Wildlife Conservation Society

Makira Forest Protected Area Project

Project Design Document

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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 epicentre 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 (CO_2) 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

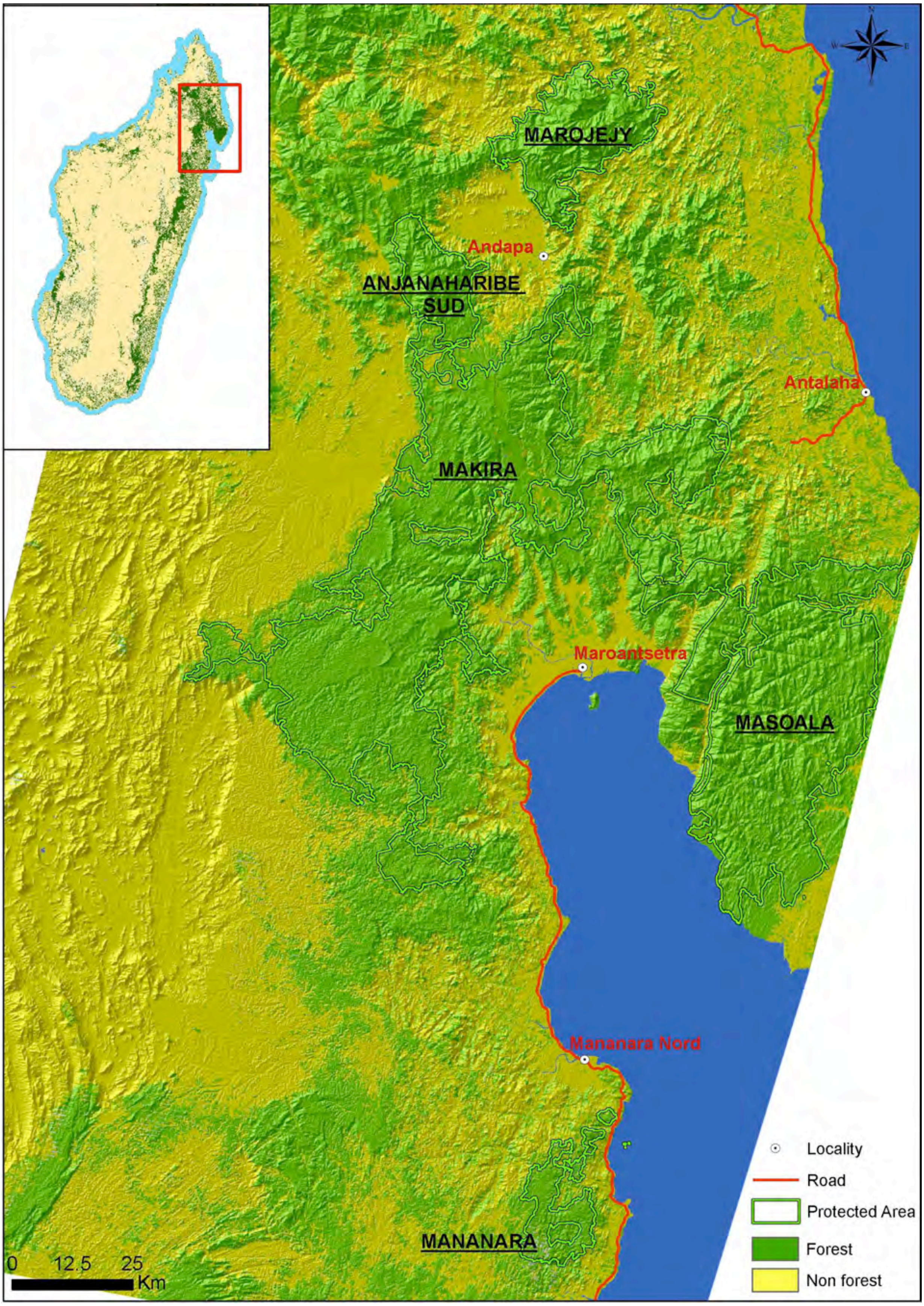
Location:

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 North-eastern 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).

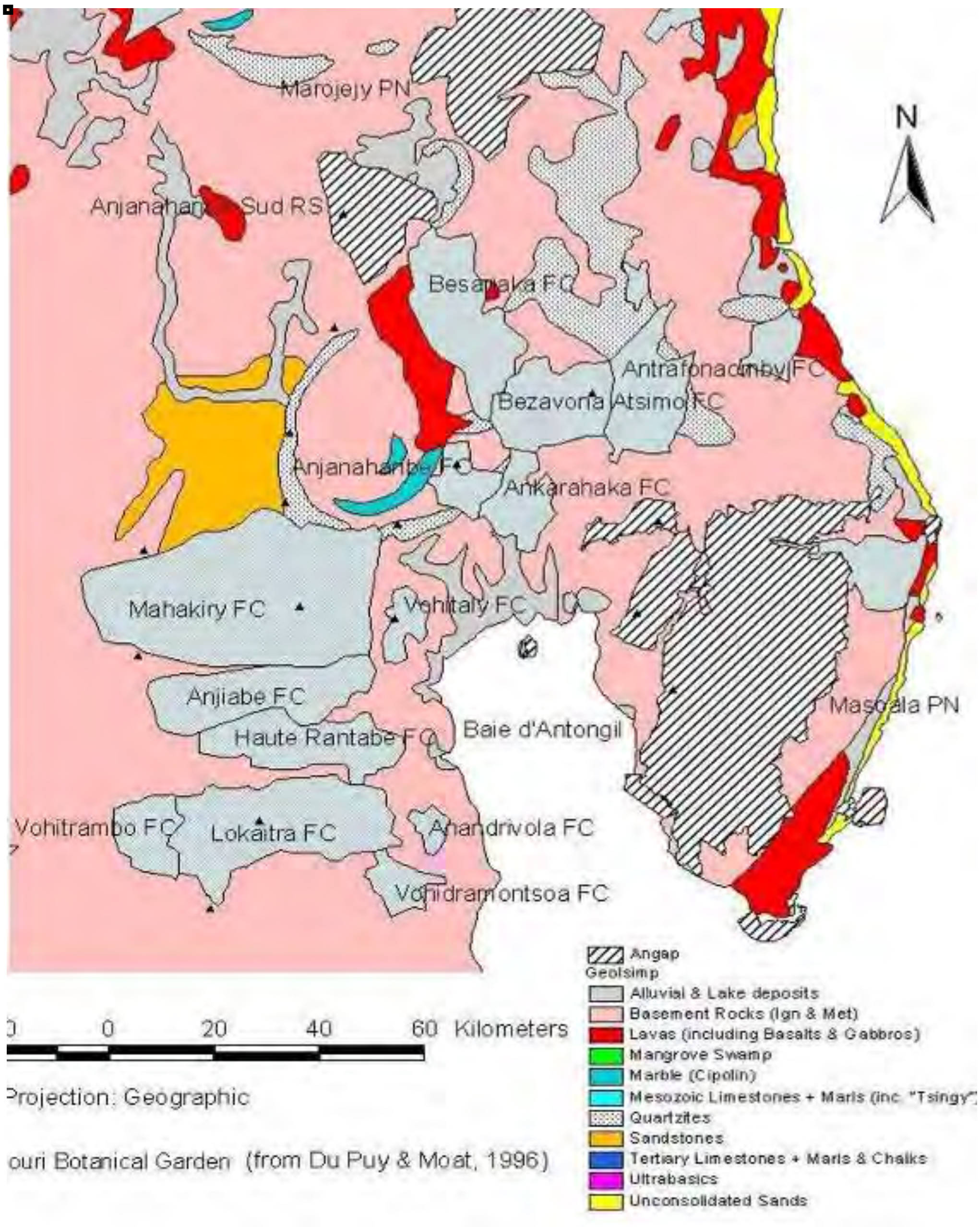
Figure 1: Location of the Makira project zone



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:

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 local and regional economies, based on both subsistence and cash crops.

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

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 800m) in the east of the project zone and mid-altitude forest (800m 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.

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. 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 (Meyers, 2001)[6].

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 Unpublished report for WCS Makira.

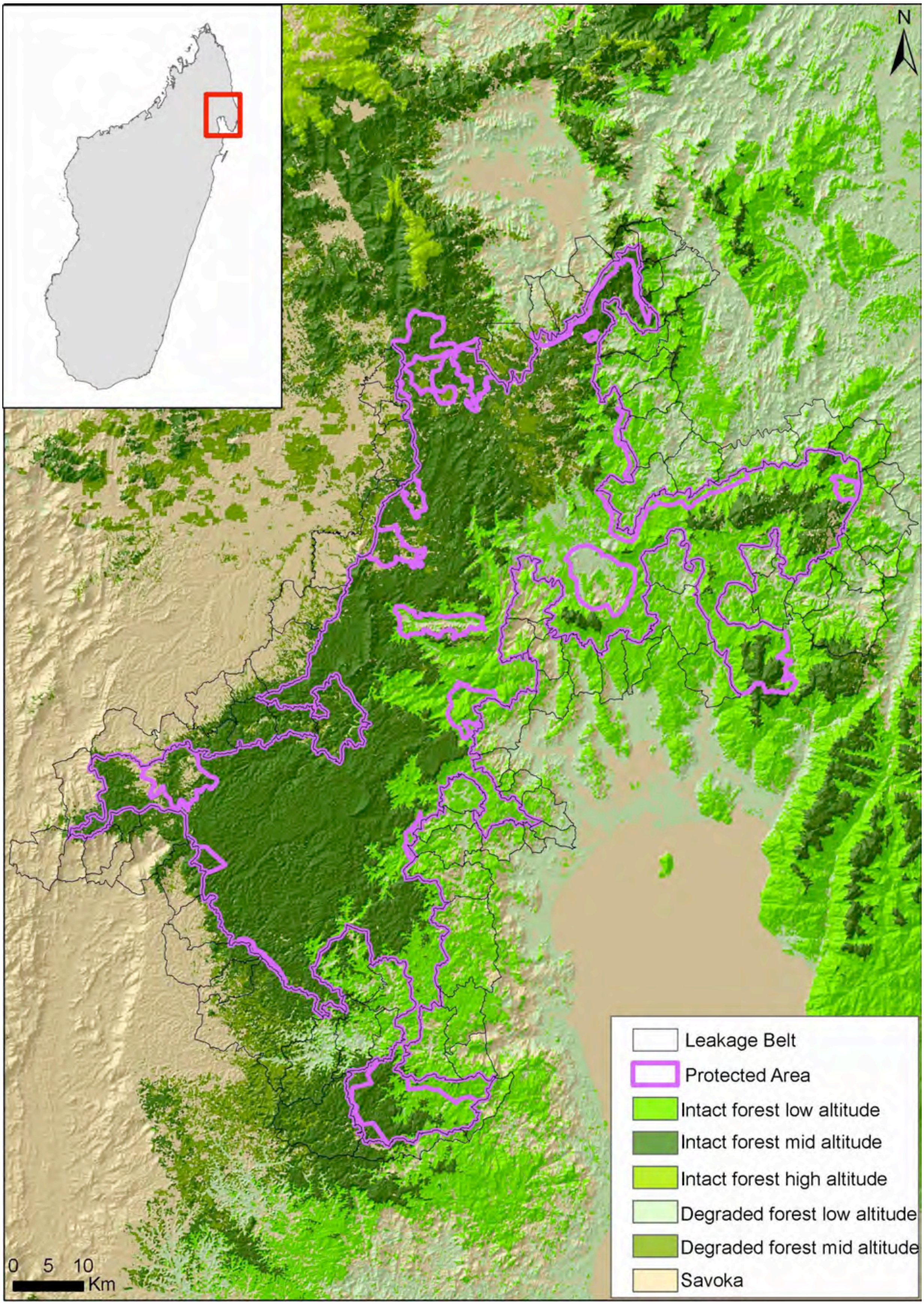
[3] Lowry, P.P., II, G. E. Schatz, J.-F .Leroy & A.-E. Wolf. 1999. Endemic families of Madagascar. III. A Synoptic revisoin of Schizolaena (Sarcolaenaceae) Adansona, ser .3,(21): 183-212

[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 3: Makira's forest cover types



The area is also very dynamic with erosion on steep slopes quite common throughout certain areas of primary forests. The area is also prone to periodic cyclone activity especially in the northern section. Most of the agriculture, rice paddies and wetlands occur below 800 meters elevation. Almost 97% (360,060 ha) of the 372,470 hectares of the project area were identified as dense primary forest. Almost one third (115,000 ha) of the dense primary forest is found below 800 meters elevation. Lower elevation forests in Madagascar are more severely threatened than higher elevation forests and tend to contain higher species-level diversity. The extremely high level of dense primary forest in the project area attests to the very high quality of that core area. (Meyers, 2001).

In the western part, secondary formations are mainly constituted by wooded savannah where most of the valleys present relicts of forests with or without raphia. These savannah are the results of the conversion of forests into pasturage fields for cattle breeding (PAGS, 2009).

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.

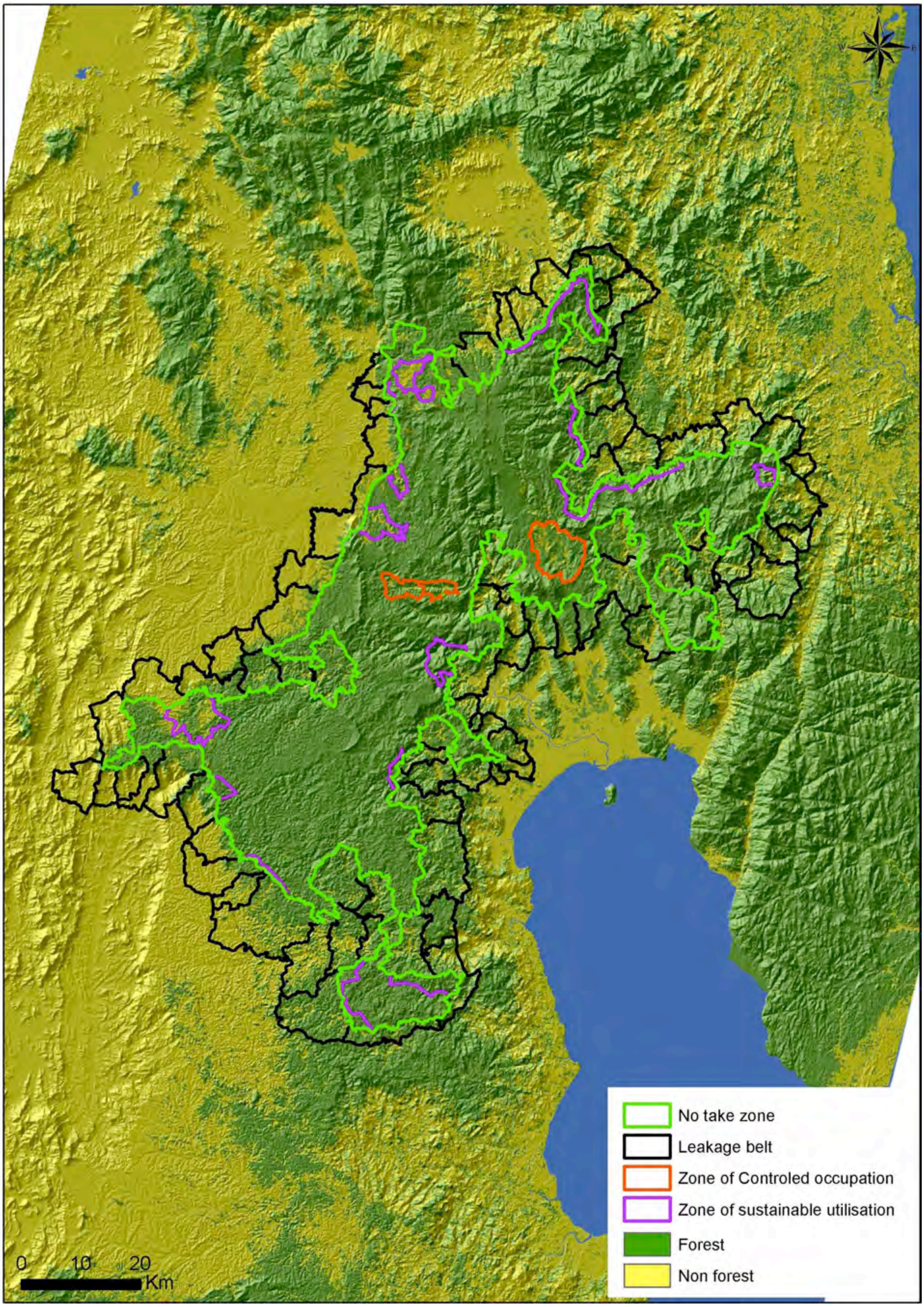
Surface areas of these different zones are presented in Table 1 below and figure 4.

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

<table>
<tr><th>Designation</th><th>Units</th><th>Sub-Units</th><th>Number</th><th>Area</th><th>Management Technique (Gestion)</th></tr>
<tr><td rowspan="3">Protected Area</td><td>Zone of Strict Pro-tection or Noyau Dur</td><td>-</td><td>1</td><td>331,993 ha</td><td>Forests under strict protection with no commercial or subsistence harvests or removals allowed</td></tr>
<tr><td rowspan="2">Multiple Use Zones or Zone Tampon</td><td>Zone of Controlled Settlement / Occupation (ZOC)</td><td>5</td><td>11,875 ha</td><td>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 (agriculture and cattle-grazing) are allowed.</td></tr>
<tr><td>Zone of Sustainable Use (ZUD)[1]</td><td>15 (6 com-munity and 9 individual)</td><td>28,602 ha</td><td>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</td></tr>
<tr><td>Protection zone</td><td colspan="2">Community-managed sites</td><td>83 GCF sites</td><td>351,037 ha</td><td>Each GCF site includes a conservation zone and an area for customary uses</td></tr>
</table>

Note: Areas in this table are total areas and include forest and non-fores areas. The project area as presented in in sections G2.3 below is constituted only by the forests inside the Makira protected area in 2005 and therefore slightly smaller than the total area presented above.

Figure 4: Map of the Makira project zone



Climate Information

G1.4. Current carbon stocks within the project area

Carbon pools:

The main carbon pools considered by the Makira project are: Above-ground live tree biomass, below-ground tree biomass and standing and lying dead wood. 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.
Above-ground non-tree biomass	Included	Included only in post deforestation stratum. Non significant in forest strata and conservatively excluded
Below-ground tree 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 associated with deforestation and therefore considered insignificant and excluded
Soil organic carbon	Excluded	Conservatively excluded

The following has been considered during the selection of carbon pools to be considered in the Makira project:

- **Non-tree biomass:**
  The non-tree biomass pool has only been included for the post deforestation stratum because there it seemed to be more significant. In the forest strata non-tree biomass was considered non-significant and has been conservatively excluded.

- **Long-term wood products:**
  The long-term wood products carbon pool was excluded mainly because deforestation practices do not include extraction of timber for long term wood products. Selective and mostly illegal logging of high value timber does occur in and around the project area, but is not associated with the deforestation process. Although it is of course very difficult to quantify such illegal and/or informal logging activities, Makira seems to have suffered much less from illegal logging than other protected areas in North-western Madagascar and the long-term wood products pool is therefore considered non significant.

Stratification:

In accordance with the X–STR module of the applied methodology, ancillary data has been used as proxies for identifying potential biomass classes. The following existing data sets have been used to identify forest strata in the project area and in the leakage belt prior to project start:

- The atlas of the Vegetation of Madagascar by Royal Botanic Gardens Kew[7]: This data distinguishes between intact and degraded humid forests in the wider project zone but identifies no forest strata based on altitude.
- The official national categorization of habitat zones, from the national forest inventory conducted in 1997[8]: This data includes "low-altitude forest" (0-800 meters) and "mid-altitude forest" (800-1,800 meters). In each altitude class intact and degraded forests are clearly distinguished but unfortunately the entire data set was not available in shapefile format and consequently only of limited use for the stratification process.
- The national analysis of forest cover change between 1990, 2000 and 2005[9]: This analysis conducted by CI and the JariAla project used a very strict forest definition and was therefor not used for stratification purposes in the Makira project.
- ENSOMOSAIC very high-resolution aerial photography conducted in 2007: Several aerial photography missions were conducted by WCS in the Makira area of which the 2007 version was the most complete. However, these images are not really compatible with other data and were consequently used only for verification purposes.

After further analysis of these datasets, an initial stratification for the preliminary carbon stock inventory, based essentially on the Kew data, distinguished the following four forest strata:

- Low-altitude (0 – 500 m) dense humid forest
- Low-altitude (0 – 500 m) degraded humid forest
- Mid-altitude (500 – 800 m) dense humid forest
- Mid-altitude (500 – 800 m) degraded humid forest

The Kew data was selected because it distinguishes clearly between degraded and intact humid forests and was readily available in GIS file format, which was not the case for the IEFN data. The relatively limited altitude range was chosen for the preliminary inventory for two reasons: i) altitudes below 800 m are still relatively easy to access while measuring samples in forests above 800 m seemed too chalenging in the context of a simple preliminary inventory; and ii) recent studies (particularly Asner et al. 2011[10]) suggest that forest degradation in Madagascar happens mostly at altitudes between 500 (southern Madagascar) and 1,000 m (Northern Madagascar) and as the degree of degradation was one of the stratification criteria this range seemed appropriate.

