting, selective logging, and/or illegal mining.

The presence of Makira Project will improve public awareness of “legal” vs. “illegal” practices on natural resources. Also, since the project proponent has been working closely with the forestry services and all community structures from local to regional level to raise their capacity and empower them in law enforcement and monitoring, most illegal practices will be reduced outside as well as inside the project zone.

B2.2. Plan to mitigate negative offsite biodiversity impacts

Mitigation of possible offsite negative biodiversity impacts will proceed through extension of community support efforts to offsite communities in the peripheral zone, so as to promote sustainable economic alternatives to destructive and unsustainable activities. A principal compoent of this effort will the development of an Information, Education and Communication (IEC) program that will raise offsite community awareness of the economic, helth and human welfare benefits of environmental protection.

B2.3 Unmitigated negative offsite biodiversity impacts

No unmitigated negative offsite biodiversity impacts.

B3. Biodiversity Impact Monitoring

This section of the Project Design Document provides information the project monitoring plan to quantify and document changes in the biodiversity resulting from project activities.

B3.1. Biodiversity monitoring plan

The monitoring activities that will measure progress in achieving the biodiversity management goals of the Makira Project will include variables for: (i) habitat loss and forest fragmentation; (ii) species loss; (iii) poaching; (iv) forest connectivity; and (V) erosion. The establishment of the Makira Forest Protected Area included identification and zonation of those areas critical to the continued existence of critically endangered and area-sensitive species. The proposed biodiversity monitoring methodologies draws on simple systems and participatory methods. Not only do these methods build a cost-effective, field-based monitoring system, but they also create a sense of ownership among resident people over the biological resources and their conservation. The monitoring activities are summarised below.

To ensure the integrity of Makira's unique biodiversity, a multifaceted monitoring program has also been established, which includes both target species monitoring within the protected area and participatory ecological monitoring within the zones of community resource management. This participatory ecological monitoring allows the collection of basis information on forest disturbance trends and system health, measured via animal and botanical variables. Participatory ecological monitoring within the community-based resource management (GCF) sites includes training and outfitting of community teams and focuses on monitoring of indicators previously established with the communities of (i) floral and faunal diversity and state, (ii) human presence and pressures in the forests, (iii) community governance transparency. *See Section CL3.2.*

Monitoring habitat loss and forest fragmentation:

Since most of the biodiversity conservation goals depend upon protection of the natural habitat, these are key monitoring variables. Forest cover and condition monitoring will be realized through a combination of remote sensing methods, aerial surveys and field measurements: details of these methodology and periodicity are presented in Section CL3.2.. However, if any important events happen, for instance a severe cyclone, aerial surveys will be conducted punctually to assess the impacts of such events. Forest cover and condition classes will be analysed. These classes will be defined first through image classification, and then will ground truthed during the first year to test that degradation classes based on image analysis correspond to real differences in canopy cover, possibly using "vegetation vertical structure"[55] as an easily-measured proxy. This latter is based on calculating foliage density on vertical scale by means of foliage touching a vertical pole erected vertically each one meter within 100 m linear of vegetation sample. The percentage of foliage touching the erected pole in the canopy height would serve as the canopy cover of the vegetation types. Ground surveys to monitor logging within the project zone will take place on a continuous basis with quarterly interim reports and an annual summary.

Monitoring species loss:

Since potential forest degradation could be at a spatial scale finer or involve a succession in species that cannot be detected by RS and aerial image analysis, permanent transects, or patrol paths, of a minimum 2 km in length will be marked and walked on a continuous basis across all the major forest ecosystem types to monitor tree-by-tree losses in the project zone. A "Ranger based monitoring" approach will be used to undertake these surveys using a standardized method. In this approach, standardized data is recorded by using GPS tracklog within each patrol path inside the project zones. The GPS tracklog coupled with notification of major habitat and key species indices will be recorded to allow mapping and subsequent identification of areas where evidence of human threat exists. Changes in indices beyond a targeted threshold will show decline in targeted species and help the Makira Project to improve its management interventions.

Since Makira represents the last intact forest that provides suitable habitat to maintain viable populations of Madagascar's top carnivore, the fosa (*Cryptoprocta ferox),* monitoring of forest carnivores' presence and abundance via camera trapping has been established. The program, initiated in 2007 will form the basis of an ongoing forest carnivore monitoring program for the Makira Project, and will be useful in effects of changes in the level of hunting.