Biomass measurements were conducted to estimate the biomass of the forest and non-forest classes. The plot survey design and sampling protocol were provided by Winrock International and are based on IPCC guidelines and 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

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

8 MEFT and FTM, 1997. Inventaire Ecologique Forestier de Madagascar (IEFN 1)

9 MEFT, USAID and CI, 2007. Change in Natural Forest Cover 1990 – 2000 – 2005.

10 Asner G.P, J.K. Clark1, J. Mascaro, R. Vaudry, K.D. Chadwick1, G. Vieilledent, M. Rasamoelina, A. Balaji, T. Kennedy-Bowdoin, L. Maatoug, M.S. Colgan and D.E. Knapp, 2011. *Human and environmental controls over aboveground carbon storage in Madagascar*. Carbon Balance and Management 2012, 7 :12.

biomass were made in each of the five classes with 10 sampling plots in each (a total of 50 plots). The locations of all preliminary measurement plots were identified in GIS and then uploaded to GPS units. Ten plots per stratum were purposely located in relatively accessible locations and were not randomly distributed. Stratum maps and sample locations for the preliminary inventory are presented in annex II.

Analysis of pilot data collected from the 40 pilot plots (10 plots in each of the four forest strata) indicated that there was no statistically significant difference in the estimated carbon stocks (SAS proc GLM) between low-altitude intact (FIB) and degraded (FDB) forests, nor was there a statistically significant difference between mid-altitude intact (FIM) and degraded (FDM) forests (cf. annex II).

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

- Low-altitude forest (0 – 800 m)
- Mid-altitude forest (800 – 1,800 m)
- Post-deforestation stratum

The final altitude ranges were taken from the national forest inventory conducted in 2007 (IEFN 1) because they represent the only available official stratification of dense humid forests and are therefore generally recognized in Madagascar. Also, recent studies on carbon density in Madagascar (Asner et al. 2011) show that carbon stocks are significantly reduced through human intervention at altitudes below 500 to 1,000 m and therefore the IEFN limit of 800 m seemed appropriate in the context of the Makira forests. Maps of the strata used in the final carbon inventory are presented in appendix II. As the final stratification is based on altitude only the areas of the two identified strata (A_i) naturally add up to the total project area as demonstrated in the corresponding table in section 4.1 of the VCS PD (see also "Makira v4 – Crosstabs" file for more details).

As pre-stratification has been applied and the two strata are based on altitude there are no sampling plots that have not been attributed to one of the two strata. Consequently and in accordance with the X-STR module of the applied methodology, no additional strata have to be delineated after inventory.

In accordance with section 4.2.2 of the BL-UP module of the applied methodology, post-deforestation land uses (savoka, agroforestry, fallows, active and abandoned croplands, etc.) have not been stratified. As available remote sensing data did not allow to distinguish clearly between different post-deforestation vegetation types throughout the historic reference period and no data on carbon stocks in these types of vegetation was available, we could not use option II of the methodology. We used option I instead, which uses carbon stocks in the most carbon rich post deforestation land use as proxy for all post-deforestation carbon stocks.

In cyclical post-deforestation land-use systems the time-weighted average of stocks in a cycle shall be used according to the applied methodology. Land use systems in Makira are cyclical, but the cycles are quite complex and as mentioned above post deforestation land use changes could not be observed via remote sensing which made determination of the time weighted average difficult. In addition, no specific data on carbon stocks of post deforestation land uses was available.

We therefore decided to randomly selected 30 samples in post deforestation land uses inside the Makira protected area and in the leakage belt, measured them and used the average as post deforestation carbon stocks. As the locations for the 30 sampling plots were selected randomly, results can be considered equivalent to the time-weighted average and therefore in accordance with option 2 of the applied methodology. Stocks in the carbon pools considered for the post deforestation stratum (above and below ground tree biomass, standing and lying dead wood and non-tree biomass) were estimated with the same methodologies as used for the two forest strata and described in the sections below. Although detailed calculations are not contained in the “Makira v4 – Carbon Stock Inventory” spreadsheet, appendix XVI contains two examples of field inventory sheets for samples with relatively high and low carbon stocks. The discussion of the results in section C2 of the carbon inventory report in appendix II also shows that the obtained average post-deforestation carbon stock of 262.98 tCO_2-e per hectare is very high compared to IPCC proxies for post-deforestation land uses and can therefore be considered very conservative.

The number of sampling plots was calculated in a way to minimize calculation errors for biomass and carbon stock estimation and was calculated using equations presented in section B2 of the carbon inventory report presented in appendix II. As the preliminary inventory did not measure carbon stocks in forests above 800 m altitude (see above) data from the 500 – 800 m strata was used to determine the minimum number of sampling plots for the mid-altitude forest stratum in the final inventory. This proved to be not very appropriate as variability in the forests measures in the preliminary inventory appeared to be somewhat lower than in mid-altitude forests, leading to relatively high 95% confidence intervals for carbon stocks of this stratum. It has however to be noted that these aspects are taken into account in the accuracy assessment and therefore could not negatively impact the carbon stock inventory.

Given the difficult terrain of the project area, a clustered sampling approach was identified. Thirty-three field measurement clusters were identified: 22 clusters in the predetermined ‘high risk’ for transition from forest to non-forest (low altitude forest) stratum and 11 clusters in the predetermined ‘low risk’ for transition from forest to non-forest (mid altitude forest) stratum. At each field measurement cluster 4 subplots were identified for a total of 132 sampling plots.

Because of the difficult terrain, the 33 sampling clusters were not distributed systematically but again taking into account the deforestation risk. In order to reduce the sampling error it seemed appropriate to take more samples in areas that were more likely to be deforested in the near future and less in areas where the deforestation risk seemed to be very low. It has however to be mentioned that the stratification process took into account forests beyond the project area that was finally defined but all samples lie inside the reference area for localisation of deforestation (RRL).

Post-deforestation carbon stocks are the long-term average stocks on the land following deforestation. These stocks depend on the land uses after deforestation in each post-deforestation land use. In the case of the Makira project, these land use classes have been integrated into the carbon stock inventories through the non-forest stratum and inventoried using the same methodology as for the forest classes. The only exception was that in non-forest lands non-tree biomass was included in the measurements as it was expected to be significant. For the non-forest 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 clusters 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. The standard operating procedures used to estimate the carbon stocks for both preliminary and additional plots and technical field methods report can be found in appendix II.

Estimation of carbon stocks:

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

- Carbon stocks in above ground tree biomass (CAB_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. During development of the PDD, Veilledent et al published a new study[11] containing improved national forest type specific allometric equations and consequently equation Mada.I.1 proposed for moist-wet forests was used. As tree height has not been measured in the field inventory the diameter-height-relation for dense humid forests also proposed by Veilledent et al. has been used, This allometric equation complies as follows with the applicability criteria of the CP-AB module of the applied methodology:
    - As no national or regional species, genus or family specific equations are available for Madagascar, the national forest specific equations from Vieilledent rank highest (c) on the preference list of the CP-AB module.
    - In table 2 on page 32 of the publication an R2 of 0.94 is mentioned for the used model Mada I.1 with height regression for moist wet forests, which is above the minimum R2 of 0.8 required by the CP-AB module of the applied methodology.
    - Table 1 on page 31 of the publication shows that for the moist-wet allometric category 346 (76 + 90 + 90 + 90) trees have been sampled for the allometric equation and 250 trees for the diameter height relationship, which is also above the minimum threshold of 30 sampled trees of the applied methodology.

11 Vieilledent, G., R. Vaudry, S. F. D. Andriamanohisoa, S. Rakotonarivo, H. Z. Randrianasolo, H. N. Razafindrabe, C. B. Rakotoarivony, J. Ebeling and M. Rasamoelina, 2011. A universal approach to estimate biomass and carbon stock in tropical forests using generic allometric models

- A total of 8 trees measured in the carbon stock inventories (3 out of 2,815 in stratum 1 and 5 out of 1,957 in stratum 2) have a dbh above the 128 cm threshold mentioned in the publication. This does not seem to be significant as Vieilledent et al discuss the maximum dbh issue mainly in relation with allometric models that do not include tree hight as a parameter because they do not take into account the possibility of a physiological maximum tree height. We however used equation Mada I.1 with tree height as parameter in combination with the diameter height relationship also developped by Vieilledent et al. based on measured trees up to 128cm dbh. In their discussion of this diameter height regression for moist-wet forests the authors mention that available data did not suggest the existence of an asymptote for the height-diameter relationship and it is therefore unlikely that applying the equation to the abovementioned 8 trees above 128cm dhp lead to an over-estimation of carbon stocks in the two strata.

Consequently, the allometric model Mada I.1 proposed by Vieilledent et al. is considered applicable in accordance with the applied metodology. The applied model uses the following equation:

$$C_{AB\_tree} = exp\ (-1.948 + 1.969 * log(dbh) + 0.66 * log(H) + 0.828 * log(\rho))$$

As tree height was not measured in the field inventory, the following height-diameter relationship also proposed by Vieilledent et al. was applied for estimating the height of each individual tree measured in the field inventory:

$$log(H) = 1.01 + 0.547 * log(dbh)$$

Species specific values for wood density (ρ) were also taken from Veilledent (2011), for unknown species a conservative density of 0.5 t/m^3 was assumed. 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). More detail on these calculations is presented in the "Makira v7 – Carbon Stock Inventory" file.

- *Carbon stocks in below ground tree biomass (CBB_tree):*
  In accordance with the applied methodology, 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[12]. In a process similar to the one used for aboveground tree biomass, average belowground tree biomass per unit area could then be estimated for each sample plot and summed up and converted into carbon dioxide equivalents for each considered stratum (cf. Table 3).

12 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

- *Carbon stocks in dead wood (CDW):*
  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 (CAB_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:

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

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 average carbon stock in the post deforestation stratum used for estimating the emission factors and estimating carbon stock changes as presented below. Table 3 provides the average carbon density by carbon pool for each of the two forest classes and the non-forest class represented in tCO_2-e/ha. More detailed results and comparison with results from other studies conducted in Madagascar can be found in the inventory report in annex II. Uncertainties related to the determination of carbon stocks are assessed in detail in section 3.4.3 of the VCS Project Description.

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

Stratum	Average carbon stocks and 95% Confidence Interval in t CO_2-e/ha									
	C_{AB_tree}		C_{BB_tree}		C_{DW}		C_{NT}		C_{BSL}	
	AV	CI	AV	CI	AV	CI	AV	CI	AV	CI
Forest Stratum 1: Low Altitude	391.78	41.96	94.03	10.07	59.08	10.71	-	-	544.89	55.87
Forest Stratum 2: Mid Altitude	609.59	157.07	146.30	37.70	54.25	20.67	-	-	810.14	195.58
Post Deforestation	177.51	58.48	42.60	14.04	16.76	6.78	2.02	0.64	238.89	73.42

$C_{BSL,i}$ = Carbon stock in all carbon pools in forest stratum *i*; t CO_2-e/ha
$C_{AB\_tree,i}$ = Carbon stock in aboveground tree biomass in stratum *i*; t CO_2-e/ha
$C_{BB\_tree,i}$ = Carbon stock in belowground tree biomass in stratum *i*; t CO_2-e/ha
$C_{DW,i}$ = Carbon stock in dead wood in stratum *i*; t CO_2-e/ha
$C_{NT,i}$ = Carbon stock in non-tree biomass in stratum *i*; t CO_2-e/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 transportation 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.[13] 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. Based on the United Nations' working definition of indigenous people[14], 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

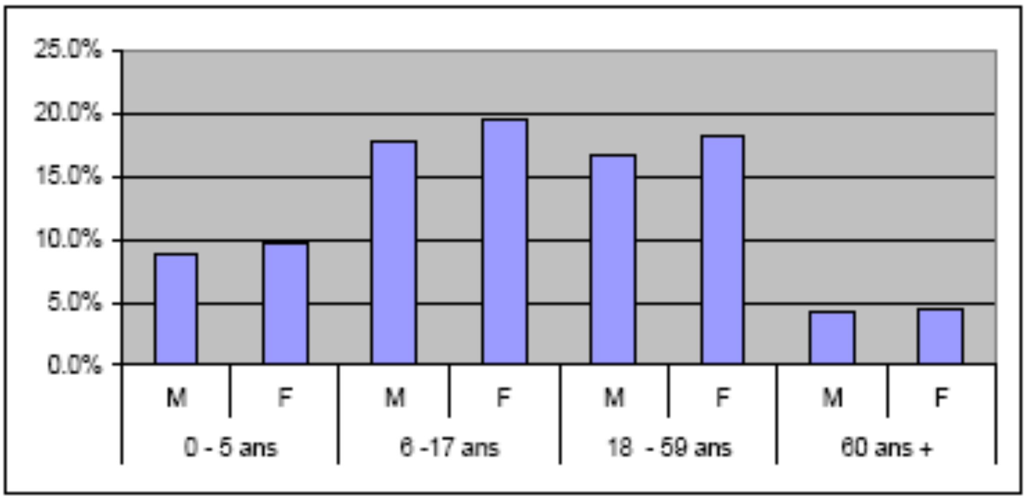
13 Evolution de la couverture de forêts naturelles à Madagascar 1990-2000-2005. USAID, Conservation International, Ministère de l' Environnement des Forêts et du Tourisme, Mars 2009.

14 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.

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.

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



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

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 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[15] 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.

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

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

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 bordering 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. 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.

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.

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.

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**

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[16]. 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" [17] (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[18] 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.

[16] Law n°2006-031 of 24 November 2006 and Decree n°2007-1109 of 18 December 2007
[17] Guichet foncier
[18] 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 plants and vegetation, 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, 20 lemur species and subspecies (the highest diversity of lemurs found within any of Madagascar's protected areas) as well as 28 other mammal species. As regard to butterfly, 145 species are currently known for the Makira forests. This is the nearly half of described species in Madagascar. The most interesting so far identified is a new species and genus of the primitive homoneurous family *Micropterigidae*, found at the summit of Anjanaharibe Mt. on the eastern/northern side of the Antaimbalanana River. (WCS, 2004; Andrianjaka, 2004; Antilahimena, 2003, Ratelolahy et al, 2007, Andrianjakarivelo et al, 2003, Jenkins et al,, 2003, Raharivololona et al, 2003, Rakotomanana et al, 2003, Razafindrasoa et al, 2003, Lees D. C., 2003, WCS, 2004,Rakotomalala et al. 2007, Rasolofoson et al. 2007, 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).

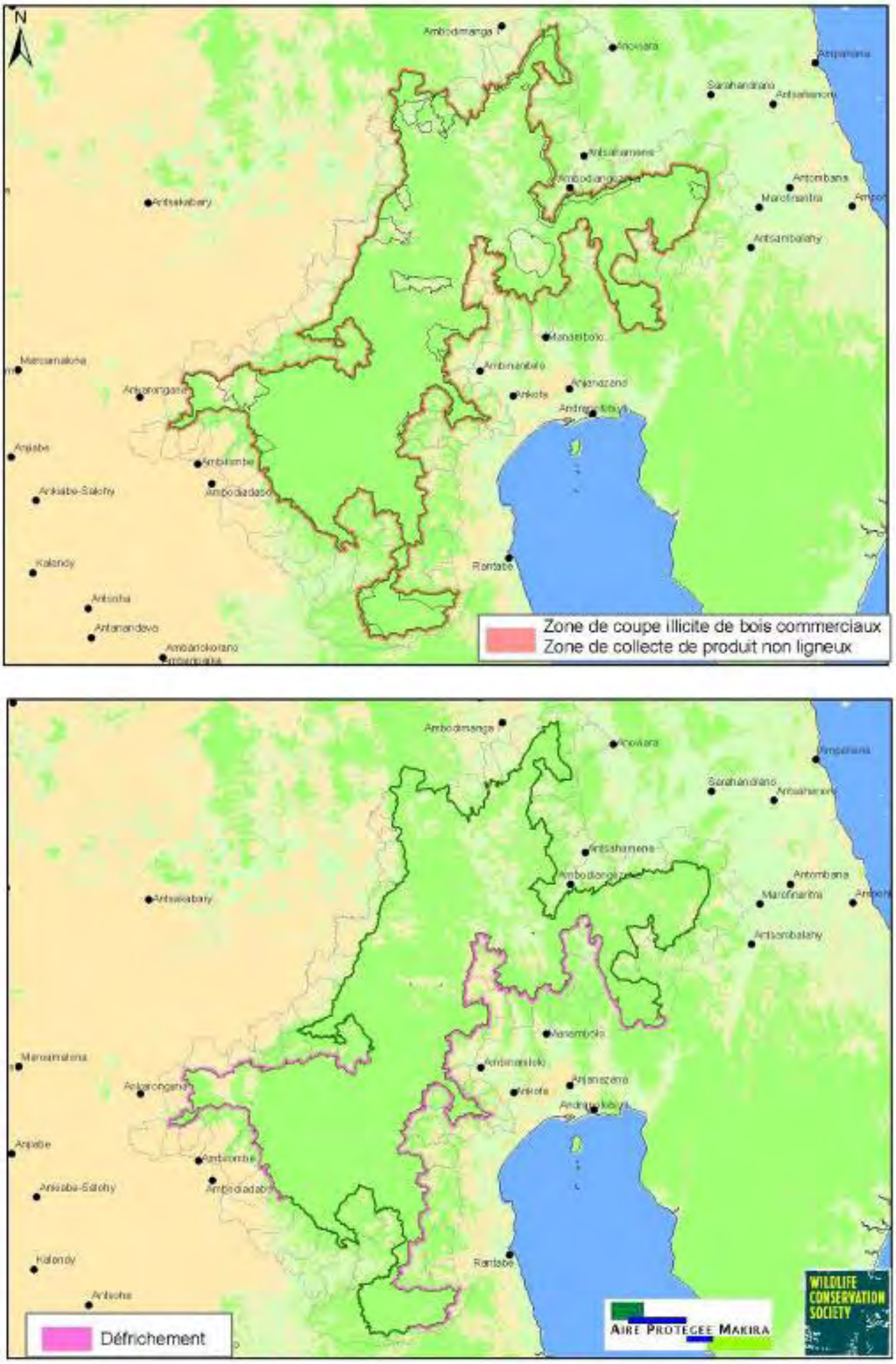
Opportunistic as well as targeted bushmeat hunting is driven by both subsistence and market demand. Research has found that twenty-one forest mammal species, including four carnivores, three bats and eleven lemur species are common hunting targets and hunting is largely unsustainable. Secondary effects 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, Golden, 2009, GERP, 2006).

Table 8: A list of species hunted in the Makira Forest

Scientific name	Malagasy name	English common name
Lemurs		
Avahi laniger	Ampongy, Fotsife	Eastern woolly lemur
Cheirogaleus major	Tsitsiha	Fat-tailed dwarf lemur
Daubentonia madagascariensis	Aye-aye	Aye-aye
Eulemur albifrons	Varikosa	White-fronted brown lemur
Eulemur rubriventer	Tongo	Red bellied lemur
Hapalemur griseus	Bokombolo	Grey bamboo lemur
Indri indri	Babakoto	Indri
Lepilemur sp.	Fitsidika, Varikandavaka	Sportive lemur sp.
Microcebus sp.	Tsidy, Kandrandra	Mouse lemur sp.
Propithecus candidus	Simpona	Silky sifaka
Varecia rubra	Variniaina	Red ruffed lemur
Varecia variegata	Varikandana	Black and white ruffed lemur
Carnivores		
Cryptoprocta ferox	Fosa	Fossa
Eupleres goudoti	Falanoka	Falanouc
Fossa fossana	Tombokantsodiny	Fanaloka
Galidia elegans	Vontsira	Ringtailed mongoose
Viverricula indica	Jaboady	Lesser Indian civet
Bats		
Minioptera spp.	Manavy	Insectivorous bats
Pteropus rufus	Fanihy	Flying fox
Rousettus madagascariensis	Andrehy	Madagascar roussette
Bush pig and tenrecs		
Potamochoerus larvatus	Lambo Dia	Bush pig
Setifer setosus	Sokiny	Greater hedgehog tenrec
Tenrec ecaudatus	Trandraka	Common tenrec

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 non-timber forest products



G1.8. High conservation values in the project zone

The Makira project zone includes all six categories of High Conservation Value (HCV), as described as follows:

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

Fauna:

The Makira forests harbour 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 macarturi* (Radespiel et al., 2008). Additional surveys in 2007 lead to the discovery of the Silky Sifaka (*Propithecus candidus*) in the low altitude forests of Makira[19]. 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 *Liophidium* (*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 not yet described 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)

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

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[19] 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.

Table 9: 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 Madagascar.;* *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* (East. Lesser Bamboo Lemur); *Eulemur rubiventer* (Red-bellied Lemur); *Eulemur albifrons* (White-fronted Brown Lemur)	*Daubentonia madagascariensis* (Aye-aye) *Eulemur fulvus* (Common Brown Lemur)
	Carnivore			*Cryptoprocta ferox* (Fosa); *Fossa fossana* (Malagasy Civet) *Salanoia concolor*	*Galidictis fasciata* (Broad-striped Mongoose) *Eupleres goudotii*
	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* (Madagascar Grebe) ; *Euryceros prevostii* (Helmet Vanga); *Oriola bernieri* (Bernier's Vanga); *Mesitornis unicolor* (Brown Mesite); *Brachypteracias Leptosomus* (Short-legged Ground-Roller); *Brachypteracias squamiger((*Scaly Ground-Roller), *Bernieria tenebrosus (Dusky Tetraka)*	*Lophotibis cristata (*Madag. Crested Ibis); *Atelornis crossleyi (*Rufous-headed Ground-roller); *Accipiter madagascariensis* (Madagascar Sparrowhawk); *Bernieria cinereiceps* (Grey-crowned Tetraka), *Accipiter henstii* (Henst's Goshawk), *Atelornis crossleyi* (Rufous-headed *Ground-Roller)*
Reptiles				*Brookesia vadoni,* *Calumma cucullata,* *Lygodactylus madagascar. (Madagascar Dwarf Gecko), Zonosaurus boettgeri*	*Calumma g. marojezensis,* *Calumma p. parsonii,*
Amphibians		*Anodonthyla rouxae* (Roux' Bamboo Mycrohylid); *Plethodontohyla Brevipes;* *Stumpffia pygmaea* *Mantidactylus webbi*		*Mantidactylus klemmeri, Mantidactylus elegans, Stumpffia pygmaea*	*Mantella laevigata* (Green Mantella); *Mantidactylus elegans;* *Mantidactylus leucomaculatus* *Dyscophus antongilii*
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 (HCV 2)

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:

- The Red Ruffed Lemur (*Varecia rubra*), found only in the forests of Masoala and Makira protected areas.
- The newly discovered nocturnal lemur species *Microcebus macarturi* (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 the north-eastern Madagascar, including 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)[20] 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 (HCV 3)

Since almost one third of the forests in the Makira Project area are comprised of lowland humid forest (approximately 115,000 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

[20] 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.

North-eastern Madagascar (Marojejy, Masoala, An55anaharibe 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 (HCV 4)

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 (HCV 5)

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. Some areas within the project zone, particularly in the buffer zone and the green belt protection zone of the Makira protected area include areas designed for community resources uses. 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) (HCV 6)

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[21]) live there. The whole community is a mixture of various ethnical groups encountered across the country.

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

No sacred forest exists within the Makira forests. In return, communities use some areas inside the project zone as a village cemetery for the burial of their relatives or for traditional rituals. Local communities in the Makira area have several traditional rituals including rasariana, tsikafara, joro, and so on. These rituals are held in specific areas that are not necessarily sacred areas and they do not have a negative impact on natural resources. During the process of delimitation of the Makira Park (see Sections G1.6 and G3.2), village-by-village discussions were carried out to discuss several issues, including among other issues, sacred areas. This process ensured that any areas of sacred value to local communities are either excluded from the park or zoned for specified access. Thus, all areas that serve as cemetery and/or for traditional rituals are included in the greenbelt protection zone that is managed by the community. The only exception is 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[22] 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 the project

This section on the additionality analysis was conducted following the different steps described in the AFOLU additionality assessment tool "*VCS-Tool-VT0001: Tool for Demonstration and Assessment of Additionality in AFOLU Project Activities*".

An initial land-use analysis carried out in 2001 based on satellite images from 1996 confirmed that Makira is one of the most pristine forested areas left in Madagascar with very high levels of dense primary forests even at altitudes below 800 meters. However, the Makira forests were under high pressure from human activities, leading to relatively high deforestation rates, estimated at about 0,43% between 1995 and 2005. Lower elevation forests seem to be more severely threatened than higher elevation forests[23] and tend to contain higher species diversity. Most of the agriculture, mainly rice paddies and other wetlands, occur below 800 meters elevation (Meyers, 2001). Forest conversion was initially concentrated in the river valleys but can increasingly be seen far up rivers.

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

22 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.

23 Asner et al. 2012. Human and environmental controls over above-ground carbon storage in Madagascar. Carbon Balance and Management 2012, 7:2

foremost a stock of arable land, above harvesting forest products, logging, or collecting non-timber forest products.

As demonstrated in section 1.8.1.1, the following two main direct drivers of deforestation are to be considered in the case of the Makira project:

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. Although tavy requires clearing and burning of forests, it can be a sustainable form of agriculture in tropical forests and does not necessarily require clearing of old growth trees as long as fallow periods are long enough and human population density very low. This can be observed in Makira when cropland is allowed to naturally regenerate for 3 to 7 years before the secondary vegetation is cleared again before planting. However, limited land availability and increasing human population growth, currently at 3% per year, have resulted in reduced fallow periods and increased old growth forests clearing.

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.

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 over longer periods leads to deforestation. The frequent use of fire also very effectively hinders natural regeneration and deforestation has therefore to be considered permanent.. 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).

Direct drivers of forest degradation are the following:

Illegal small-scale logging:

Fortunately for the Makira forests, illegal logging is still very localized due to difficulty of access and transporting timber out of the forests and therefore considered a driver of forest degradation but not of defoerestation. 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 north-eastern 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[24]. 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[25]. This figure from Makira likely contributed to the total amount estimated to come from Masoala, as opposed to being additional. In any case, extraction of wood for timber is usually not a part of deforestation activities observed in and around the Makira Protected Area and related emissions can therefore be considered non significant.

As wood still is he major energy source in rural Madagascar, it is much more commonly extracted by local populations for fuel. Based on the population density inside the protected area (less than 2,000 following the management plan) and annual fuel wood needs per capita estimated at 0.69 m^3 per person and per year in rural areas by Ramamonjisoa et al (2006)[26], annual extraction of wood for fuel can be estimated at about 1,500 m^3 per year. Considering the important areas of natural forest available to local communities for collection of fuel wood, it is expected that extraction will be less than 1 m^3/ha/y, far below the natural increment of 5.89 m^3/ha/y (Ramamonjisoa et al 2006), and fuelwood extraction can thus be considered sustainable. Charcoal is traditionally used only in urban centres and due to transport issues charcoal production is not significant in the Makira protected area.

A similar argument can be made for the local use of wood for construction by populations living inside and around the Makira protected area. Ramamonjisoa et al. (2006) estimate the annual wood consumption for construction at 0.24 m^3 per person and per year in rural areas. The resulting annual consumption of about 500 m^3 would lead to harvesting of about 0.23 m^3/ha/y, again far below the natural regeneration and can therefore also be considered sustainable.

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 impacted. Here quartz is quarried and sold to wealthy, well organized by buyers. Mining for quartz uproots trees and small forest fragments at a number of sites but remains small-scale and therefore contributes to forest degradation only. 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.

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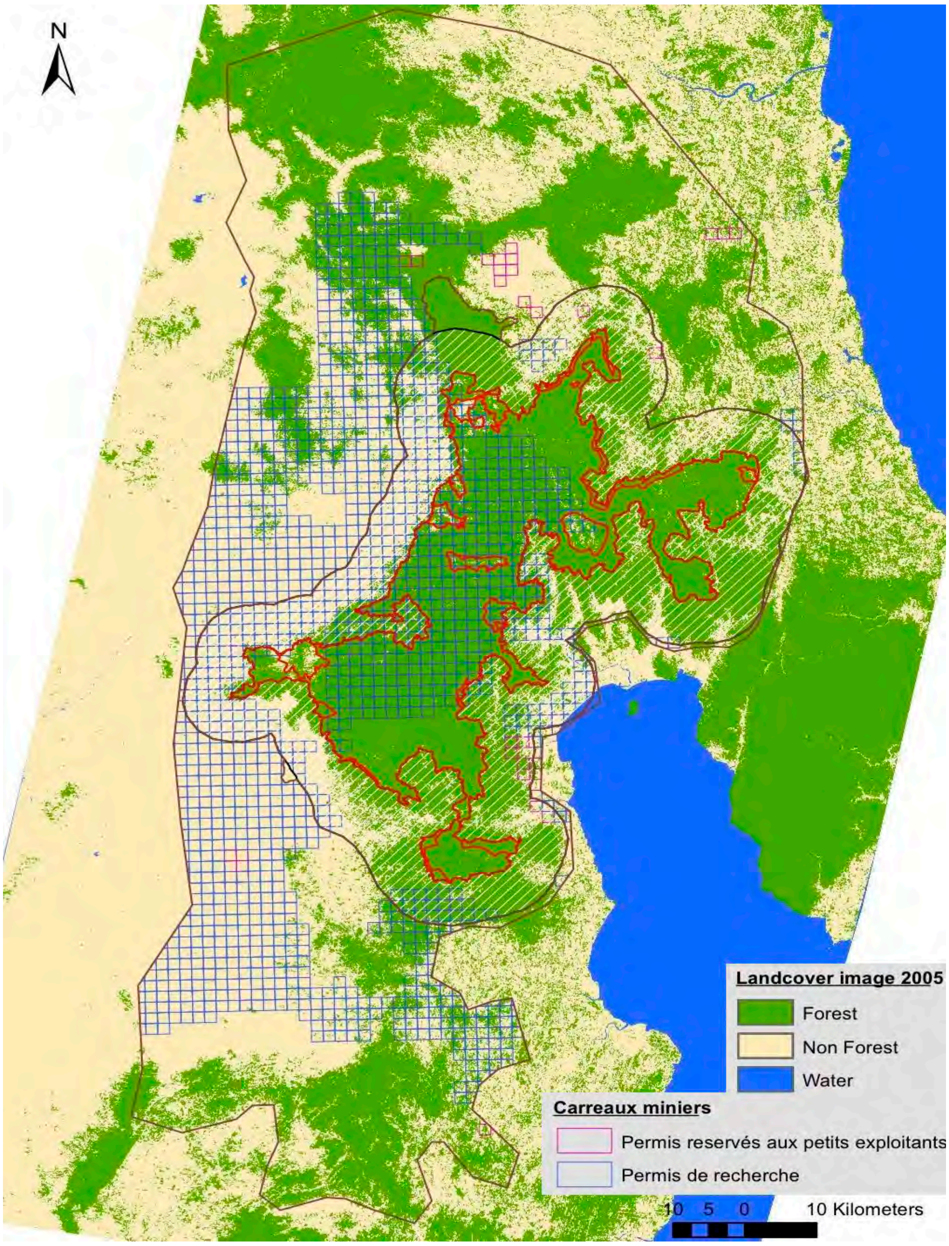
24 Randriamalala, H and Z. Liu, 2010, Rosewood of Madagascar: between democracy and conservation. Madagascar Conservation and Development 5:11-22.

25 Pers Comm. Valina Andriamaholy, National Director, Makira Natural Park.

26 Ramamonjisoa, B., D. Myers, J. Sève, m. Rajafindramanga, C. Burren, 2006. Etude sur la consommation et la production en produits forestiers ligneux à Madagascar. MEF, USAID and IRG

Regarding larger scale and more formal mining operations, figure 8 below shows the situation of existing mining permits in the Makira area in 2006. This map demonstrates that up to that date only exploration permits (“permis de recherche) have been issued to formal mining operators, with some squares being reserved for small-scale operators (“permis reserves aux petits opérateurs”). Inter-ministerial order 19560/2004 from October 2004 suspended issuance of mining and forestry permits inside zones identified as "conservation sites" and this order has been extended by ministerial orders 17914/06 from October 2006 and 18633/2008 from October 2008. Maps attached to the orders show that in all three orders the Makira are included in priority and potential zones for conservation and sustainable management where the suspension applies. Consequently no mining operations could have led to planned deforestation in the wider project area during the historic reference period (1995 to 2005, cf. paragraph (ii) on page 67) or after the project start in 2005.

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



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.

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.

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.

Table 10: Importance of deforestation drivers in the Makira forests

Driver of Deforestation	Agents of deforestation	Contribution to deforestation
Slash and Burnt cultivation (T*avy*)	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

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.

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):

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. As mentioned above, the most recent VCS additionality[27] 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 sections provide a list of pre-project and other land uses that constitute alternative scenarios, which could occur 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 fibres 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 degrade 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 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

[27] “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)

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[28], (Cunningham et al., 1997[29]). 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.

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.

[28] 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

[29] 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

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[30] 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.

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.

[30] 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 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.

As required by the applied additionality tool, these land use scenarios include: i) continuation of the pre-project land use (scenarios 1 to 4, 6 and 7); and ii) activity similar to the project without REDD+ (scenario 5). Scenario category iii) is not applicable because no legal requirements for protection exist and extension of existing protected areas does not seem feasible in the socio-economic context.

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
- Creation of a protected area outside REDD
- 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[31].

Although creation of a new protected area outside REDD would be in compliance with mandatory legislation and regulations, this option was not included in the baseline scenario because it cannot be considered common practice (cf. 2.8.3). Management and funding capabilities of MNP are already stretched and integration of a protected area the size of Makira into its network seems very unlikely. Also, MNP already manages two protected areas pretty close to Makira (Marojejy and Masoala), which makes the creation of a new protected area under traditional funding even more unlikely.

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

Finally, there haven't been any other concrete conservation / forest protection measures within the project area prior to the VCS AFOLU project.

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.
- 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 implementation

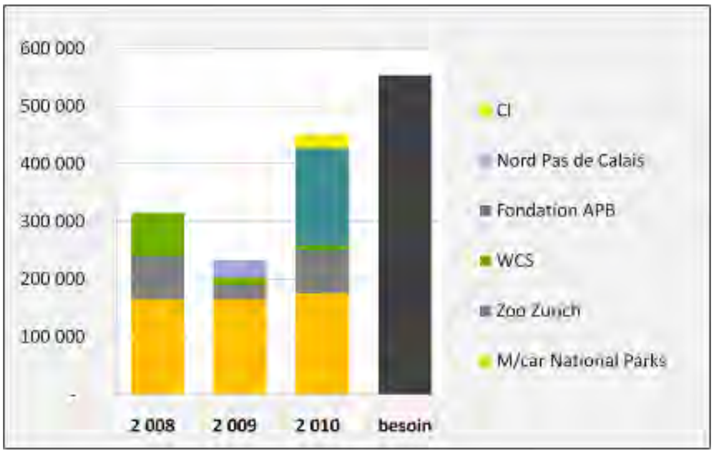
of project activities will go mostly to local communities and not to the project proponent as return on investment.

- 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:

As mentioned above, the main activities of the Makira project are the creation of the Makira protected area and implementation of alternative activities addressing deforestation drivers (cf. section 1.8). In the entire country, there is currently no other non-REDD protected area project of the same scale as Makira. The only one that could be considered common practice is Masoala National Park, the largest National Park in Madagascar with a total area of 230,000 ha (compared to 372,470 ha for Makira). It is located geographically in the same landscape and was created in a similar socio-economic and regulatory environment as the one the Makira project is currently evolving in. Masoala National park was created less than 10 years before the start date of the Makira project and to date does not include any REDD related activities. It also has to be noted that some activities to reduce deforestation and forest degradation similar to the ones proposed by the Makira REDD project (e.g. support to local communities) have been implemented in and around the current the project area since 2001 and thus before the start of the Makira project. After the signature of the first management delegation contract with the Ministry of environment and Forest in 2003, WCS as delegated manager also implemented control and patrol activities, mainly with its own funding.

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



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

In difference with Makira, the Masoala National Park was created in 1997 mainly with funding from the first instalment of the National Environmental Program. Under EPII and later EPIII, the creation of protected areas was no longer funded and replaced by support to the sustainable management of protected areas by the Ministry and MNP. However, even under these circumstances Masoala National Park is still suffering from a lack of funding and it can be concluded that without the prospect for additional funding from REDD creation of a new protected area it would not have been possible. Regarding activities funded by the Makira project before the project start date it is important to note that the Makira project was initiated with a long-term sustainable financing objective, and specifically as a pilot carbon project in Madagascar. It can certainly be argued that WCS as promoter would not have been able to raise funding for these initial activities without the long term prospect of carbon funding from emissions reductions contributing substantially to management of the protected area.

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 $3-10 million annually. Consequently, Masoala National Park is still currently suffering from a lack of funding, which is an additional indication that creation of a new protected area the size of Makira would not be possible without additional revenues from carbon financing. The annual revenues from tourism of about US$ 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 (cf. figure 9).

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

Carbon stocks:

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

Table 11: 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 fossil 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

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 11).

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. Table 12 below shows the areas and table 13 provides an overview of landscape and infrastructure factors for the project boundaries discussed in detail below.

Table 12: Main zones and areas of the Makira project

Zone	**Total area [ha]**	**Forest [ha]**	**Non forest** (savannah, agricul-ture, villages, etc.) **[ha]**	**Forest cover**
Project area (2005) (forests in protected area incl. 5 ZOC and 15 ZUC)	**360,060**	**360,060**	**0**	100%
Leakage Belt (2005) (10-km buffer around PA, including management transfers)	**606,847**	**341,469**	**265,378**	56%
RRD (1995)	**681,225**	**681,225**	**0**	100%
RRL (1995)	**979,340**	**712,192**	**267,148**	73%

Table 13: Comparison of landscape and infrastructure factors for different project boundaries

Zone	Project Area	Leakage Belt	RRD	RRL
Land Cover Types				
Low altitude forest (0-800 m)	35%	67%	44%	51%
Mid-altitude forest (800-1,800 m)	65%	33%	49%	49%
High altitude forest (> 1,800 m)	0%	0%	7%	0%
Altitude classes				
0 – 500 m	7%	37%	14%	26%
500 – 1,000 m	68%	56%	47%	60%
1,000 – 1,500 m	25%	6%	23%	14%
> 1,500 m	0%	1%	16%	0%
Soil Types				
Ferralithic soils	90%	79%	81%	84%
Hydromorph and alluvial soils	1%	8%	5%	5%
Ferrugineus and poorly dev. soils	8%	13%	14%	11%
Slope Classes				
Gentle slopes (< 15%)	80%	74%	61%	76%
Steep slopes (> 15%)	20%	26%	39%	24%
Road Density				
Length of roads per area [km/km^2]	0.0615	0.1924	0.1361	0.1312
Settlement Density				
Nb. of settlement per area [n/km^2]	0.0294	0.0282	0.0267	-

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

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 protection zone managed by local communities at the beginning of the project (cf. figure 10). The total area of the Makira project area at the start of the project period is 360,060 hectares (cf. Table 12).

In accordance with the VCS AFOLU requirements, the project area did not include any forests of less than 10 years of age at project start (cf. “Makira v3 - Crosstabs” file):

- Forest 1995 - Forest 2005: 360,060 ha
- Forest 1995 – Non-forest 2005: 1,547 ha
- *Non-forest 1995 – Forest 2005: 0 ha*
- Non-forest 1995 – Non-forest 2005:10,863 ha
- **Total: 372,470 ha**

This demonstrates that the PA is constituted only by forests that were already forested in 1995 and therefore contains no secondary forests of less than 10 years of age.

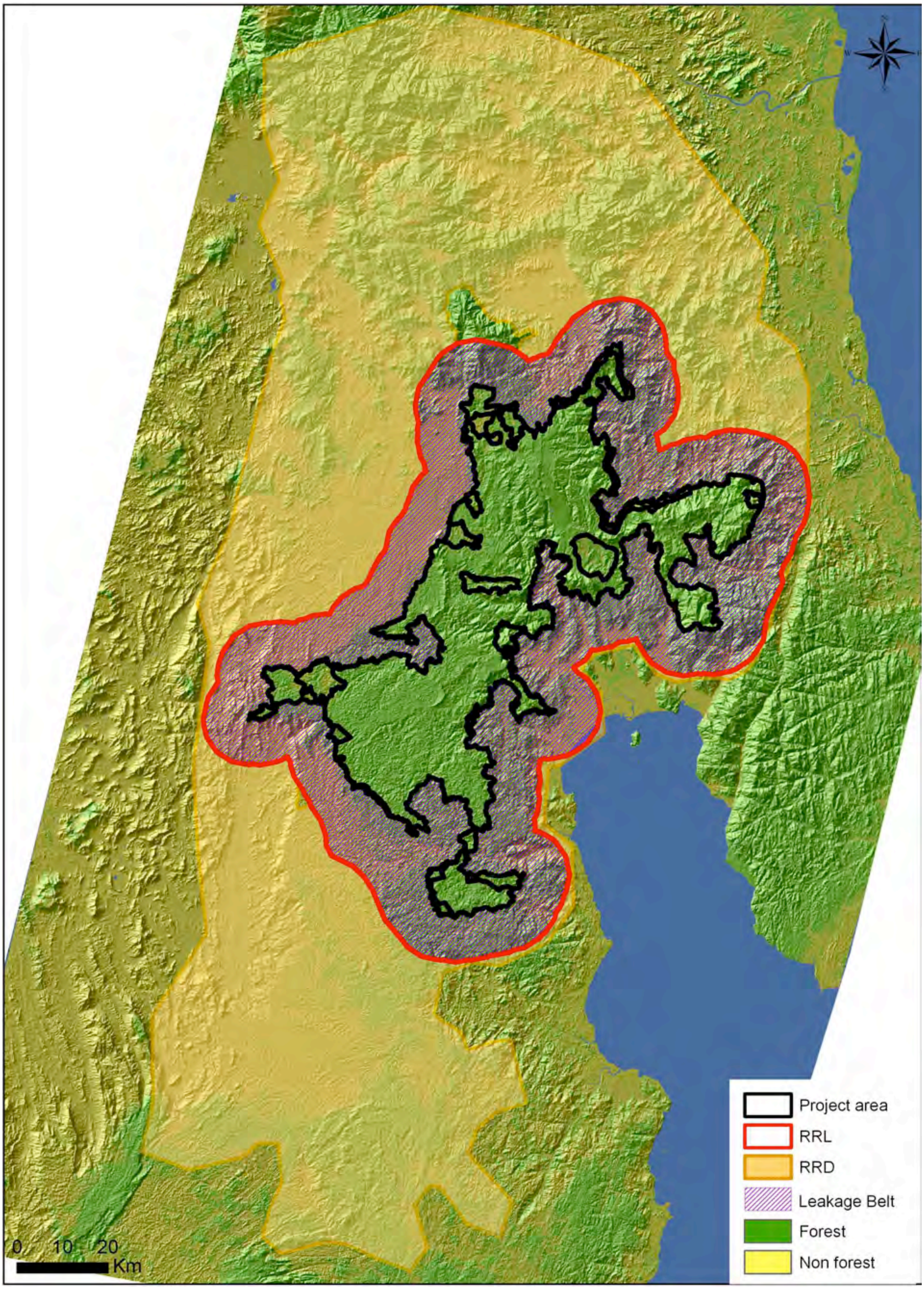
(ii) **Leakage Belt (LB):**

Activities that deforestation agents would implement inside the project area in absence of the REDD project activity could be displaced outside the project boundary as a consequence of implementation of REDD project activities. In order to take into account these displaced emissions in the estimations of 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 in principle made up of the community management areas surrounding the Makira protected area (cf. figures 10 and 12). However, as these management transfers are based on traditional land use ranges and political boundaries, the maximum distance fro the boundary of the project area is very variable and does not include all forests to which activities conducted in the project area by deforestation agents could potentially be displaced. Consequently, we chose a 10-km buffer around the project area as the leakage belt, this distance corresponding roughly with the maximum distance of forests transferred to communities from the project area. In that configuration the leakage belt has a total area of 606,847 ha, of which 341,469 ha (56%) were forests at project start, and covers the great majority of forests outside the project area. The leakage belt complies as follows with the criteria outlined in the BL-UP module of the applied methodology:

- As the leakage belt is composed by the community managed zones adjacent to the project area, its forests are the forests closest to the project area.
- Delimitation of the community forest management zones constituting the majority of the leakage belt was based on ongoing activities and accessibility of forests to local communities. Forests within the proposed leakage belt can therefore be considered accessible and reachable by baseline deforestation agents.