[55] Gauthier, L. 1994. Structure et Flore de la forêt sur la pente d'Andranomay, eds. Birkinshaw, C. R., Messmer, N., Ralimanana, H., Ranaivojaona, R., Randrianaivo, R., Ravololonanahary, H., Centre d'Information et de Documentation Scientifique et Technique, Antananarivo. Recherches pour le Développement, Série Sciences biologiques, 13 : 15-29.

Poaching and targeted species population monitoring:

The fact that current hunting pressure on diurnal lemurs and carnivores in the project zone appears to be unsustainable[56], monitoring the number of potential passive traps and snares inside the project zone will be used to measure hunting pressure. Reduction of this number will serve as a reasonably good proxy for success of stopping overall hunting within Makira. In addition, snare density and distribution patterns will be compared with the mammal densities collected during transect surveys and ranger based patrols.

Maintenance of connectivity:

The forest connectivity will be monitored through remote sensing analysis and GIS. Sensitive narrow forest corridors will be restored through a community-based program and monitored intensively by means of patrols and tree growth measurements carried out by community and park management teams.

Erosion:

Given the prevalence of sedimentation on water system and watershed within the project zone, consideration should be given to monitoring the status of these ecosystems. At a minimum, monitoring of water quality in the major rivers, and possibly nearby lakes, should be included in the management plan. Water quality measurements should include basic health and ecological parameters such as dissolved organic matter, sedimentation loads, pH and alkalinity, dissolved oxygen levels, and phyto and zooplankton loads. The monitoring plan for health and state of water courses will build off a pilot study carried out in the watershed of the Andranomena River. The Andranomena is 70 square kilometers in area and is one of the many tributaries of the larger Antaninambalana River basin that flows into Antongil Bay. This pilot study, carried out in 2006 considered the ecological impacts of land use on the water quality and flow in the Andranomena River basin, part of the Antaninambalana River watershed. The pilot study investigated the relationship between land use and water quality and quantity through the establishment of a series of monitoring stations across a gradient of land use types wihth ithe watershed. The parameters that were measured for in each sample basin include land use characteristics, stream temperature, conductivity, sediment load, discharge rate, rainfall and total nitrogen57.

[56] Golden, C. 2009. Bush meat hunting and use in the Makira forest, north-eastern Madagascar: a conservation and livelihoods issue. Oryx, 43(3): 386–392

[57] Albietz,J.M., 2006, Watershed protection for ecosystem services in the Makira Forest Area, Madagascar: a preliminary biophysical assessment. WCS internal technical report.

Table 25: Biodiversity monitoring plan for the Makira Project

Threats to the Biodiversity	Monitoring methods	Time frame	Target
Habitat loss and fragmentation	remote sensing aerial surveys field survey	2 years basis annual	Deforestation rate below 0.06%/yr
Species loss	Ranger based monitoring Density estimation with transects counts, camera trappings	Bi-annual	Zero local extinction in the project area Zero cut tree inside the project area
Poaching and targeted species population decline	Monitoring the number of potential passive traps Density of targeted species	Bi-annual	Zero traps inside the project area Population density of targeted lemurs increase above 30% of the current value.
Maintenance of connectivity	Tree growth and width of sensitive narrow forest corridors	Bi-annual	Increase of corridor width
Erosion	Water quality parameters of major rivers and lakes	Bi-annual	Value to be compared to the benchmark value

B3.2. Monitoring plan for HCVs

The monitoring activities described in Section B3.1. include assessment of the maintenance of HCVs related to the globally significant biodiversity occurring within the Makira Project area and its environs. An additional consideration for monitoring HCVs is through reducing principal threats such as bush and forest fire, forest clearing, bushmeat hunting, illegal logging, within the project area and the project zone will allow for measuring the effectiveness of the project activities. At present, if the HCVs are found to be in decline, management and protection actions will be undertaken to guarantee their conservation. Through this, threats monitoring would serve as indication of the Makira Project success in preserving the HCVs.

Table 26: Makira Project monitoring plan for HCV

Threats	Measures taken (activities)	Indicators of success
Bush and forest fire	Firebreak systems in highly exposed areas	Forest fire frequencies from three times a year to zero
Forest clearing	Joint patrols of the MEFT, WCS and police if necessary	Forest clearing rate reduced to 0,06% in ten years
Bushmeat hunting	Joint patrols of the MEFT, WCS and police if necessary Public awareness campaigns	Number of traps and snares from 25 per sq km to zero
Illegal small-scale mining	Joint patrols of the MEFT, WCS and police if necessary Public awareness campaigns	Current number 106 reduced to zero
Illegal logging	Joint patrols of the MEFT, WCS and police if necessary Public awareness campaigns	Number of infractions reduced to 0.1% of current value

B3.3. Development of full monitoring plan

As per Madagascar Government protected area law (COAP), a full biodiversity monitoring plan is currently in development for the Makira Forest Protected Area and will be finalized within twelve months of validation against the standard. All monitoring results will be made public and communicated to the local communities and stakeholder groups. Results will be disseminated in differing degrees of detail via the quarterly project newsletter, through formal technical reporting to government and non-government partners, through upload to and management in the centralized Information System for the the Antongil Bay (SIBA) housed in the Maroantsetra Program office, and through upload to the Madagascar Biodiversity Network (REBIOMA) portal.

GOLD LEVEL SECTION

GL1. Climate Change Adaptation Benefits

This section of the Project Design Document provides information on the significance of the support that the Makira Project will bring to communities and biodiversity in adapting to impacts of climate change.

GL1.1. Likley regional climate change and climate variability scenarios and impacts in the absence of the project

Recent studies conclude that in the near future it is quite possible natural forest will cease to exist outside of protected areas in Madagascar (MEFT, 2008). Madagascar's Forest cover has declined by roughly 40% since 1950, and continues to decline at a rate of 1-2% per year with about 15% of Madagascar currently forested (Harper et al., 2007). Studies targeting critical species and systems indicators suggest increasing evidence that rapid changes in meteorological patterns are reducing already narrow habitat niches (Raxworthy et al. 2008; Schatz & Cameron 2008).

Community vulnerability will be measured through changes in rainfall and temperature patterns. Macro-scale assessment of climate change suggests that sea-level rise and increased storm frequency – includeing more and more powerful cyclones – will bring greater flooding and erosion to costal zones, threaten coastal communities and mangroves (MEFT, 2008). In complement, increased drought and resultant crop failure in the islands southern regions threatens food security (Tadross et al. 2008).

Overall, water availability is expected to decrease, reducing the potential for establishing water management measures needed to intensify agricultural production (Milly et al. 2005).

Current estimates are that 73% of the population of Madagascar lives in a rural environment and depend directly on agriculture, fisheries and forestry for subsistence (World Bank, 2008). Overall, these impacts will increasingly affect the poorest communities in coastal and rural areas.

A national assessment of climate change and climate variability that included the region of the Makira Project: here considered to include the regions of Analanjirofo, Sava, Sofia, and hereafter referred to as the project region, reports the following impacts/scenarios.

- While the project region is likely to serve as a climate refugium for plant species currently distributed in low elevation humid forests, all humid forest plant species are expected to to show significant range contractions by 2080 (MEFT, 2008).
- Endangered and critically endangered primate species found in the Project region that are highly vulnerable to climate change and climate variability include among them: *Varecia*

variegate, Varecia variegate rubra, Propithecus candidus, Indri indri, and *Allocebus trichotis*. (MEFT, 2008). All these species exist in the Makira Project Zone.

- Temperature and rainfall variation, coupled with increased cyclones, has resulted in shifts in farming schedules and increased crop failure (MEFT, 2008).

These generalized findings are supported by the results of a climate change and climate variability modelling study (using MAXENT: Phillips et al., 2006 and ZONATION) that specifically targeted the Makira project region (Razafimpahanana, 2010) see Appendix XV. Using three different Coupled Atmospheric-Oceanic General Circulation Models and 2 generalized land use / land change scenarios: one emphasising protection and one without protection measures Razaphimpahanana reports the following impacts/scenarios for temperature, 23 indicator species and human agriculture practices.