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

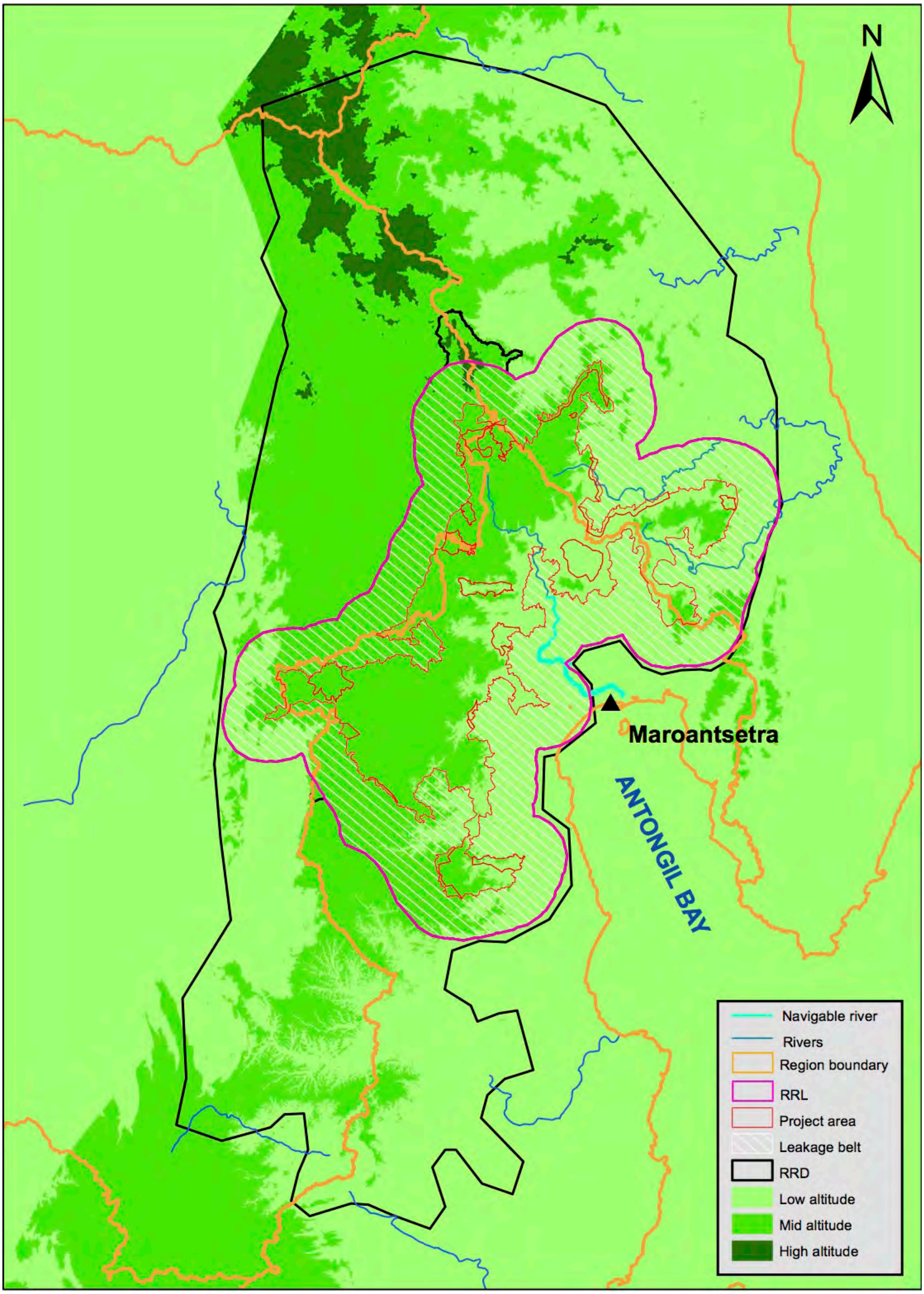


- The use of a 10-km buffer around the project area prevented spatial bias in terms of distance of edge of belt from edge of project area. It has to be noted that in this configuration only very few forest lands suitable for conversion to agricultural lands remain outside the leakage belt. In general, forests in the leakage belt are also forests managed by local communities. The only exception from this rule is the extreme south of the leakage belt, where due to topographic characteristics (valley bottom close to the boundary of the protected area) the areas transferred to local communities are relatively narrow (cf. figure 12).
- Although the management transfer process started only shortly before the project period and currently only 46 community forests out of the 80 surrounding the project area have been transferred, it seems quite unlikely that some of the areas inside the leakage belt will finally not be transferred to local communities. The management transfer process started with an information and communication phase, held during the initial delimitation consultations in 2004 and 2005. During these sessions, all communities located in the leakage belt have expressed their interest in taking management responsibilities for their forests. It was however not possible to launch the transfer process in all concerned communities because this overstretched the available means and personnel of the project promoter. As WCS has already secured funds from various sources to finalize the remaining management transfers, it is expected that all transfers will become effective over the next few years.

Table 14: Comparision of landscape and infrastructure factors for project area and leakage belt

Zone	Project Area	Leakage Belt	Diff. PA to LB
Land Cover Types			
Low altitude forest (0-800 m)	35%	67%	-48%
Mid-altitude forest (800-1,800 m)	65%	33%	+97%
High altitude forest (> 1,800 m)	0%	0%	-
Altitude classes			
0 – 500 m	7%	37%	-81%
500 – 1,000 m	68%	56%	+21%
1,000 – 1,500 m	25%	6%	+317%
> 1,500 m	0%	1%	-
Soil Types			
Ferralithic soils	90%	79%	+14%
Hydromorph and alluvial soils	1%	8%	-88%
Ferrugineus and poorly dev. soils	8%	13%	-38%
Slope Classes			
Gentle slopes (< 15%)	80%	74%	+8%
Steep slopes (> 15%)	20%	26%	-23%
Road Density			
Length of roads per area [km/km^2]	0.0615	0.1924	-68%
Settlement Density			
Nb. of settlement per area [n/km^2]	0.0294	0.0282	-17%

Figure 11: Situation of major rivers in the wider makira area and spatial relations with the different project boundaries highlighting known navigable sections



- **Landscape factors:**
  - As in the project area, the two forest types occurring in the leakage belt are tropical humid low-land (0 – 800 m) and mid-altitude (800-1,800 m) forests, and a small fraction of higher altitude forests in the extreme North. There are some differences in the proportion between these two forest types (cf. table 14), which are explained by the differences in altitude mentioned below. Consequently, the leakage belt contains considerably more low-altitude forests than the project area (37% compared to only 7% in the project area), localized essentially to the East and the South-east of the project area. Differences in proportions are above the maximum threshold of the applied methodology, but due to the situation of the Makira protected area mentioned above, exclusion of low altitude forests in order to respect the threshold would have led to a very narrow leakage belt in the East and the South.
  - The great majority of soils in the leakage belt are ferralithic soils. Other soil types are ferruguineus soils, lithosols and other poorly developed soils. Table 14 shows that there is no significant difference in soils between the leakage belt and the project area.
  - Due to the fact that the Makira project area is oriented along a mountain ridge and the leakage belt is surrounding this ridge, altitude classes of the leakage belt are naturally lower than in the project area. This leads to a considerably higher proportion of low altitude areas in the leakage belt (37%) than in the project area (7%) as presented in table 14. As mentioned above, we chose to accept this difference because correcting it would have led to an unacceptably narrow leakage belt to the East and the South of the project area.
  - The ratio of slope classes gentle (< 15%) to steep (≥ 15%) is lower in the leakage belt (2.75) than in the project area (4) as shown in table 14. With about 30%, the difference between the two ratios is slightly above the maximum threshold allowed by the applied methodology, but this can be considered conservative and a certain compensation for the lower situation of the leakage belt and would in any case be very difficult to correct.
- **Transportation factors:**
  - As detailed in the RRD section below, there are no navigable rivers in the project area. As the leakage belt is generally located at lower altitudes and also has a slightly less pronounced relief, especially in the East of the project area, lwer sections of the Antainambalana river are navigable. This navigable section is however relatively short and consequently the difference can be considered non-significant (cf. figure 11).
  - Road density in the selected leakage belt (0.1924 km/km^2) is much higher than the projected density of roads in the project area including a 1-km buffer around it (0.0615 km/km^2) as shown in table 14. It has however to be noted that road density has been included as a deforestation factor in the deforestation process and this will lead to deforestation areas being attributed proportionally to road density. Dissimilarities between road density in the PA and in the LB will therefore be compensated in the

deforestation modelling process. In other words, although forests in the PA and in the LB are of similar size, much more deforestation will be located in the LB than in the PA and lower road density in the PA can thus be considered conservative. This is confirmed by the spatial deforestation projections presented below with about 200,000 ha projected deforestation in the LB and only 100,000 ha projected deforestation in the PA.

  - As presented in table 14, the settlement density in non-forested areas within a 1-km buffer around the forests constituting the project area (0.0294 n/km^2) is similar to the density of settlements in non-forest areas within a 1-km buffer around forests in the leakage belt (0.0282 n/km^2).

- It has already been demonstrated that policies and regulations having an impact on land use change patterns are similar throughout the wider Makira area. Most notably, the Makira protected area was created in 2005 after the project start and although the leakage belt does in fact include small areas of forests the Masoala and Anjanaharibe-Sud Sud protected areas, it has to be considered that these areas are quite remote and therefore protection status seems to be difficult to enforce (cf. figure 12). Unlike the project area some management transfer contracts have been signed in the leakage belt during the historic reference period. However, signaturess occurred onls some months befor project start.
- Except the ethnic composition of the local populations mentioned already under section G1.5 there are no particular social factors having an impact on land use change patterns in the project area and in the leakage belt.
- With a total area of 341,469 ha, forests within the leakage area represent roughly 95% of the project area and 56% of the total area of the leakage belt and therefore fulfils the area requirements mentioned in the applied methodology.

(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 10. 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 (1995) 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 681,225 ha and was entirely forested at the start of the historical reference period in 1995. It therefore complies with the minimum size requirements for the RRD (cf. section 2.3.1.1 of the VCS project description).
- **Deforestation agents:**
  - As shown above, the main agents of deforestation in the Makira area 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 socio-economic 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 are similar to those expected to cause deforestation in the project area. It is therefore very likely that the proportion of agriculturalists versus ranchers in the RRD was similar in 1995 to the one that occurred in the project area in 2005 at the start of the baseline period.
  - For the same reasons, the proportion of agents resident in the area versus immigrants seems to have been similar in the RRD in 1996 and in the project area at project start.
  - Despite some efforts towards decentralisation, in Madagascar rights to use forest resources are based on laws and regulations defined at national level. Resources use rights can be granted to local communities through management transfer contracts, but these contracts cannot include plans to clear forested lands. In any case, to our knowledge there were no management transfers in the RRD at the beginning of the historic reference period as would be the case in the project area without the intervention of the Makira project. On the other hand, management transfers cannot be initiated inside a protected area meaning that there were no management transfers inside the project area at the beginning of the project period. As the Makira protected area achieved protection status only at project start in December 2005, access rights can be considered similar in the RRD in 1995 to those in the project area at project start.
- **Landscape factors:**
  - Forest types in the humid parts of Madagascar are defined mainly by altitude and thus the two main types of forest in the project area are tropical humid low altitude (0 – 800 m) and mid-altitude (800 – 1,800 m) forests. As shown in table 15, the proportion of low altitude forests is slightly higher in the RRD than in the project area (44% and 35% respectively), while the opposite is the case for mid-altitude forests (49% and 65%). The RRD contains in addition 7% of high altitude forests, occurring above 1,800 m and thus not represented in the project area. While the differences are slightly above the 20% threshold accepted by the applied methodology, it has to be noted that slash and burn agriculture in Madagascar does usually not occur above 1,500 m and therefore a higher proportion of high altitude forests in the RRD than in the project area can in fact be considered conservative.

- Only very limited information is available on the different soil types in the wider Makira area and their suitability for agriculture, but it is clear that the great majority of soils are ferralithic soils. Other soil types are ferrugineus soils, lithosols and other poorly developed soils. Table 15 shows that soil proportions in RRD and project area are similar.
- With 1.56, the ratio of "gentle" (<15%) to "steep" (≥15%) slopes in the RRD is considerably lower than the ratio of 4 encountered in the project area (cf. table 15), the difference lying clearly above the maximum threshold of the applied methodology. However, as steep slopes are less attractive for conversion of forests to agricultural lands, this also means that there are less slopes suitable for deforestation in the RRD than in the project area and can thus be considered conservative.
- As the Makira forests are part of a forest corridor lying in South-North direction and gaining in altitude towards the North, it seems obvious that there are quite significant differences in the proportions of height classes between the RRD and the project area. Although the RRD was deliberately placed more to the North than to the South of the project area, low altitudes between 0 an 500 m are better represented in the RRD, while the opposite is the case for altitudes between 500 and 1,500 m. Altitudes above 1,500 m can only be found in the RRL and as for forest types it can again be argued that this over-representation of higher altitude classes in the RRD will in fact lead to lower deforestation rates and can thus be considered conservative.

Table 15: Comparision of landscape and infrastructure factors for Project Area and RRD

Zone	Project Area	RRD	Diff. PA to RRD
Land Cover Types			
Low altitude forest (0-800 m)	35%	44%	-20%
Mid-altitude forest (800-1,800 m)	65%	49%	+33%
High altitude forest (> 1,800 m)	0%	7%	-
Altitude classes			
0 – 500 m	7%	14%	-50%
500 – 1,000 m	68%	47%	+45%
1,000 – 1,500 m	25%	23%	+9%
> 1,500 m	0%	16%	-
Soil Types			
Ferralithic soils	90%	81%	+11%
Hydromorph and alluvial soils	1%	5%	-80%
Ferrugineus and poorly dev. soils	8%	14%	-43%
Slope Classes			
Gentle slopes (< 15%)	80%	61%	+31%
Steep slopes (> 15%)	20%	39%	-49%
Road Density			
Length of roads per area [km/km^2]	0.0615	0.1361	-55%
Settlement Density			
Nb. of settlement per area [n/km^2]	0.0294	0.0267	+10%

- **Transportation and infrastructure factors:**
    - As shown in figure 11, there are no navigable rivers in the project area due to the relatively pronounced relief and altitude. Only the lower sections close to the sea (and inside the leakage belt) of the Antainambalana River are known to be navigable. As comparable rivers in the RRD shown in figure 11 are farer away from the sea and the RRD also has a higher proportion of steep slopes (cf table 15), it is very unlikely that these rivers are navigable.
    - It is quite difficult to assess the road density in the Makira area, mainly because the available FTM (National Topographic Institute) map data (digitized as BD500, BD200 and BD100) is quite old and was not updated very frequently. For the project area we have additional data on footpaths from field visits and analysis of satellite imagery and aerial photos, but as we did not have similar data for the RRD we only used data from the 1:200,000 scale national topographic maps (BD200) available for both areas. Based on these assumptions, road density in the RRD (0.1361 km/km^2) appears to be considerably higher than the density in the project area including a 1 km buffer around it (0.0615 km/km^2) as shown in table 15. As higher road density is thought to increase deforestation, this could lead to an overestimation of annual areas of unplanned deforestation in the PA. It can however be expected that this will be compensated by the lower slope ratio in the RRD.
    - Regarding settlements we faced similar data availability issues as the ones mentioned for data on roads mentioned above. We used the same approach and data from “BD200”and the analysis in table 15 shows that the density of human settlements in a 1-km buffer around the forests constituting the project area (0.0294 n/km^2) appears to be similar to the density of settlements in a 1-km buffer around the forests constituting the RRD (0.0267 n/km^2).
- Social factors having an impact on land-use change patterns are similar within the RRD and the project area. Most notably, the ethnic composition of local populations around the RRD is very similar to the ones around the project area. This observation is again based on the fact that the selected RRD presents the same east-west and north south gradients as the project area.
- **Policies and regulations** having an impact on land use change patterns are in Madagascar defined at the national level and the regions have only very limited authority in this domain. Most importantly, protected areas are created by ministerial orders at the central level and forest management transfers have to be authorised by the central forest administration before contracts can be signed. All forests in protected areas are excluded from the RRD as Makira reached temporary protection only in December 2005 and was not a protected area during the historic reference period (1995 to 2005) period. Also, to our knowledge no management transfers existed in the RRD prior to project start and section 1.8 demonstrates that this was also the case in the project area. Finally, the level of enforcement of policies and regulations is also expected to be similar as there is no significant difference in financial and

human means of the different administrations in the three Regions relevant for the Makira project. Policies and regulations influencing deforestation are thus considered to be similar in the PA and the RRD.

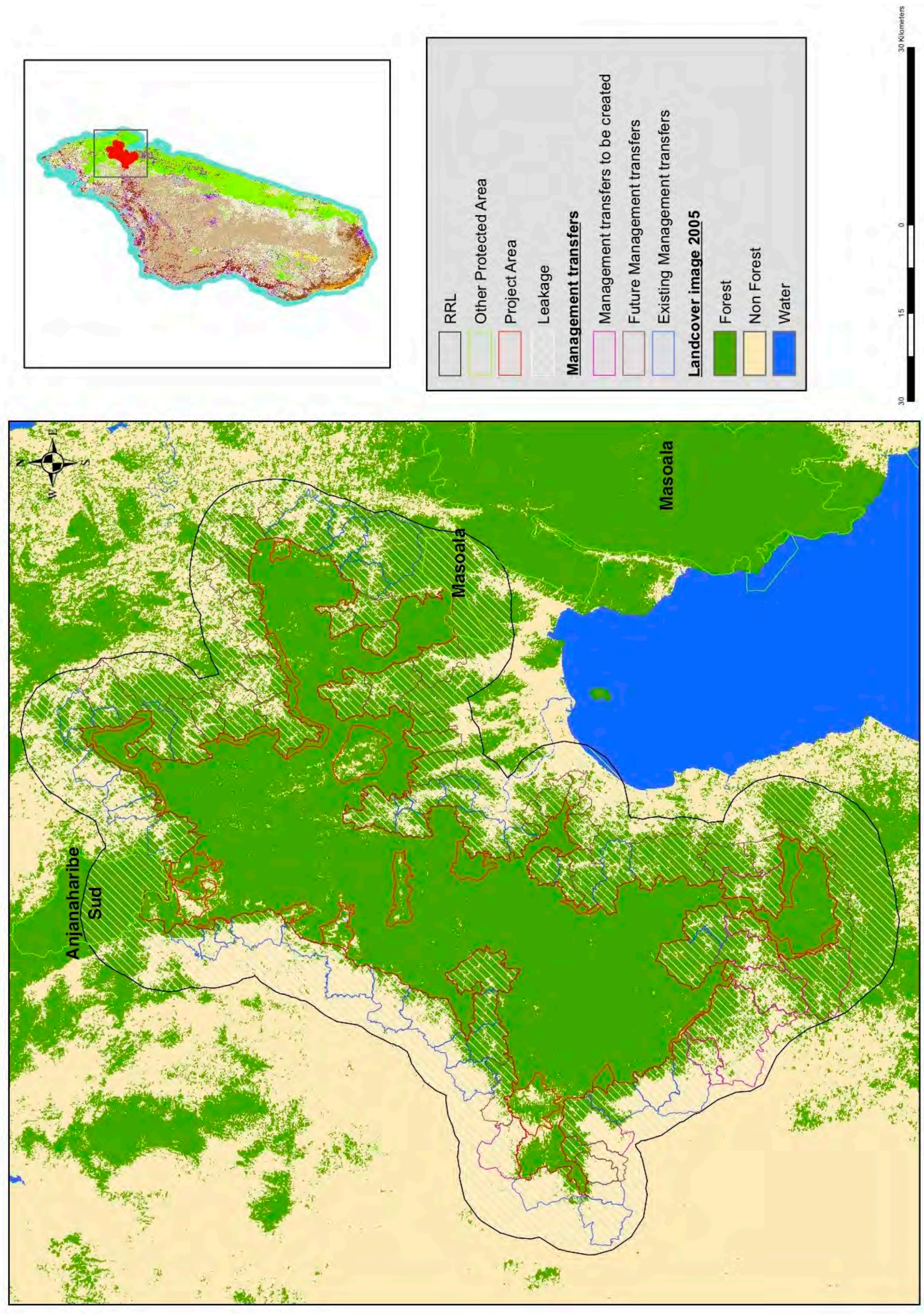
- No areas of planned deforestation are included in the reference area for deforestation. Following the BL-UP module of the applied methodology, this would include deforestation due to large-scale commercial agriculture, infrastructure and mining projects. It has already been demonstrated in section 1.10.3 that commercial agriculture does exist in the Makira but does not lead to significant deforestation and also that only prospecting permits existed in the RRD prior to project start and therefore no planned deforestation from mining could have occurred during the historic reference period.