- There will be a mean yearly temperature increase between 2.06 and 3.26 degree C in the next century.
- Of 12 vertibrate species considered (4 mammal and 8 bird) all show significant range contractions over an 80-year, with some *Brachypteracias leptosomus*, *Euryceros prevostii*, *Mesitornis unicolor, Indri indri,* and *Varecia variegata* disappearing completely (Razafimpahanana, 2010).
- Of 11 plant species considered all show range contrations with *Voanioala gerardii* and *Dialyceras parvifolium* likely disappearing completely (Razafimpahanana, 2010).
- Considering change in availability of arable land for rice cultivation – irrigated rice being the principal land use variable modeled – significant decrease in suitable land is predicted as a result of climate change (Razafimpahanana, 2010).

These generalized and specific findings support the argument that during this century land use practices will shift as temperature increases, availability of suitable irrigated rice drainages decreases, cyclone and resultant flooding increases. These significant climate change impacts suggest that local communities will increase investment in hillside rice cultivation through increased clearing of forest so as to ensure greater food security (Holmes, 2007).

GL1.2. Risks to the project's climate, community and biodiversity benefits resulting from climate change and climate variability impacts and how these risks will be mitigated

Risk assessment:

Participatory assessment of climate change risk to community benefits in the project zone was undertaken in 2008 (USAID, 2008). The community participatory evaluations of climate change risk and impacts on livelihoods adopted an approach based on the Guidance Manual for Development Planning for climate change Vulnerability and Adaptation (V&A) assessments (USAID, 2007). In particular, the field level stakeholder meetings, consultation and focus group discussions with local communities were designed to gather information about the vulnerability of

local livelihoods and rural production systems to increased climate variability and climate change (step 1), to identify adaptation options (step 2) and to conduct some initial analysis (step 3) to summarize and report on community level perceptions, concerns and recommended interventions.

Communities within the project zone recognized increased climatic variability and the impacts of this variability on their subsistence livelihoods. The following table identifies the climate change risks, needed adaptation measures and barriers to adaption that were identified by communities during the assessment.

Impact	Adaptation	Barrier
Less cultivable land; soil erosion in highlands	Improved and intensified managemtne in lowlands	1. Level of instruction and technical know-how 2. Health: malnutrition 3. Increasing population growth / Pressure 4. Access to communication 5. Investment/access to capital
Water management and control for farming	Improved agricultural infrastructure including construction of dams	
Disruption of agricultural calendar and lower rice productivity from changes in rainfall and temperature	Improved rice techniques: selection of alternative seeds, planting in November to avoid flooding, diversification of crops, alternate cropping cyles	
Changes in rainfall and temperature	Advancement of the cultivation period	
Lower fishing and agricultural yields	Livelihood conversion: agriculture to fishing; fishing to agriculture	
Erosion from cyclones and floods	Reforestation and restoration efforts	
Lower fishing yields; fish further out in ocean; tenure	Implementation of community-based resource management system approach (GCF)	
Reduction in viability of fishing and agriculture livelihoods	Supplementary income: honey production; local crafts; tourism; traditional medicine; further developing market access	

This participatory study concluded that in the region of the Makira Project climate change will exacerbate existing rural development challenges including income generation, food and water security, and health. Without sufficient and suitable resources, rural populations are extremely vulnerable to small upsets in their livelihood production, making climatic unpredictability extremely dangerous for their continued subsistence. In addition, the increase in natural disasters

and their effects (mainly cyclones and flooding) will require more emphasis to be placed on disaster management measures as well as disaster warning systems.

Sections GL1.1. and GL1.3. provide a general overview of regional climate change and climate variability and specific measures of climate change impact on biodiversity.

Mitigation measures:

Community-based climate change mitigation and adaptation measures will center on improving community forest resource governance, improving subsistence agriculture including agricultural techniques, improving agricultural infrastructure, and crop diversification. See Sections G3.2. and G3.8. for further detail on community engagement, capacity building and livelihoods improvement.

The table below shows a more comprehensive list of solutions proposed by community members, which, given sufficient outside investment and support, could help address the major threats from climate change being faced by communities. These community proposed solutions map onto those solutions proposed throught the establishment of the Makira Project, and are reinforced by the proposed equitable distribution of carbon revenue (See Section G3.1.1.)

Intervention	Solution	Threat addressed
Natural resource management	Reinforcement of COBA activities	Biodiversity loss, water supply, fuel supply, unsustainable resource management
	Increased reforestation and restoration efforts	Water supply, fuel supply, soil fertility, lack of technical ability in tree-planting; lack of pollen for bees; food security/income generation (fruit trees)
Agriculture	Research into short-cycle crop seeds	Food security
	Construction of dams and tributary canals that better control water flow into agriculture fields	Flood protection
	Increased technical assistance to improve cultivation techniques	Food security; income generation; soil fertility
	Improved agricultural infrastructure	Food security; flood protection; increased rainfall management
	Improvement of plantation cultivation (intensified rice and cash crop agriculture)	Food security; income generation

Husbandry	Better management of pasture land (western makira project zone)	Income generation; food security
	Increase access to veterinarians	
Human development	Improved education and literacy among rural population	Income generation; food security; improved health and family well-being
	Improved access to health care	Improved health and family well-being; food security

Sections B1.1. and B1.2. provide an overview of mitigtion and adaptation measures the Makira Project will deliver to address risks climate change impact on biodiversity.

GL1.3. Impact of current or anticipated climate changes on community well-being and conservation status of biodiversity

A climate change and climate variability modelling study (using MAXENT: Phillips et al., 2006 and ZONATION) that specifically targeted the Makira project region reports significant negative impacts on community well-being and conservation status of biodiversity in the project zone (Razafimpahanana, 2010).

Using three different Coupled Atmospheric-Oceanic General Circulation Models and 2 generalized land use / land change scenarios: one emphasising protection and one without protection measures Razaphimpahanana reports the following impacts/scenarios for temperature, 23 indicator species and human agriculture practices.

- There will be a mean yearly temperature increase between 2.06 and 3.26 degree C in the next century.
- Of 12 vertibrate species considered (4 mammal and 8 bird) all show significant range contractions over an 80-year, with some *Brachypteracias leptosomus*, *Euryceros prevostii*, *Mesitornis unicolor, Indri indri,* and *Varecia variegata* disappearing completely (Razafimpahanana, 2010).
- Of 11 plant species considered all show range contrations with *Voanioala gerardii* and *Dialyceras parvifolium* likely disappearing completely (Razafimpahanana, 2010).
- Considering change in availability of arable land for rice cultivation – irrigated rice being the principal land use variable modeled – significant decrease in suitable land is predicted as a result of climate change (Razafimpahanana, 2010).

GL1.4. Adaptability of communities and biodiversity in the face of climate change resulting from project activities