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

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. figures 10 and 12). This reference area for projecting location of deforestation fulfils the following requirements imposed by the applied methodology:

- The RRL is a single parcel contiguous with and including the entire project area as well as the leakage belt.
- With a total area of 712,192 ha at the start of the historic reference period, the forested area inside the RRL is about 8% bigger than the reference area for projecting deforestation. This difference is below the 25% maximum threshold mentioned by the applied methodology.
- At the start of the historic reference period, as well as at the start of the project period, the chosen RRL included more than 5% non-forested areas and also more than 50% forests.
- Considering that areas suitable for deforestation are forest lands between 0 and 1,000 m altitude (86% in the RRL against 75% in the PA) on gentle slopes (76% in the RRL against 80% in the PA), the RRL contained at the start of the historic reference period similar proportions of forests suitable for conversion to the land-use practices of the deforestation agents as the project area at the start of the project period.
- As the RRL has to include the leakage belt it does also include small areas of forests the Masoala and Anjanaharibe-Sud protected area. As these areas are quite remote protection status seems to be difficult to enforce and we kept these forests in the RRL. However, these areas have been treated in a particular way during deforestation modelling in order to take management status into account.
- To our knowledge, the RRL does not overlap with project or reference areas of other carbon related projects.

Figure 12: Situation of the RRL and its two main components project rea and leakage belt highlighting protected areas and some transportation aspects.



(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. 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.

(vi) Deviations from criteria of the used VCS methodology:

Due to the particular situation of the Makira protected area as central element of a forest corridor situated on a North-South oriented ridge, several of the criteria set by the BL-UP module of the applied methodology to delimitate RRD, RRL and leakage belt in relation to the project area could not be respected. The most important factor was the increase of altitude from the South to the North (and less pronounced from East to West), which resulted in discrepancies of altitude classes, mainly between the project area and the RRD and the leakage belt. As forest types in Madagascar are defined mostly through altitude, this also impacted on the proportions of forest types within the spatial boundaries.

Although the methodology allows for relaxation of the criteria under certain circumstances, this was prevented by the somewhat complex size relationships between the four spatial boundaries and the important size of the Makira project area. As the RRL has to include the project area as well as the leakage belt and be similar in size to the RRD the RRD needed to be twice as large as the project area, an area of forest that was not easy to find outside existing protected areas in North-eastern Madagascar.

Regarding differences between the project area and the RRD it seemed appropriate to analyse their influence on estimated areas of unplanned deforestation, as this is the main parameter that is estimated in the RRD based on historic deforestation. In most cases it appeared that the observed differences would in fact lead to a lower baseline deforestation rate in the RRD than in the project area and could thus be considered conservative. The only exception is the higher road density in the RRD that could lead to an over estimation of deforestation rates in the baseline. This was nevertheless considered acceptable, as it seemed to be compensated by differences leading to more conservative baseline estimates, but also by the relatively conservative deforestation regression presented below.

In a frontier deforestation configuration, as is the case for the Makira project, differences in altitude, accessibility and vegetation types between the project area and the leakage belt seem to be quite normal as the leakage belt has to include areas immediately surrounding the project area. It has also to be noted that spatially explicit deforestation modelling has been used in order to determine annual areas of unplanned baseline deforestation in the project area and in the leakage belt. As the modelling process integrated some of the accessibility and physical parameters mentioned above, differences in the proportions of these parameters for the project area and the leakage belt were not considered to be an essential issue in determining annual areas of unplanned baseline deforestation.

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 ten years, starting in February 1995 and ending in April 2005.

(ii) **Project start date:**

Under the VCS, the project start date for an AFOLU project is "the date on which activities that lead to the generation of GHG emission reductions or removals are implemented" (VCS AFOLU Requirements 3.2.1). In the case of the Makira project the following activites, agreements and interventions have to be considered (cf. figure 13 and detailed project timeline in appendix XVII):

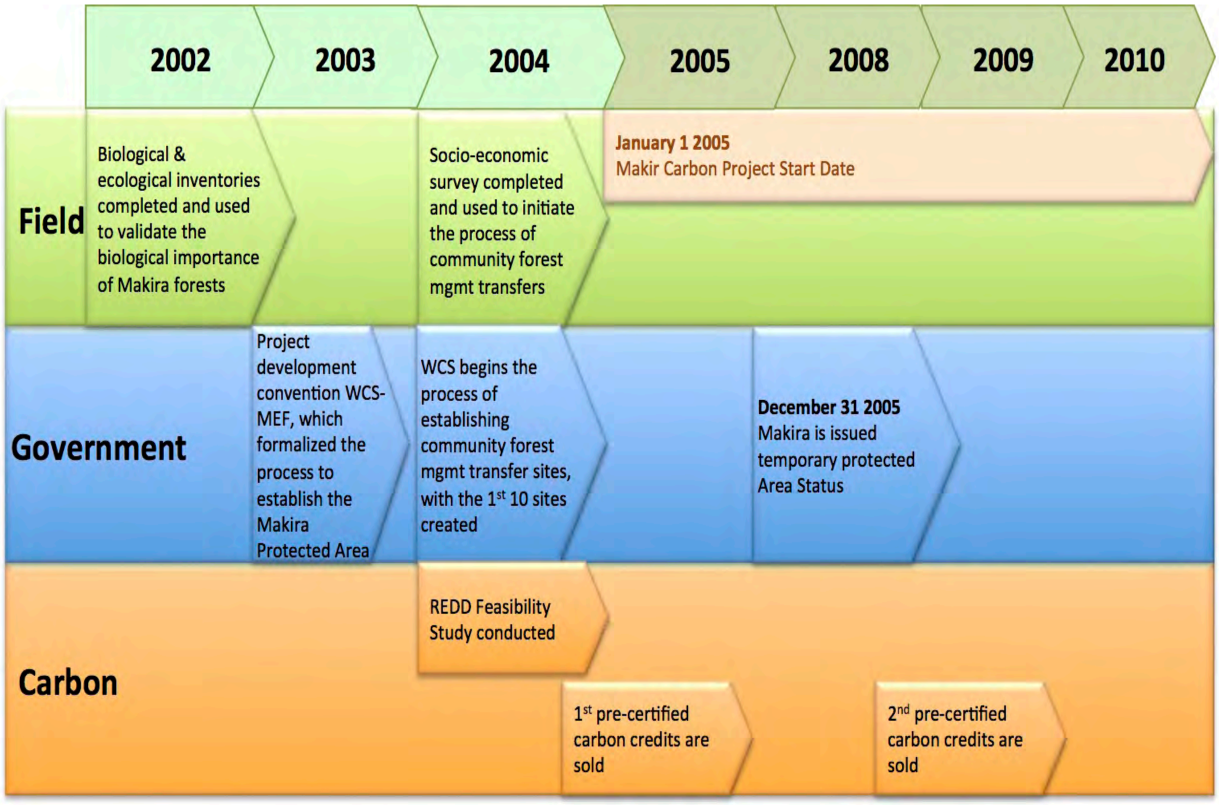
- In 2001, the Madagascar Ministry of Water and Forests (MEF), in collaboration with the Wildlife Conservation Society (WCS), launched a program to create the Makira Forest Protected Area and to finance its management, at least partially, through carbon markets.
- Detailed biological and ecological inventories and surveys have been conducted in the Makira forests starting in late 2002. Detailed results from these studies and inventories are presented in the biodiversity sections of the present project description (cf. section G 1.7).
- In 2003 a convention was signed between WCS and the MEF recognizing WCS as implementing organisation of the Makira conservation site project. This gave WCS responsibility for setting up the first project management structures in the Makira area (cf. section G 3.2) and consequently lead to a substantially increase of its presence in the area in order to ensure management of the project, conduction of further ecological and socio-economic field studies and support local communities in developing management transfers, co-management structures for the future Makira protected area and rural development and alternative revenue activities. This progressively extended field presence of WCS, including animators living in the villages inside the future protected area (Controlled occupation zones ZOC) and its protection zone, certainly had a positive effect on forest conservation in the area.
- In 2004 WCS launched socio-economic studies and consultations with local communities on the creation of management transfers in the planned protection zone of the future Makira protected area. The first two transfer contracts for the Andapa zone were signed between communities and MEF in November and the first eight contracts in the Maroantsetra zone in December 2004 (cf. appendix XIIX) and in parallel WCS supported local communities in strengthening their capacities regarding sustainable management and monitoring of natural resources and developing co-management structures for the future protected area (cf. section G 3.2). As described in more detail in the sections below, management transfer contracts include management plans and dina, containing rules and procedures (control, monitoring, etc.) regarding conservation and sustainable use of forest resources and the signature of the

management transfer contracts between local communities and the state (represented by the regional forest service) can therefore be considered as start of the implementation of forest protection activities leading to first emission reductions in the future protected area and its protection zone.

- At the end of 2004 WCS, in close collaboration with Winrock, completed a feasibility study for a REDD project in the Makira forests which provided a first estimation of the GHG reduction potential of the project. This provided a first basis for the pre-sales of emission reduction credits described below.
- The above-mentioned feasibility study lead to the sale of about 50,000t of pre-certified emission reductions in December 2004 through the Conservation International Centre for Environmental Leadership (CI CELB). The proceeds from this sale contributed to the further development of the Makira project as set forth in an agreement between the MEF and Conservation International (cf. paragraph (iii) below).
- In early 2005 consultations with local communities on the delimitation and final creation of the Makira protected area started and lead to the temporary creation in December 2005 (cf. appendix VII).
- Management transfers are not possible inside the future protected area, but WCS started in early 2005 working with populations living inside the Makira on delimitating and developing management plans for the future zones of controlled occupation (ZOC) and zones of controlled use (ZUC). Rules and procedures contained in these management plans are similar to the ones mentioned above for the management transfers. Although these plans are not formalized by a contract between the forest administration and the local communities they have been formalized locally in 2006 and can be expected to have a similar effect on conservation of forest resources as the transfers and can therefore also be considered having triggered further emission reductions in the future project area.
- In early 2005 consultations with local communities on the delimitation and final creation of the Makira protected area started (cf. section G 3.2). They were based on the ecological and socio-economic studies conducted earlier and lead ultimately to the temporary creation by ministerial decree in December 2005 (cf.appendix VII).
- A second pre-sale of about 100,000 t of pre-certified emission reductions was conducted in June 2008 again through the Conservation International Centre for Environmental Leadership (CI CELB). The proceeds from this sale contributed to the further development of the Makira project as set forth in a second agreement between the MEF and Conservation International (cf. paragrapg (iii) below).
- On June 19 2012, the Government validated the definitve creation of the Makira protected area and this decision has been communicated on the web. The decree is currently being signed by the different concerned Ministries and will be published in the officiel journal once this process is completed (cf. http://www.newsmada.com/communique-conseil-de-gouvernement-du-19-juin-2012-mahazoarivo/).

The main activities leading to emissions reductions and/or removals are the creation of the new Makira Protected area prohibiting deforestation and forest degradation in the project area, the setting up of efficient management structures including local communities and the implementation of control and monitoring mechanisms (cf. section G 3.2). Figure 2 below (cf. details in appendix XVII) shows that although the Makira protected area was created temporarily only in December 2005 (cf. appendix VII), consultations with local communites on delimitation and co-management of the new protected area and preparation of the management transfers started as early as 2004 and resulted in the creation of the first ten management transfers in the protection zone in late 2004. It was also in December 2004 that the first carbon-financing programme (December 2004 to March 2006) based on pre-certified emission reduction credits was signed with Conservation international and the Government of Madagascar (cf. paragraph (iii) below).

Figure 13: Makira Project timeline (cf. detailed table in annex 12)



Activities and investments occurring before January 2005 in and around the project area have been focused on analysing the general ecological and socio-economic conditions in the area as well as the potential for reducing emissions from deforestation and forest degradation and are therefore not considered having directly triggered emission reductions and/or removals in the project area of the Makira project.

It is thus considered that the implementation of the Makira protection plans in the sense of the VCS AFOLU requirements mentioned above became effective in early 2005 and consequently January 1st 2005 has been selected as the project start date.

(iii) **Project crediting period:**

The VCS project crediting period for the Makira project will be of thirty years, stretching from January 1st 2005 to December 31st 2034. A detailed financial plan for managing the Makira project over the entire project period can be found in appendix XIV. Projections for expenses in this plan are based on the Makira management plan developed by WCS and approved by MEF in 2010, while expected revenues are based on current negotiations with potential buyers and experience from previous sales.

It has to be noted that 154,329 tCO_2-e of emission reductions from the Makira Project were sold upfront to help financing the establishment of the project. Contract for a first support phase, based on the sale of about 40'000 tCO_2-e of emission reductions generated by the Makira project and panned to last 15 months, was signed in December 2004 between CI and the Government. A second contract on about 100,000 tCO_2-e was signed in 2008 and is currently still ongoing. These sales were carried out by the Conservation International Centre 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, 154,329 VCUs, the number equivalent to the total tCO_2-e of emission reductions already sold from the project will be deducted from the total VCUs generated by the Makira Project. The details of the WCS Makira Project 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.

(iv) **Review of Project baseline:**

In accordance with VCS standards and the applied methodology, the project baseline will be revisited every 10 years (2015 and 2025). A baseline revision can also 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.

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:

Initially, analysis of historical deforestation for the Makira project was based on data from a national study on the evolution of the natural forest cover of Madagascar between 1990 and 2005 published in 2009[32]. Although the time period of this study was 1990-2000-2005, this was possible because the earliest data used for the Makira area was in fact from 1996 and did therefore apply to the requirements of the applied methodology. As the 2-ha filter applied to the analysed data by the national study did not correspond to the national forest definition (minimum area 1 ha) we used the analysed raw data and applied a 1-ha filter to correct.

Table 16: 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	21 nov. 1994	158	070
					29 mar. 1995*		
					22 aug. 1996		
Landsat-5	Thematic Mapper	28.5m	6 channel visible and near-infrared	8,300	21 nov. 1994	158	071
					08 jan. 1995*		
					24 jan. 1995		
					22 aug. 1996**		
Landsat-5	TM	28.5m	6 channel visible and near-infrared	8,300	05 may 2000*	158	070
Landsat-7	ETM+				04 oct. 2000		
Landsat-5	TM				28 oct. 2000**		
Landsat-5	TM	28.5m	6 ch. visible and near-infr.	8,300	22 mar. 2000*	158	071
Landsat-7	ETM+				15 oct. 2001**		
Landsat-7	ETM+	28.5m	6 channel visible and near-infrared	8,300	16 may 2004	158	070
					01 jun. 2004		
					17 apr. 2005*		
Landsat-7	ETM+	28.5m	6 channel visible and near-infrared	8,300	16 may 2004	158	071
					12 feb 2005		
Landsat-5	TM				08 mar 2005*		
Landsat-7	ETM+	28.5m	6 channel visible and near-infrared	8,300	01 may 2010	158	070
Landsat-5	TM				09 may 2010*		
Landsat-7	ETM+				06 sep 2010		
Landsat-7	ETM+	28.5m	6 channel visible and near-infrared	8,300	01 may 2010	158	071
					06 sep 2010*		
Landsat-5	TM				17 oct 2010		

During the analysis of this data however, several problems appeared, linked mainly to the cloud coverage in the Landsat images used by the national study, but also to the insufficient analysis of the precision of the produced maps. For these reasons we decided to develop a completely new analysis

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

of historic deforestation as described in the following sections. It is important to note that the new deforestation analysis was finalized before the revision the Makira PD. RRD, RRL and LB boundaries have been updated in version 3 of the PD and their areas in the deforestation analysis report are therefore slightly different from the values in this PD. The only are that did not change is the project area areas mentioned in table 2 of the report do in fact correspond with the areas mentioned in tab "HistDef" of the "Makira v3 - Deforestation Projections" Spreadsheet. For similar reasons the maps presented in the deforestation analysis are in certain points different from the maps in the PD.

In accordance with the applied methodology medium resolution Landsat images were chosen as data source for the deforestation analysis because of their availability, quality and price. The revisit period for Landsat satellites is 18 days; but image availability is in fact quite limited due to frequent cloud cover over the Makira protected area and the whole eastern Madagascar. Data sources acquired for the analysis of historical deforestation are presented in table 16.

Different definitions of forest in the past have created confusions in comparing the amount of forest cover present in Makira. According to UNEP(1998), there are many definition in use for what is defined as forest and non-forest. In Madagascar the following definitions are commonly used:

- IEFN: The national forest inventory conducted for the first time in 1997 did not use a clear definition of forest besides the minimum area of 6 ha corresponding with the minimum mapping unit of the study due to the low resolution satellite imagery used.
- FAO: Land with tree crown cover (or equivalent stocking level) of more than 10 percent and area of more than 0.5 hectares (ha). The trees should be able to reach a minimum height of 5 meters (m) at maturity in situ. This is a very open definition that would lead to the inclusion of very open formations into the forest land cover.
- CI national deforestation study: For the national study on deforestation mentioned above, Conservation international applied a stricter definition including only closed canopy forest (80% cover), 7 meters high and 2 ha minimum area. This definition excludes many open and degraded forests as well as secondary formations.
- National Designated Authority (CDM): Stands of trees with 30% crown cover, 5 m high at maturity and at least 1 ha in area.

As in the case of the Makira project the forest definition influenced the establishment of emission baseline for the Makira project, we have chosen the national definition of forest for the Clean development Mechanism (CDM):

"Stands of trees having at least 30% crown cover, of 5 meters high and at least one hectare in area".

Deforestation is thus defined as a transition of the vegetation cover from above to below at least one of the thresholds of the forest definition (below 30% of crown cover or below 5 m overall height or below 1 hectare of total area). In accordance with the applied methodology and VCS requirements an additional criteria was introduces:

“Only forests of at least 10 years age are considered”.

In this definition, slightly degraded areas as well as pristine forest are included. Are also included area of medium degradation and few plantations and even dense agroforestry areas (plantation of cloves for instance). We have then excluded in this analysis any vegetation that is less than 5 meters high or having less than 30% of crown cover. Secondary formations of les than 10 years age have been excludes from the forest stratum even if they fulfilled all the criteria of the applied forest definition.

A priori, heights of trees are not visible in imagery, but the analysis relied on good knowledge of vegetation types, vegetation succession and field experience to decide what vegetation to include as forest. Also, high-resolution images from Google Earth were used to have a clearer view of the vegetation existing in the area. A similar process was used to ensure that secondary forests of less than 10 years age were also excluded fom the forest stratum. Also, as shown in section 2.2 conversion of forests to non-forested lands is considered to be permanent. due to the frequent use of fire in local agriculture and it is therefore very unlikely that secondary forests of less than 10 years of age exist in the Makira area.

Both Landsat-5 and Landsat-7 satellites measure reflected light in six spectral bands in the visible light as well as near and medium infrared. Through these spectral bands, closed-canopy mature forests appear different from almost all other land cover types. Image treatment and analysis consists in enhancing these differences in order to track changes in forest cover from 1995 - 2000 - 2005 and 2010. There are several possible methods used for change detection but they can be classified in two groups:

- Combine images and classify to detect cover change: this is the ideal method, and has been used successfully by Conservation International (CI) for their national forest cover change analysis. This method is however time consuming and practically impossible if more than two dates ate to be analysed, as this would create a very high number of layers or bands within the single image to be classified.
- Classify images separately and superimpose the resulting images to derive change: this is the method adopted in this analysis. It consists of classifying images separately then combining them at the end to form an image of change.

The accuracy of both methods is similar and depends a lot on the geo-registration of each individual image. That is why, the co-registration of images are of prime importance for an analysis of forest cover change, since a displacement of pixel may be interpreted as change in the cover type. Summarized below are the specific steps in the methodology:

- **Co-registration and pairing:**

  Although the acquired images were already geo-referenced, there is always misalignment between different images, ranging from 10 to 100 m, depending on the image sources (Landsat 5TM or Landsat 7 ETM+). It is then of prime importance that images be co-registered to a maximum of 1 pixel displacement. Base images used to geo-reference images were the

Landsat 7 ETM geocover images from 2000. These are ground and orbit referenced and thus the most accurate of the used images. All the other images are registered to these images.

- **Cloud removal:**

  Clouds covering parts of the satellite images can be a major source of classification error, due to their nature, sometimes semi transparent, sometimes opaque, with an array of colours. Also, cloud shadows lead to significant changes of the pixel values where they are occurring. Unfortunately, clouds are persistent over the eastern humid forests of Madagascar and Makira is among the wettest areas of the country and images of this area usually present important cloud cover and it was therefore almost impossible to find cloud free images for the required dates.

  Apart from clouds, the failure of the scan line corrector on the Landsat 7 satellite leads to additional data gaps on Landsat-7 satellite imagery, which worsened the cloud issues.

  To successfully remove clouds and data gaps from the images, we have acquired up to four images for each observation date and superimposed them over the main satellite image. This process allowed us to eliminate most of the clouds and data gaps and replacing them with true land cover values from other images. Below is a summary of the process to remove the clouds (for more detail see deforestation analysis report in appendix XVIII) :

  - Unsupervised classification of images.
  - Selecting clouds from the classified imagery.
  - Manually remove misclassification from the classified image.
  - Recode the value to 0 and 1, 1 for clouds and 0 for non-clouded areas.
  - Use the binary map as mask and create the image without clouds for one date.
  - Repeat the process for more images.
  - Superimpose all masked images, this will automatically use non clouds value for the hole.

  This process lead to a reduction of cloud cover to about ???% for all observation dates. This value is far below the 10% threshold required by the applied methodology.

- **Display set-up:**

  There are a lot of band combinations available for image analysis. In the case of the Makira forests, the most important are the green band and the red band, mainly due to the fact that vegetation absorbs red light and reflects green light. The most frequently used band combinations for vegetation analysis are 4/3/2 and 4/5/3. Both combinations show vegetated areas in red and bare area in grey. The denser an area is covered with vegetation, the deeper the reflected red is in response. For the current land cover analysis the 4/5/3 combination was the main one used as it shows more contrast on the forest. With this combination, primary old growth forests are shown in a dark red to brown colour, while deforested areas such as savoka and annual vegetation show up in a much lighter pinkish colour.

  In the 2011 version of the ERDAS IMAGINE software, it is now possible to open and to synchronize Google Earth views with the satellite images to be analysed, leading to a simultaneous view of the Landsat images with the higher resolution images used in Google

Earth. This technique was used in order to verify the correspondence between the observed colour of the Landsat scene and the real vegetation cover and thus improved the precision classification process significantly.

- **Training sites selection:**

  An initial inspection of all areas on the image has been performed. Based on differences in the spectral signature, existing ancillary data (mainly old vegetation maps), imagery in Google, and local knowledge of the processor, it proved to be rather easy to create homogeneous sites used to train the software for the classification. Training sites were created for all vegetation and land cover types encountered in the area to be analysed.

- **Classification:**

  Once training sites were selected, we performed a supervised classification using ERDAS IMAGINE 2011. Polygons were created for homogeneous areas (training sites) and signatures were imported into the signature editor module. In this process as many training sites were created as there were visible and/or evident land cover differences detected. At this stage it was important to separate each spectrally different land cover type in order to avoid misclassification. This lead to the creation of many sub-classes for each main land cover class. For example, in one of the forest classes, we might have: i) forest dark brown on western hillside; ii) forest light brown on eastern hillside; iii) forest brown degraded; iv) forest with glossy canopy, etc.

  Several algorithms currently exist for classifying satellite images based on a set of signature files, most notably:

  - Maximum Likelihood: The maximum likelihood decision rule is based on the probability that a pixel belongs to a particular class. The basic equation assumes that these probabilities are equal for all classes, and that the input bands have normal distributions.
  - Mahalanobis Distance: The Mahalanobis distance decision rule uses the covariance matrix in the equation. Variance and covariance are figured in so that clusters that are highly varied will lead to similarly varied classes, and vice versa.
  - Minimum Distance: The minimum distance decision rule (also called spectral distance) calculates the spectral distance between the measurement vector for the candidate pixel and the mean vector for each signature.

  Based on experience gained in similar studies, maximum likelihood algorithms usually produce the best results and have therefore been used for the present analysis.

  After classification we checked the classified images by superimposing each of them over the corresponding unclassified Landsat image and comparing the two by flickering the screen (alternating view of original Landsat and classified image) or setting transparency to one layer allowing us to see the classified images and the original at the same time. If errors were detected, we restarted the classification by adding new classes or replacing existing classes of signatures.

- **Mapping**

  Based on this process, the following maps have been produced for the Makira reference and project areas:

  Forest cover maps:

  Forest cover maps have been produced for all three points in time in the historical reference period: 1995, 2000 and 2005 covering the reject area and the leakage belt as well as the two reference areas (RRD and RRL) as shown in figure 14.

  Deforestation maps:

  Three different deforestation maps have been produced for the reference period: deforestation between 1995 and 2000; deforestation between 1995 and 200; and deforestation between 2000 and 2005 (cf. figure 14).

- **Map accuracy assessment**

  The accuracy assessment determines the quality of the information derived from remotely sensed data and can be either qualitative or quantitative. Qualitative assessments determine if a map "looks right" by comparing what we see in the imagery with what we see on the ground, usually in a quite subjective way. Quantitative assessments attempt to identify and measure the remote sensing-based map error. In such assessments, the developed map data is compared with reference or groundtruthing data (where groundtruthing data is assumed to be 100% correct) using the equation:

  $$\textit{Map accuracy} = \#\ \textit{of pixels classified correctly} / \textit{total}\ \#\ \textit{of classified pixels}$$

  In the case of the Makira protected area, high resolution satellite imagery from Google earth was used as groundtruthing data and compared with the produced 2010 forest cover map. Although 2010 is outside the historic reference period this was considered acceptable because the 2010 map was developed using the same procedures as the other maps for 1995, 2000 and 2005. To assess the accuracy of the produced map, a set of 250 sampling points was distributed randomly across the reference area[33] using Hawths' tool for ArcGIS. Each point was then exported to .kml format and imported into Google Earth in order to compare the result of the satellite image classification with the real land cover determined in Google Earth.

33 As mentioned above, the deforestation analysis was redone for the current version of the PDD. The RDD used for the map accuracy assessment was the one used in the previous version of the PDD.

This process allowed to estimate two types of mapping accuracy:

- The user accuracy (Pu) showing percent of classified pixel that is correct in the field/reference. It is seen from the user's perspective : "If I select any forest pixel on the classified map, what is the probability that I'll be standing in a forest stand when I visit that pixel location in the field?". It can be estimated with the following equation:

$$P_u = \frac{number\ of\ pixels\ classified\ correctly}{number\ of\ reference\ pixels} \times 100$$

- The production accuracy (Pp), which is the percent of pixels from the field that are correctly represented on the map. It is seen from the producer's perspective: "If I know that a particular area is forested what is the probability that the digital map will correctly identify that pixel as forest?". it can be computed using the following equation:

$$P_p = \frac{number\ of\ pixels\ classified\ correctly}{Total\ number\ of\ pixels\ classified} \times 100$$

Some of the 250 randomly selected points had to be removed after checking on Google Earth because they fell on clouds either in Google Earth or on the classified maps and clouds represent a moving entity and thus a certain error on the matrix. We removed 10 such a points, leaving us with 240 reference points to assess the mapping accuracy.

The confusion matrix in table 17 summarizes all of the accuracy parameters for each class in the last cover maps (2010). The table shows that the overall accuracy of the map is 92.92% meaning that the map in general is accurate at around 93%.

Table 17: Map accuracy assessment results

Maps	**Reference (Google Earth)**			
	Forest	**Non-Forest**	**Total**	**User Accuracy**
Forest	126	13	139	90.65%
Non-Forest	4	97	101	96.04%
Total	130	110	240	
Producer Accuracy	96.92%	88.18%		**92.92%** Overall Accuracy

Figure 14: Forest cover and deforestation maps produced for the entire RRD (cf. annex I for bigger scale maps)

Forest 1995

Forest 2000

Forest 2005

Deforestation 95-00

Deforestation 00-05

Estimation of annual areas of historic deforestation in the RRD:

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 GIS. 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. Detailed results of the estimation of historic deforestation in the reference area are presented in table 18.

Comparing these deforestation numbers for the RRD with deforestation in the same period in other areas of the Makira project show that historic deforestation in the RRD is about double the rate in the leakage belt and ten times the rate in the project area (cf. “Makira v4 - Deforestation Regressions” File for more detail). This is considered normal in the case of a frontier deforestation configuration, where baseline deforestation rates in the project area are expected to increase after the start of the project.

Table 18: Estimation of historical deforestation in the reference area for deforestation (RRD)

<table>
<tr><th>Description</th><th colspan="2">1995</th><th colspan="2">2000</th><th colspan="2">2005</th></tr>
<tr><td>Date</td><td colspan="2">02/1995</td><td colspan="2">04/2000</td><td colspan="2">03/2005</td></tr>
<tr><td>Period between points in time [yr]</td><td></td><td colspan="2">5.17</td><td colspan="2">5.08</td><td></td></tr>
<tr><td>Total deforested area cloud free [ha]</td><td colspan="2">-</td><td colspan="2">10,852</td><td colspan="2">29,995</td></tr>
<tr><td>Deforested area cloud free per period [ha]</td><td rowspan="7"></td><td colspan="2">10,852</td><td colspan="2">19,143</td><td rowspan="7"></td></tr>
<tr><td>Rate of total deforestation per period [%]</td><td colspan="2">1.59%</td><td colspan="2">2.86%</td></tr>
<tr><td>Annual deforested area per period [ha]</td><td colspan="2">2,100</td><td colspan="2">3,766</td></tr>
<tr><td>Annual deforestation rate per period [%]</td><td colspan="2">0,31%</td><td colspan="2">0.56%</td></tr>
<tr><td>Overall total deforested area [ha]</td><td colspan="4">29,995</td></tr>
<tr><td>Overall annual deforested area [ha]</td><td colspan="4">2,926</td></tr>
<tr><td>Overall annual deforestation rate [%]</td><td colspan="4">0.43%</td></tr>
</table>

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 18. As mentioned above only three points in time over the whole historic reference period were available (1995, 2000 and 2005) and the numbers in table 18 suggest that deforestation from 2000 through 2005 was higher than in the 1995 to 2000 period.

This result was quite different from the previous deforestation analysis conducted based on the data produced by the national study. However, it has to be noted that in this initial analysis about 40% of the total area deforested between 1996 and 2005 could not be observed in 2001 because of cloud cover, making the apparent difference between the two deforestation rates quite uncertain. In the new analysis, clouds were effectively eliminated by using several images for each date and consequently the new result is considered reflecting real deforestation rates much more realistically.

Based on these estimates of historic deforestation in the RRD and in accordance with the BL-UP module of the applied methodology, we then used a linear regression to estimate annual areas of unplanned baseline deforestation in the RRD. The following equation was used:

$$A_{BSL,\ RRD,\ unplanned,\ t} = m * th + int$$

Where:

$A_{BSL,\ RRD,\ unplanned,\ t}$	= Projected area of unplanned baseline deforestation in the RRD in year t; ha
m	= Slope; ha/y^2
th	= 1, 2, 3, … th years elapsed since the start of the historic reference period
int	= Intercept; ha/y

In the case of the Makira project, the two parameters *m* and *int* could be easily computed based on the numbers provided in table 16 and using the LINREG function in Excel:

$$m = 324.9859\ ha/y^2$$

$$int = 1{,}260.8059\ ha/y$$

As this regression was only based on two points in time (mean values from the two periods 1995 to 2000 and 2000 to 2005), R^2 is of course equal to 1 and the regression is significant, and in accordance with the applied methodology the regression can be used for estimating annual areas of unplanned baseline deforestation of the project.

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

In accordance with the BL-UP module of the applied methodology, projected annual areas of unplanned baseline deforestation in the RRL were estimated as follows:

$$A_{BSL,RR,unplanned,t} = A_{BSL,RRD,unplanned,t} * P_{RRL}$$

Where:

$A_{BSL,RR,unplanned,t}$	= Projected area of unplanned baseline deforestation in RRL in year t; ha
$A_{BSL,RRD,unplanned,t}$	= Projected area of unplanned baseline deforestation in RRD in year t; ha
P_{RRL}	= Ratio of forest area in the *RRL* to the total area of the *RRD* at the start of the baseline period; dimensionless
t	= 1, 2, 3, … t* years elapsed since the start of the REDD project activity

In the case of the Makira project P_{RRL} was estimated as follows:

$$P_{RRL} = 701{,}545 / 651{,}230 = 1.0773$$

The same linear regression proposed for estimating annual areas of unplanned deforestation in the RRD was then used for estimating annual areas of unplanned baseline deforestation in the RRL using the following equation:

$$A_{BSL,RR,unplanned,t} = (m * th + int) * P_{RRL} = (324.9859 * th + 1{,}260.8059\ ha/y) * 1.0773$$

Results, annual areas of unplanned baseline deforestation in the RRD for the entire 30-year project period, are presented in table 10 in the VCS project description. For more detail on deforestation projections in the RRD please refer to the "Makira v4 - Deforestation Projections" file.

In accordance with the applied methodology, $A_{BSL,RR,unplanned,t}$ has been used as the annual area of unplanned deforestation in the RRL while the annual areas of unplanned deforestation in the project area have been determined through the process of location and quantification of threat of unplanned deforestation described in the following section.

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

It has already been shown above that the Makira project fulfils the criteria of a frontier deforestation configuration and therefore detailed analysis of the location of projected unplanned deforestation was required in order to determine the annual areas of unplanned baseline deforestation in the project area and in the leakage belt. The objective of this process is to develop a deforestation model that predicts which forest areas inside the reference area including the project area would be deforested during the project period, or at least during the first baseline period, without the intervention of the project.

The development of spatially explicit models of unplanned deforestation is a two-stage process. Stage 1 is the calibration stage where a model that relates some combination of the driving factors of deforestation to locations of deforestation seen in a historic period is developed. Stage 2 is the validation stage that confirms the quality of the model developed in Stage 1 by comparing a projection of deforestation to true deforestation seen during the second historic period. In the case of this feasibility assessment, the calibration data used was the data produced by the analysis of historic deforestation between 1986 and 2000, and validated by projecting deforestation from 2000 to 2008 and comparing the projected deforestation to the true deforestation seen from 2000 to 2008.

In accordance with the applied methodology, the IDRSI Land Change Modeller (LCM) software was used for the calibration/validation process. 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. Data used for the development and the calibration of the model was the available data on deforestation between 1995 and 2000, as well as spatial information on several potential drivers of deforestation described above. For the validation of the models deforestation data form the 2000 – 2005 period presented above was used. The different steps of the calibration and validation process are presented in the paragraphs below.

Model Calibration:

Before the model of deforestation can be generated, spatial data sets, representing the forces driving deforestation, must be generated. These are spatial representations of the driving factors (or deforestation driver variables) described above. The applied methodology allows for a variety of deforestation factors to be used in the deforestation modelling process. The factors are distributed into four factor groups as follows:

- **Landscape factors:** Slope, elevation, vegetation type, soil, etc.
- **Accessibility factors:** Distance to roads, distance to navigable watercourses, etc.
- **Anthropogenic factors:** Distance to settlements, distance to recently deforested areas, etc.
- **Actual land tenure and management:** Protected area, communal boundaries, etc.

The methodology also requires that at least one factor from each of the four groups be used. Based on the analysis of deforestation drivers presented above, the following deforestation driver variables were used for further analysis:

- **Slope (SLO):** Derived from a Digital Elevation Model (DEM) based on the digital version of the topographic maps of Madagascar (BD500 and BD100).
- **Elevation (ELV):** Derived from a Digital Elevation Model (DEM) based on the digital version of the topographic maps of Madagascar (BD500 and BD 100).
- **Soil type (SOT):** Derived from ORSTOM 1968[34].
- **Distance to roads and tracks (DRT):** Based on information from BD500 and BD100, enhanced with spatial information acquired during field activities conducted in the project area and analysis of recent satellite imagery.
- **Distance to permanent watercourses (DPW):** Based on information from BD500 and BD100.
- **Distance to forest edge (DFE):** Based on results of the deforestation analysis described above.
- **Distance to villages (DTV):** Based on information from BD500 and BD100, enhanced with spatial information acquired during field activities conducted in the project area and analysis of recent satellite imagery.
- **Distance to Recently Deforested Areas (DRD):** Based on a GIS file attached to inter-ministerial order n° 18633/ 2008 defining existing and planned future protected areas on national level.[35]
- **Conservation Status (COS):** Based on a GIS file attached to inter-ministerial order n° 18633/ 2008 defining existing and planned future protected areas on national level.[36]

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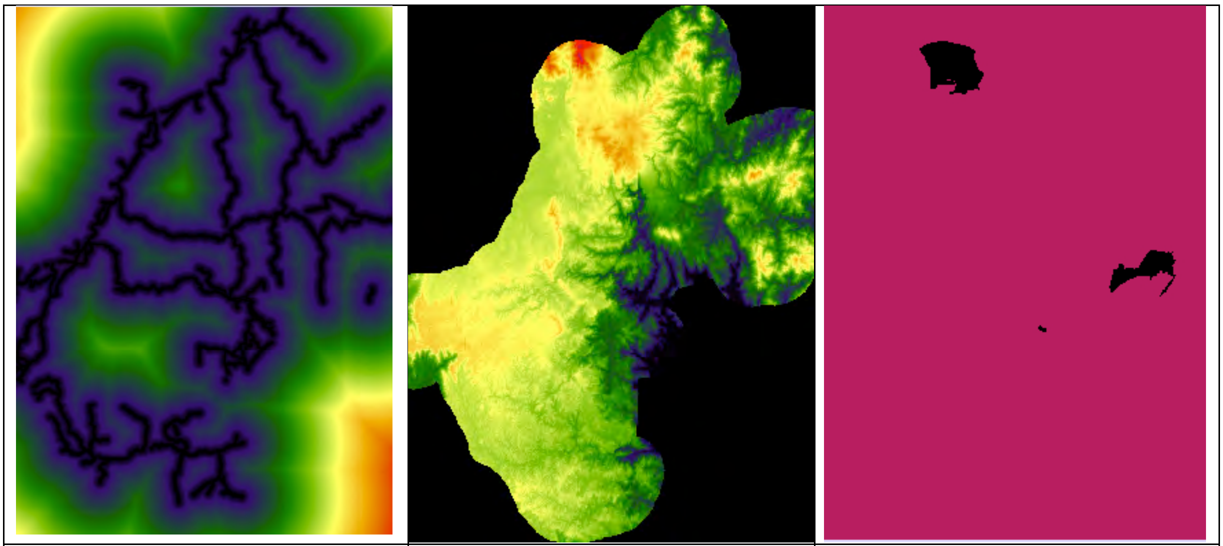
34 ORSTOM 1968. Carte pédologique de Madagascar à l'échelle de 1:1 000 000 : feuille nord / dressée par J. Riquier. Tananarive, Office de la recherche scientifique et technique outre mer, Service cartographique,

35 Arrêté Interministériel n°18633/ 2008 / MEFT/ MEM portant mise en protection temporaire globale des sites visés par l'Arrêté interministériel n° 17914 du 18 octobre 2006 et levant lasuspension de l'octroi des permis miniers et forestiers pour certains sites

36 Arrêté Interministériel n°18633/ 2008 / MEFT/ MEM portant mise en protection temporaire globale des sites visés par l'Arrêté interministériel n° 17914 du 18 octobre 2006 et levant lasuspension de l'octroi des permis miniers et forestiers pour certains sites

Figure 15: Three examples of deforestation factor maps



Distance to roads and Tracks	Slope	Evidence likelyhood PAs

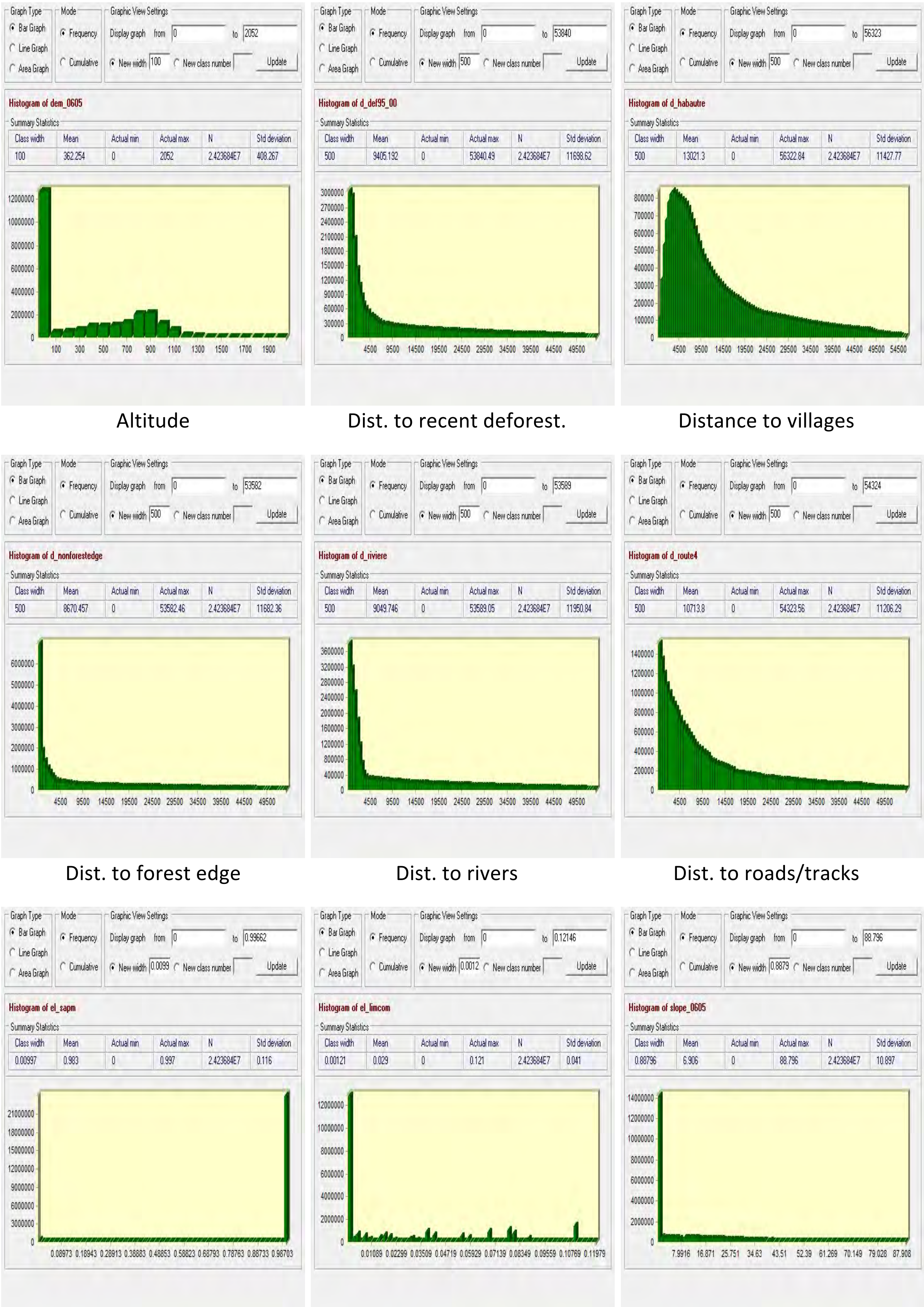
Model Calibration:

Once, the historic land cover images and driving factors were prepared, the model of deforestation could be generated. This two stage process, described earlier, begins with the calibration of the model. For the calibration stage, we use the 1995 to 2000 deforestation data and different combinations of driving factors to develop a model of unplanned deforestation for the entire reference area (RRL).