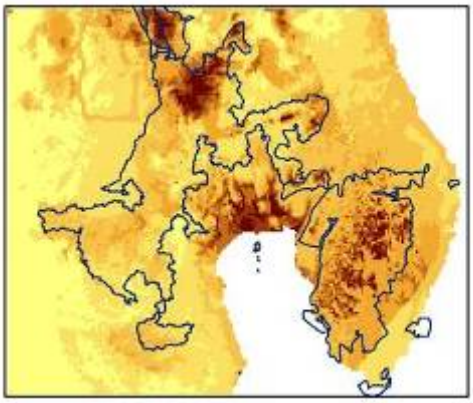
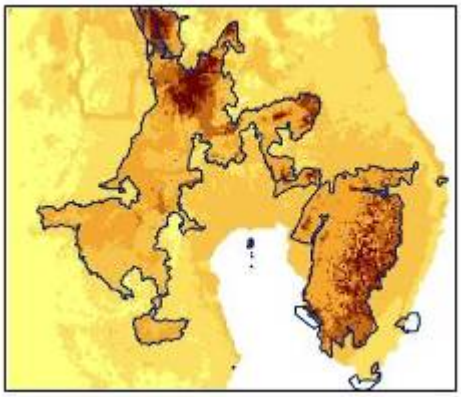
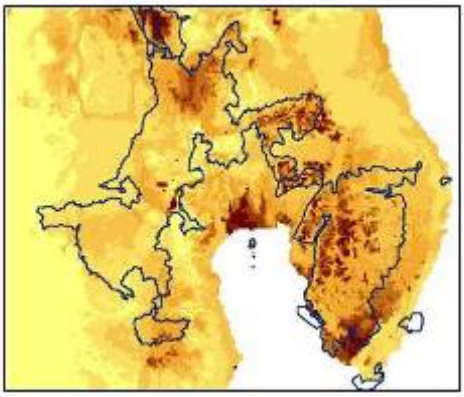
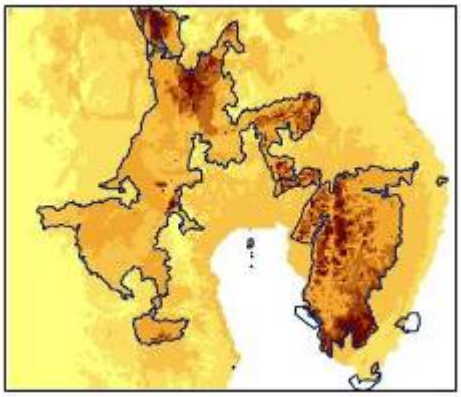
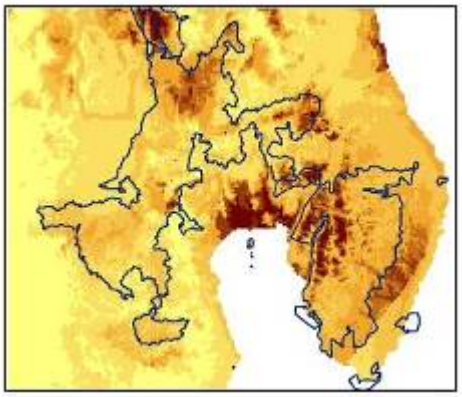
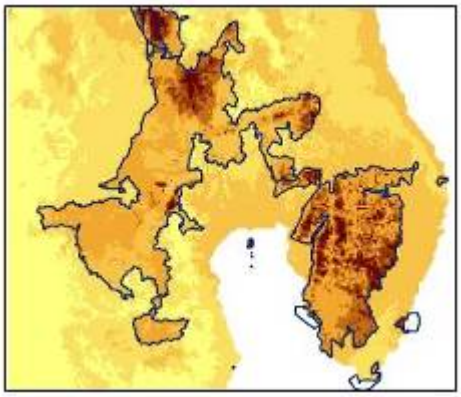
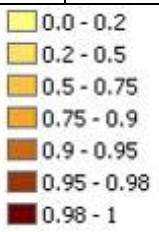
Communities:

As summarized in Section GL1.2. and detailed in Sections G3.2. and G3.8., and Section CM1 subsection CM1.1. the activities to be undertaken throught he Makira project are designed to assist communities to adapt to adverse impacts of climate change and climate variability. Improving community forest resource governance, improving subsistence agriculture including agricultural techniques, improving agricultural infrastructure, and crop diversification will be direct means through which local communities will be able adapt their livelihoods. Increased access to health infrastructure coupled with health and education program development will provide the means for community empowerment. These activitied and initiatives in concert will assure effective community stewardship over local natural resources that will lead to improved sustainable livielihoods in the face of climate change and climate variability.

Biodiversity:

As summarized in Section GL1.3. there is predicted significant negative impact on biodiversity resulting from climate change and climate variation. In considering mitigation of negative impacts the study of Razafimpahanana modelled the effects of protected area establishment. The study found that over an 80-year time period negative impacts of climate change and climate variability will be greatly reduced through the service of the Makira protected area as a biodiversity refugium. As detailed in Section B1.1. principal net positive benefits of the establishemen of the Makira Protected Area will be ensured connectivity and reduced deforestaiton, which directly support maintenance of biological and ecological integrity in the face of climate change and climate vulnerability.

Figure 23: ZONATION modeling of change in biodiversity within and around the Makira Protected Area over 80-year time period

Indices of Biodiversity		
	Without Protected Area	With Protected Area
2000		
2050		
2080		
 Gradient of biodiversity concetration		

GL3.Exceptional Biodiversity Benefits

This section of the Project Design Document provides information on the exceptional biodiversity benefits that the Makira Project delivers with regard to the global significance of biodiversity conservation. The project proponent will use the vulnerability criteria for demonstrating exceptional biodiversity benefits.

GL3.1. Vulnerability

The Makira forest was identified as a highly important area for its unique and vulnerable species in the first national biodiversity prioritization workshop held in 1995 (Ganzhorn *et al.,* 1995). Makira has also been identified as a Key Biodiversity Area (KBA) (Langhammer *et al.,* 2007), as well as a highly important area for conservation of Madagascar's avifauna (ZICOMA, 1999). Most recently the systematic conservation planning exercises under the Madagascar Protected Areas System (SAPM)" identify Makira forest as a high priority for conservation.