As mentioned above, this was done in the IDRISI software using the Land Change Modeller (LCM) tool, which was developed specifically to help model future land cover. LCM derives a relationship between the historic land cover change and the driving factors of change, using either a logistic regression analysis or a multilayer neural network analysis (see IDRISI Taiga Software Manual for full details on LCM). For this work we selected the logistic regression analysis as it provides more information about the relationship between the driving factors and deforestation as well as a clearer indication of the quality of the model.

The recently approved VCS Methodology BL-UP Module VMD0007 version 3.0 (February 2012), changes the requirements for the spatial model used to predict unplanned deforestation. While version 2.0 of the module stated in section 3.1.1 that the spatial model must "be transparent" and did not allow the use of "black box calculations such as neural networks", version 3.0 of the BL-UP module now has the following four requirements presented in section 3.1.1 on page 25 of the BL-UP module: 1) "Be peer-reviewed"; 2) "Be transparent"; 3) "Incorporate spatial datasets that have been documented to explain patterns of and are correlated with deforestation"; and 4) "Be able to project location of future deforestation." IDRISI's automated Multi-Layer Perceptron neural network satisfies these requirements as follows.

Figure 16: Contribution of tested deforestation factors



Altitude | Dist. to recent deforest. | Distance to villages

Dist. to forest edge | Dist. to rivers | Dist. to roads/tracks

Protected Area | Communal boundaries | Slope

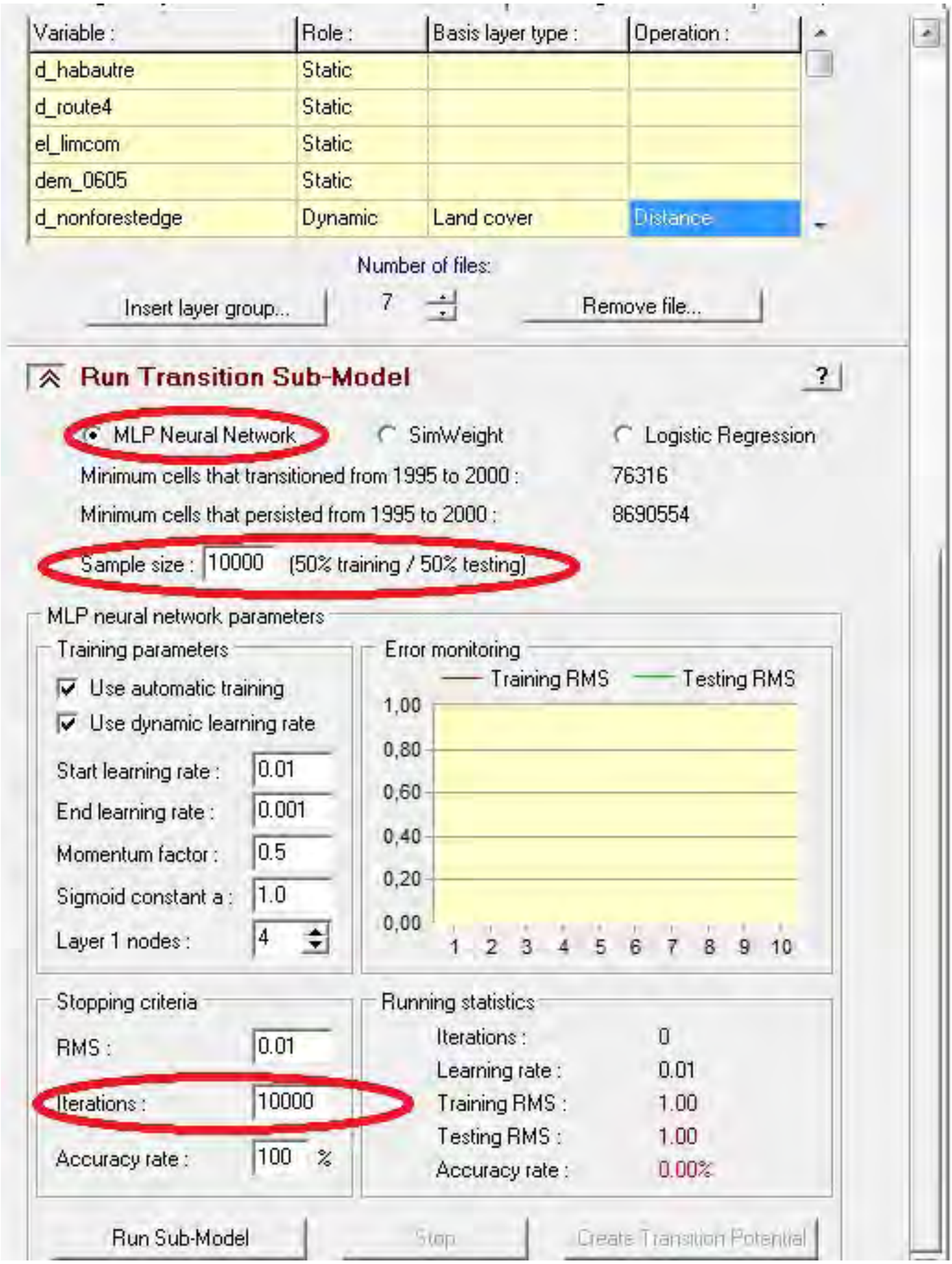
- First, neural network models have been used as a tool to model land cover change with good success. Perez Vega et al (2012)[37] showed that the neural network model found in IDRISI generated better overall models as compared to other methods. Ray et al (2010)[38] used neural network models to understand how future urbanization, forest regrowth and riparian buffer setbacks impact surface water runoff, and Almeida et al (2008)[39] predicted urban land use change using neural network models. These are just three examples of numerous peer-reviewed studies using neural networks to model land use and land cover change. While neural networks are not the only method for modeling future unplanned deforestation, the literature suggests it is a useful method and performs better than others when compared.
- In terms of transparency, we used the histogram tool in IDRISI to assess the contribution of explanatory variables (cf. figure 16 below). For assessing accuracy, the method pulls out a set of land cover transition pixels to use for the training data and, once trained, uses the separate test pixels. In accordance with the applied methodology, 10,000 transition pixels were randomly chosen, 5,000 for training and 5,000 for testing (cf. figure 17). This process was repeated over and over until the minimum of 10,000 iterations required by the applied methodology was reached (cf. figure 17). At this point, the model provides an overall accuracy rate derived from the set aside test data. For the finally selected model MLP_22, the reported accuracy, based on the training and testing algorithm was 91.99% as shown in table 19 part 3, the highest accuracy achieved by a model tested in the deforestation modelling process.
- As with the logistic regression model in IDRISI, the neural network model uses spatial data sets that were shown to have a significant correlation to land cover change. These variables were derived based on in-depth knowledge of land transformation in the region as presented in the deforestation driver and factor analysis presented in sections G 1.6 and G 2.1. The drivers of land cover change were then developed as spatial data sets used in various combinations in the tested models as presented above and in table 19.
- Finally, we have shown through the calibration and validation steps, that the neural network model can successfully project land cover change to known periods, which leads to the conclusion that the same models can be used to project unplanned deforestation into the future. For the final model used here, the resulting accuracy was 91.99%.

37 A. Perez-Vega, J.-F. Mas, and A. Ligmann-Zielinska, 2012. "Comparing two approaches to land use/cover change modeling and their implications for the assessment of biodiversity loss in a deciduous tropical forest," Environmental Modelling & Software, vol. 29, no. 1, pp. 11–23, Mar. 2012.

38 D. K. Ray, J. M. Duckles, and B. C. Pijanowski, 2010. "The Impact of Future Land Use Scenarios on Runoff Volumes in the Muskegon River Watershed," *Environmental Management*, vol. 46, no. 3, pp. 351–366, Sep. 2010.

39 C. M. Almeida, J. M. Gleriani, E. F. Castejon, and B. S. Soares-Filho, 2008. "Using neural networks and cellular automata for modelling intra-urban land-use dynamics," *International Journal of Geographical Information Science*, vol. 22, no. 9, pp. 943–963, 2008.

Figure 17: Transition sub-model training and testing examle



Based on the histograms mentioned above, numerous trials, with different combinations of deforestation factors were run in order to develop a series of models that could then be compared and evaluated. Table 19 shows results from six trials, the driver variables included in the tested models, deforestation risk and validation maps produced with each model, as wellas some statistics developed using the crosstab tool in LCM. The calibration stages thus provides indications of the influence each factor has on deforestation. For the final model, it was shown that forested areas close to other non-forested areas, close to roads, close to villages and on low slopes had a higher probability of being converted to non-forest over the project period.

Model Validation:

In order to validate one of the models for unplanned deforestation tested in the calibration stage, we projected land cover in the RRL from 2000 to 2005 based on the model and then compared that result to the deforestation map for the 2000 to 2005 period for the RRL derived from the satellite image analysis presented above.

All projections of land cover are based on the deforestation risk maps for the used model. These risk maps are a result of applying the logistic regression equation to the set of factors used in the model in order to estimate the probability of a forest to non-forest conversion for each cell in the landscape. Three examples of deforestation risk maps, developed based on different deforestation models, are presented in table 19. For projecting deforestation during the validation period, the deforestation risk map was then applied to the 2000 forest cover map and forested pixels with the highest risk of deforestation were converted to non-forest for the 2005 forest cover map. The annual areas of deforestation projected up to 2005 matched the true areas of deforestation seen in the reference land cover change maps from the 2000 – 2005 period.

In order to test the accuracy of projected deforestation during the 2000 - 2005 period, we also used the overall accuracy rate provided by the software. The crosstab tool finally performs a standard accuracy assessment between two land cover maps, one projected for 2005 based on the deforestation model and the second is the reference forest cover map for 2005 based on the satellite image analysis. The output of the command includes a table comparing the reference land cover map to the predicted land cover map, as well as estimates of the overall error in comparison and a Kappa statistic, which is a statistical indicator of the quality of the comparison (cf. table 20). A high quality model will result in a high Kappa value, and a high percentage of pixels that are the same class in both the reference forest cover map and the predicted forest cover map (cf. table 19). In our case, model 6 (MLP_22) had the highest accuracy rate as shown in table 19. This model used the following driver variables:

- **Landscape factors:** Slope
- **Accessibility factors:** Distance to roads and tracks
- **Anthropogenic factors:** Distance to recently deforested areas
- **Actual land tenure and management:** Protection status

Table 19: Comparision of tested deforestation models part 1: Factors, Statistics, Risk and Validation Maps for models MLP_05 and MLP_11

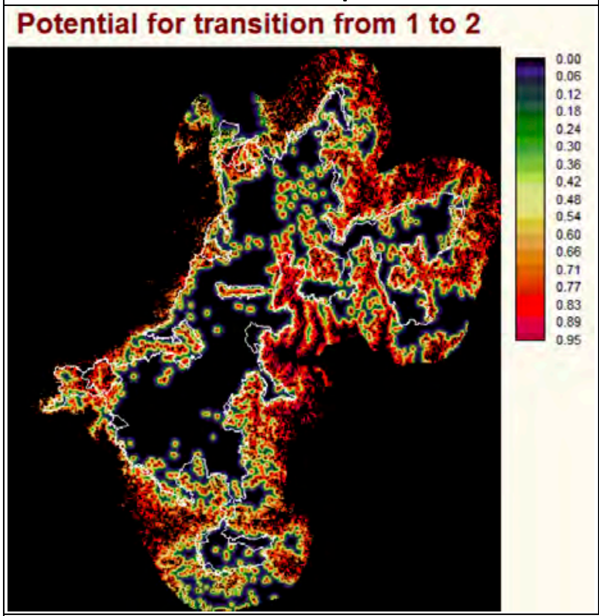
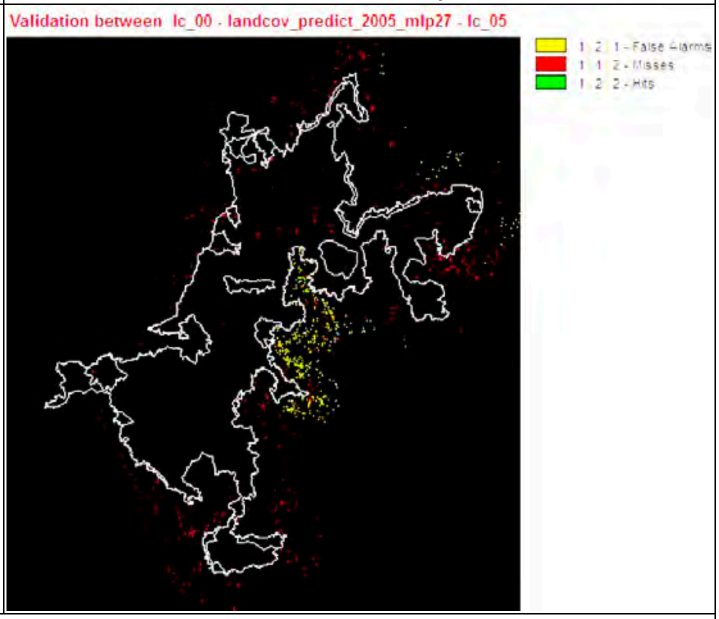
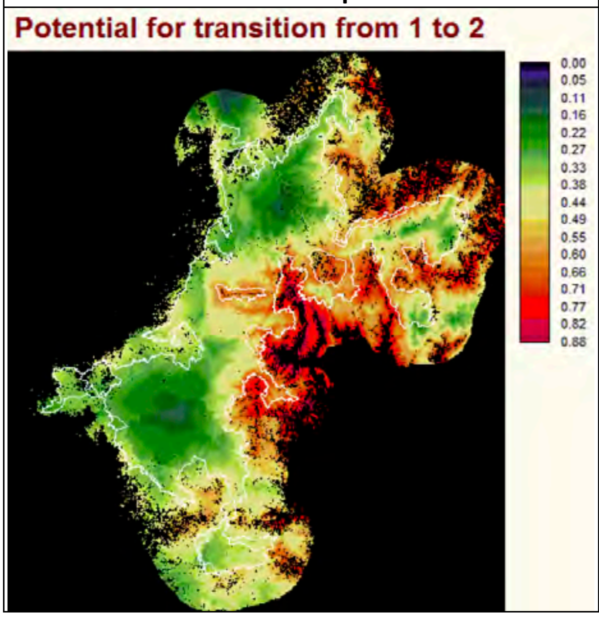
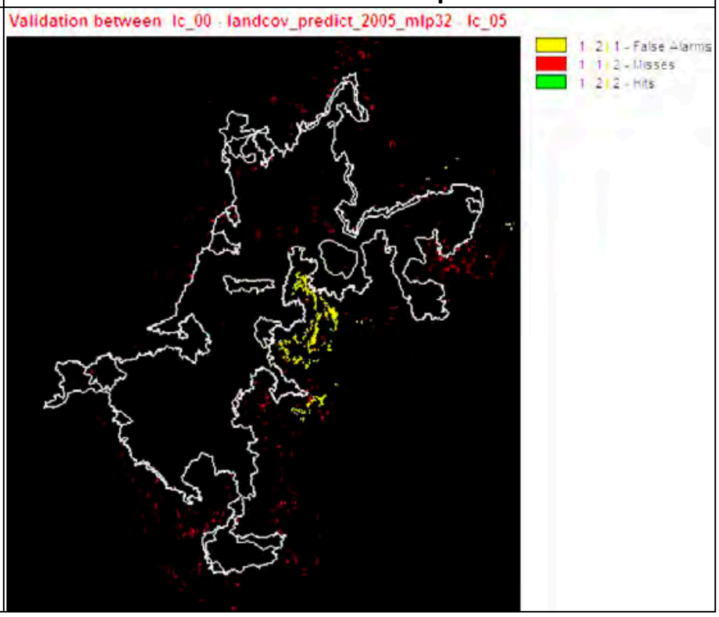
Model 1: MLP_05					
Used Factors:	Distance to: Non-forest edge	Distance to: Roads & Tracks	Distance to: Permanent Rivers	Distance to: Settlements	Evid. Likelyhood: Slope
	Evid. Likelyhood: Altitude	Evid. Likelyhood: Communes	Evid. Likelyhood: Protected Areas	-	-
Accuracy rate:	77.22%	**FOM:**	1.88%	**PFOM:**	33.00%
Risk Map			**Validation Map**		
					
Model 2: MLP_11					
Used Factors:	Distance to: Perman. Rivers	Evid. Likelyhood: Altitude	Evid. Likelyhood: Communes	Evid. Likelyhood: Protected Areas	-
Accuracy rate:	64.88%	**FOM:**	1.65%	**PFOM:**	25.12%
Risk Map			**Validation Map**		
					

Table 19: Comparision of tested deforestation models part 2: Factors, Statistics, Risk and Validation Maps for models MLP_13 and MLP_15