Table 27: Lemur species occurring within the Makria Project forests

Species Name	Common Name	Conservation Status
Indri indri	Indri	Endangered
Varecia variegata variegate	Black and White Ruffed Lemur	Critically Endangered
Varecia rubra	Red Ruffed Lemur	Endangered
Eulemur albifrons	White-fronted Brown lemur	Vulnerable
Eulemur rubriventer	Red-bellied lemur	Vulnerable
Hapalemur griseus griseus	Grey Bamboo Lemur	Vulnerable
Lepilemur mustelinus	Weasel Sportive Lemur	Data Deficient
Lepilemur microdon	Small-toothed Sportive Lemur	Data Deficient
Lepilemur seali	Seal's Sportive Lemur	Data Deficient
Avahi laniger	Eastern Woolly Lemur	Least Concern
Microcebus rufus	Rufous Mouse Lemur	Least Concern
Microcebus murinus	Gray Mouse Lemur	Least Concern
Microcebus macarthurii	Anjiahely Mouse Lemur	Data Deficient
Microcebus mittermeieri	Mittermeier's Mouse Lemur	Data Deficient
Allocebus trichotis	Hairy-eared Dwarf Lemur	Data Deficient
Cheirogaleus major	Greater Dwarf Lemur	Least Concern
Cheirogaleus sibreei	Sibree's Dwarf Lemur	Data Deficient
Propithecus candidus	Silky Sifaka	Critically Endangered
Phaner furcifer	Masoala fork-marked Lemur	Least Concern
Daubentonia madagascariensis	Aye-aye	Near Threatened

As presented in Sections G1.7. and G1.8.1., Makira's biological diversity is largely unequalled in Madagascar and represents a globally significant site for biodiversity conservation. Makira is home to 20 of Madagascar's currently identified lemur species; this is likely the greatest diversity of lemur species existing in a single protected area in Madagascar, and represents the only protected area with all five of the families of living lemurs represented (GERP pers. com., 2011).

Found in Makira are the critically endangered Black and White Ruffed Lemur (*Varecia variegata*) and the critically endangered Silky Sifaka (*Propethicus candidus*): the Silky Sifaka is classified as one of the 25 most endangerd primates in the world and only recently discovered in the forests of the Makira Protected Area. Also found in Makira are the endangered Indri (*Indri indri*) and Red Ruffed Lemur (*Varecia rubra*). Further evidence of Makira's exceptional biodiversity comes from the recent discovery of 5 new species of palm of which three are critically endangerd and two are classified as vulnerable (Rakotoarinivo *et al.,* 2009), as well as the recent discover of a new species of mouse lemur: *Microcebus macarthurii* (Radespiel *et al.*, 2008) known only to exist in the forests of Makira. It is likely that continued floral and faunal surveys will lead to additional new discoveries, thus further demonstrating the global biodiversity importance of the Makira forests.

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APPENDICES

Appendix I: Makira Terrestrial Carbon Stock Measurement Standard Operating Procedures

Appendix II: WCS Technical Field Report of Makira Terrestrial Carbon Stock Measurements

Appendix III: Article 39 du Loi constitutionnelle n° 2007-001 du 27 avril 2007

Appendix IV: Malagasy Environnemental Charter

Appendix V: Makira's Environmental Permit (January 22nd, 2009)

Appendix VI: Madagascar's Protected Area Code (COAP)

Appendix VII: Arrêté n°20.022 /2005-MINENVEF by the Ministry of Environment, Water and Forests, providing temporary protection status to Makira

Appendix VIII: Delegation of management of Makira Protected Area from the Mnistry of Environment and Forests to WCS.

Appendix IX: DECRET N° 2001-122 Fixant les conditions de mise en œuvre de la gestion contractualisée des forêts de l'Etat.

Appendix X: Sample resources management transfer Contract for a community-managed site (GCF site)

Appendix XI: Sample supporting letter from local authority

Appendix XII: Sample agreement on Controlled Occupation Zone (ZOC)

Appendix XIII: Attestastion de repérage

Appendix XIV: Makira Project ten years financial plan