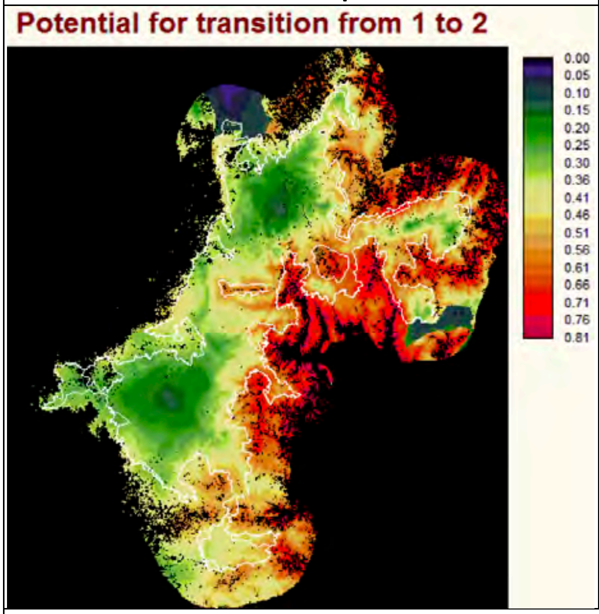
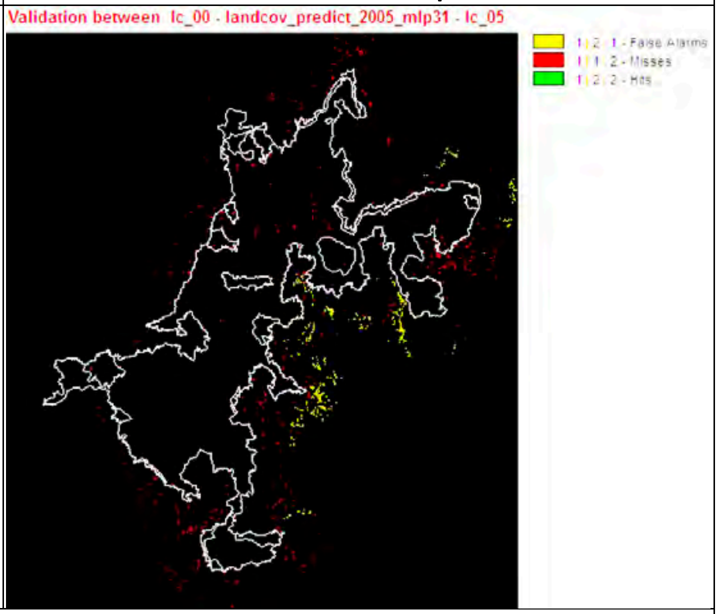
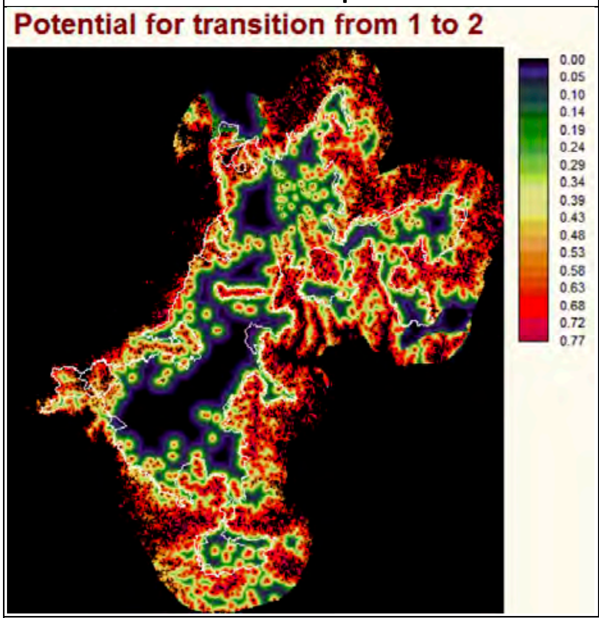
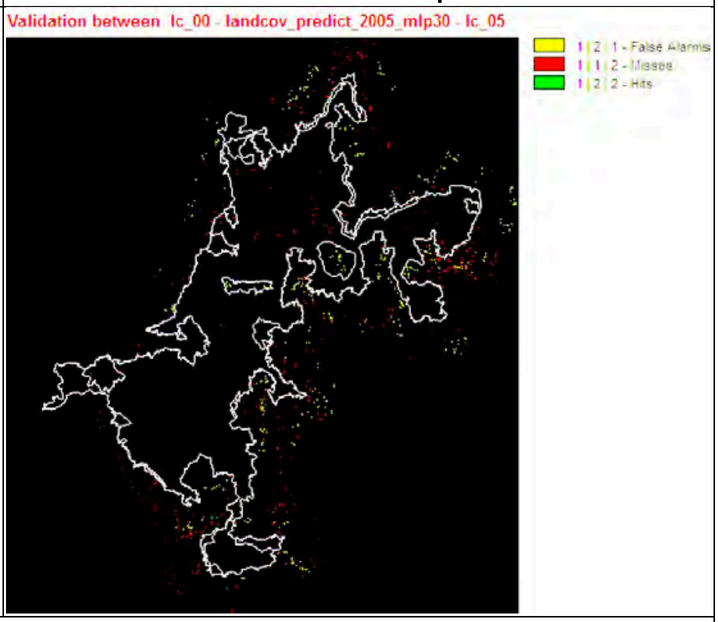
Model 3: MLP_13					
Used Factors:	Distance to: Perman. Rivers	Distance to: Settlements	Evid. Likelyhood: Altitude	Evid. Likelyhood: Protected Areas	-
Accuracy rate:	64.25%	**FOM:**	1.61%	**PFOM:**	35.11%
Risk Map			**Validation Map**		
					
Model 4: MLP_15					
Used Factors:	Distance to: Non-forest edge	Distance to: Perman. Rivers	Distance to: Settlements	Evid. Likelyhood: Slope	Evid. Likelyhood: Protected Areas
Accuracy rate:	76.11%	**FOM:**	1.88%	**PFOM:**	66.64%
Risk Map			**Validation Map**		
					

Table 19: Comparision of tested deforestation models part 3: Factors, Statistics, Risk and Validation Maps for models MLP_19 and MLP_22

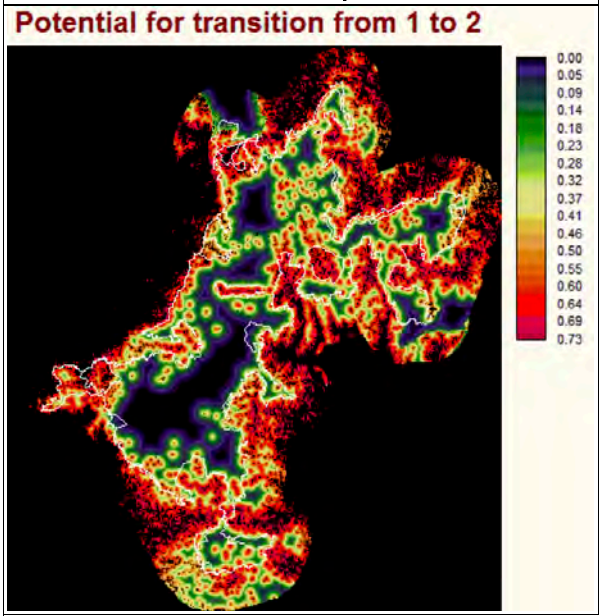
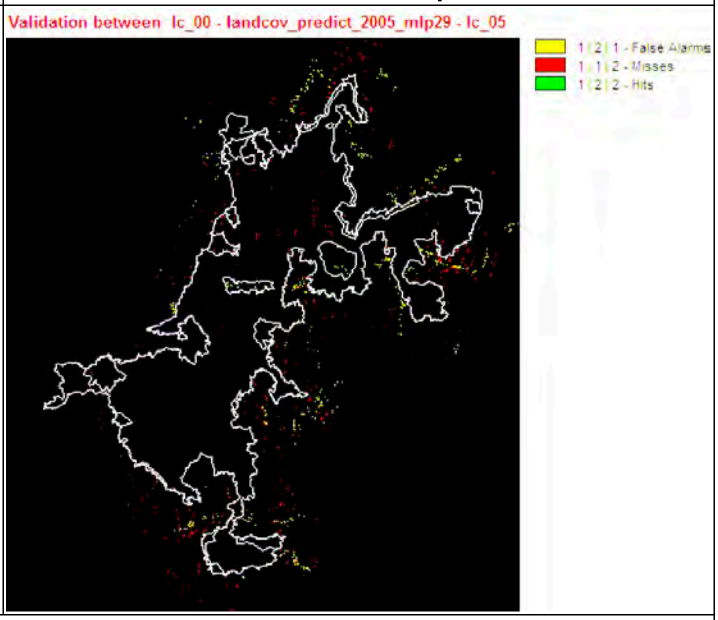
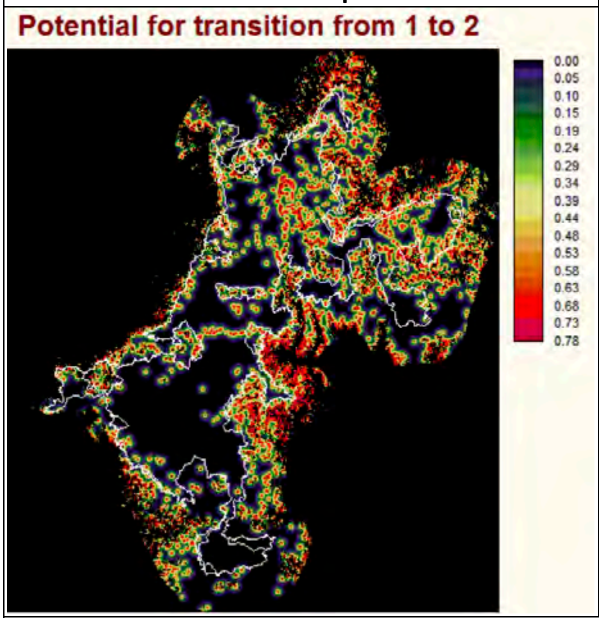
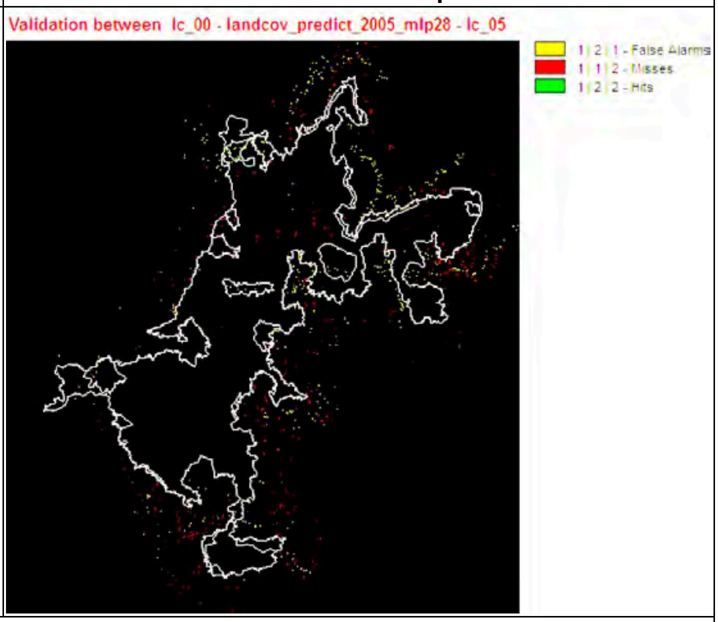
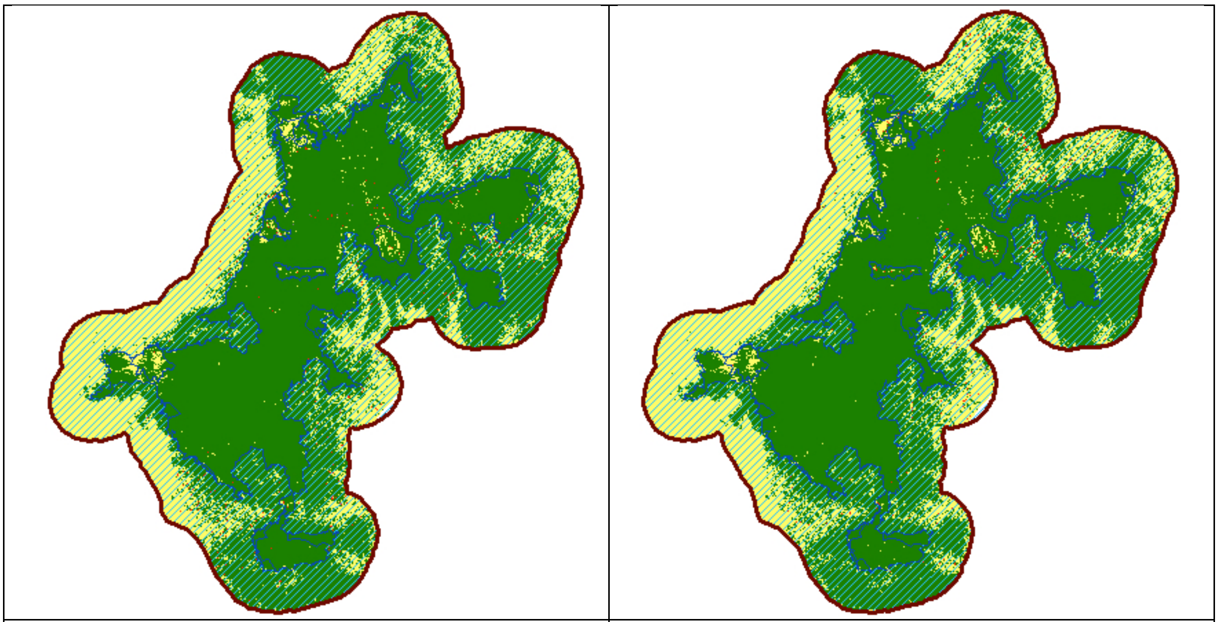
Model 5: MLP_19					
Used Factors:	Distance to: Non-forest edge	Distance to: Roads & Tracks	Distance to: Settlements	Evid. Likelyhood: Slope	Evid. Likelyhood: Protected Areas
Accuracy rate:	76.23%	**FOM:**	1.73%	**PFOM:**	62.04%
Risk Map			**Validation Map**		
					
Model 6: MLP_22					
Used Factors:	Distance to: Recent Deforest.	Distance to: Roads & Tracks	Evid. Likelyhood: Slope	Evid. Likelyhood: Protected Areas	-
Accuracy rate:	91.99%	**FOM:**	2.07%	**PFOM:**	68.29%
Risk Map			**Validation Map**		
					

Figure 18: Projected and observed deforestation in the RRL for the validation period



Historic deforestation 2000 – 2005	Projected deforestation 2000 – 2005

Table 20 and figure 18 compare the prediction of the 2005 forest cover map to the 2005 reference forest cover map for the best model. In this table, the columns represent the true forest cover based on the 2005 reference forest cover map and the rows represent the predicted forest cover for 2005 based on the final model. The numbers represent the count in pixels for each category with the values in the diagonal representing pixels that were correctly predicted and the off-diagonals are the errors. The total true row is the sum of each True Land Cover Type columns and represents the total Forest, Non-Forest and Water pixels in the reference land cover map, and the total Predicted column is the sum across each Predicted Land Cover Type row representing the total number of Forest, Non-Forest and Water pixels in the predicted land cover map. From these values, an overall percent correct can be calculated to give an indication of the quality of the prediction. The percentage of forested pixels correctly predicted by model MLP_22 was 99.08% (8,636,673/8,637,057), and the percentage of correctly predicted non-forest pixels was 98.23% (3,400,938/3,401,322). The overall Kappa Index of Agreement (KIA) value for this comparison is 0.9929.

Table 20: Accuracy assessment table for the Final Model prediction of 2005 land cover

		True Land Cover Type			**Total Predicted**
		Forest	**Non-Forest**	**Water**	
Predicted Land Cover Type	**Forest**	8,585,350	51,323	-	8,636,673
	Non-Forest	51,707	3,349,615	-	3,401,322
	Water	-	-	7,126	7,126
Total True		8,637,057	3,400,938	7,126	

In addition to the above quality assessment, the BL-UP module of applied methodology requires the model with the best fit to be validated by applying the below "Figure of Merit" (FOM) equation[40]:

$$FOM = CORRECT/(CORRECT + Err_A + Err_B)$$

Where:

$CORRECT$	= Area correct due to observed change predicted as change, ha
Err_A	= Area of error due to observed change predicted as persistence, ha
Err_B	= Area of error due to observed persistence predicted as change, ha

The initially used version 2.0 of the BL-UP module of the applied methodology specified that to calibrate a model of unplanned deforestation the comparison between projected deforestation and true deforestation for the calibration period must result in an FOM value of at least 40%. This specification has however been updated in the recently approved VCS Module VMD0007 Version 3.0 (February 2012) and now paragraph 2 on page 27 of the revised BL-UP module reads: "The minimum threshold for the best fit as measured by the Figure of Merit (FOM) shall be defined by the net observed change in the reference region for the calibration period of the model."

This effectively lowers the minimum FOM need for calibration to a level that matches the observed deforestation rate from the reference region during the calibration period. In the case of the Makira Forest Project, the observed deforestation rate in the reference area for deforestation (RRD) during the 1995 to 2000 calibration period was 1.59% (cf. table 18 on page 77). For the best fitting model 6 (MLP_22), the observed FOM was 2.07%, which is higher than the specified minimum FOM threshold of 1.59%, indicating a model that meets the criteria for success during the calibration stage.

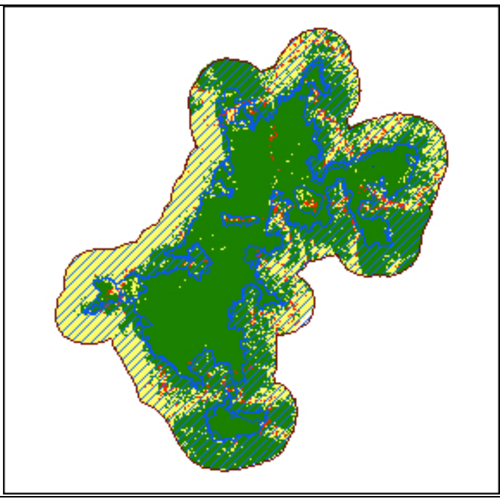
Estimation of annual areas of unplanned baseline deforestation in the project area:

Once a final model has been calibrated and validated, we could then project unplanned deforestation into the future for the entire reference area including the project area. This was done by applying the deforestation risk map to the most recent land cover reference map (2005) in order to predict future deforestation for the entire project period. Part of the process of predicting future deforestation is also to update the deforestation risk maps, based on changes in the driver variables over time. For example, planned roads can be added to the corresponding factor map in order to take into account this kind of evolution of the deforestation driver variables. However, in the case of the Makira project the same factor maps as the ones from the calibration/validation process were used.

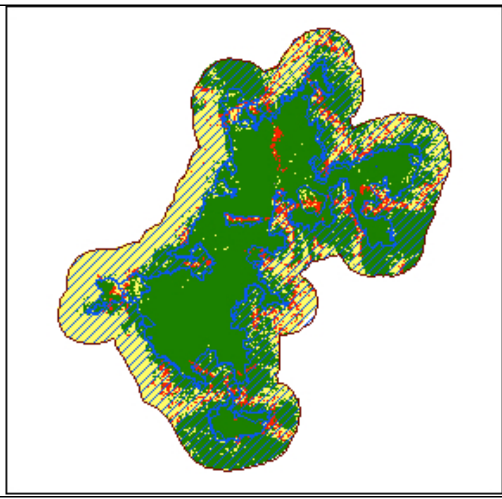
Future deforestation is assumed to happen first at the locations with the highest deforestation risk value determined in the deforestation risk maps shown above. The area of deforestation to be used is $A_{BSL,RR,unplanned,t}$ allowing the allocation of deforested areas throughout the RRL based on highest likelihood of deforestation/deforestation risk as predicted by the spatial model presented above.

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

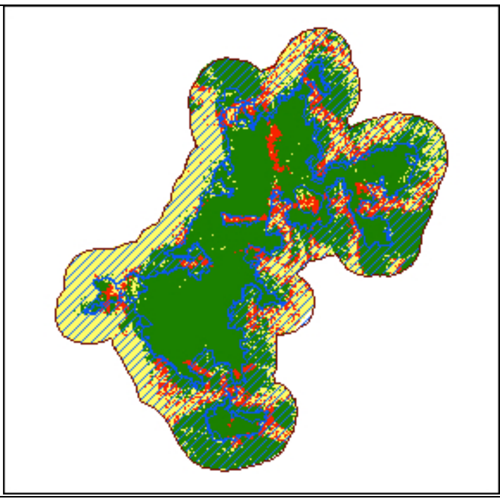
Figure 19: Projected deforestation in the RRL over the entire project period



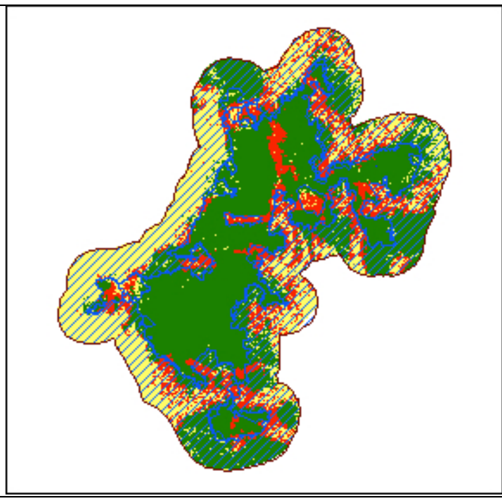
Projected Deforestation 2005-2009



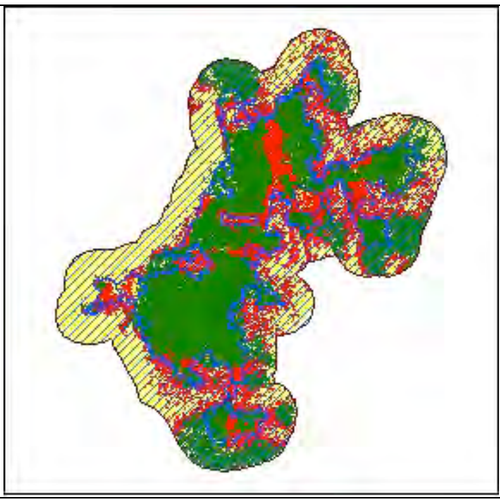
Projected Deforestation 2005-2014



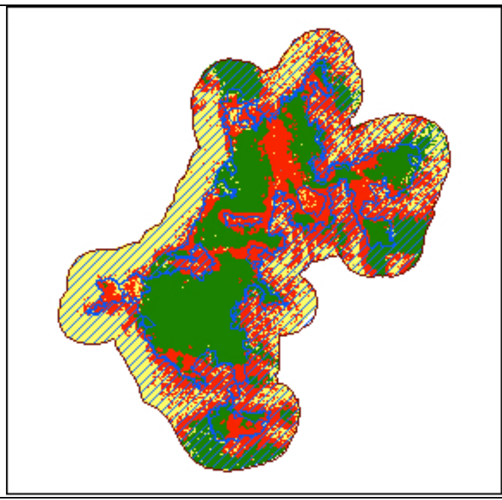
Projected Deforestation 2005-2019



Projected Deforestation 2005-2024



Projected Deforestation 2005-2029



Projected Deforestation 2005-2034

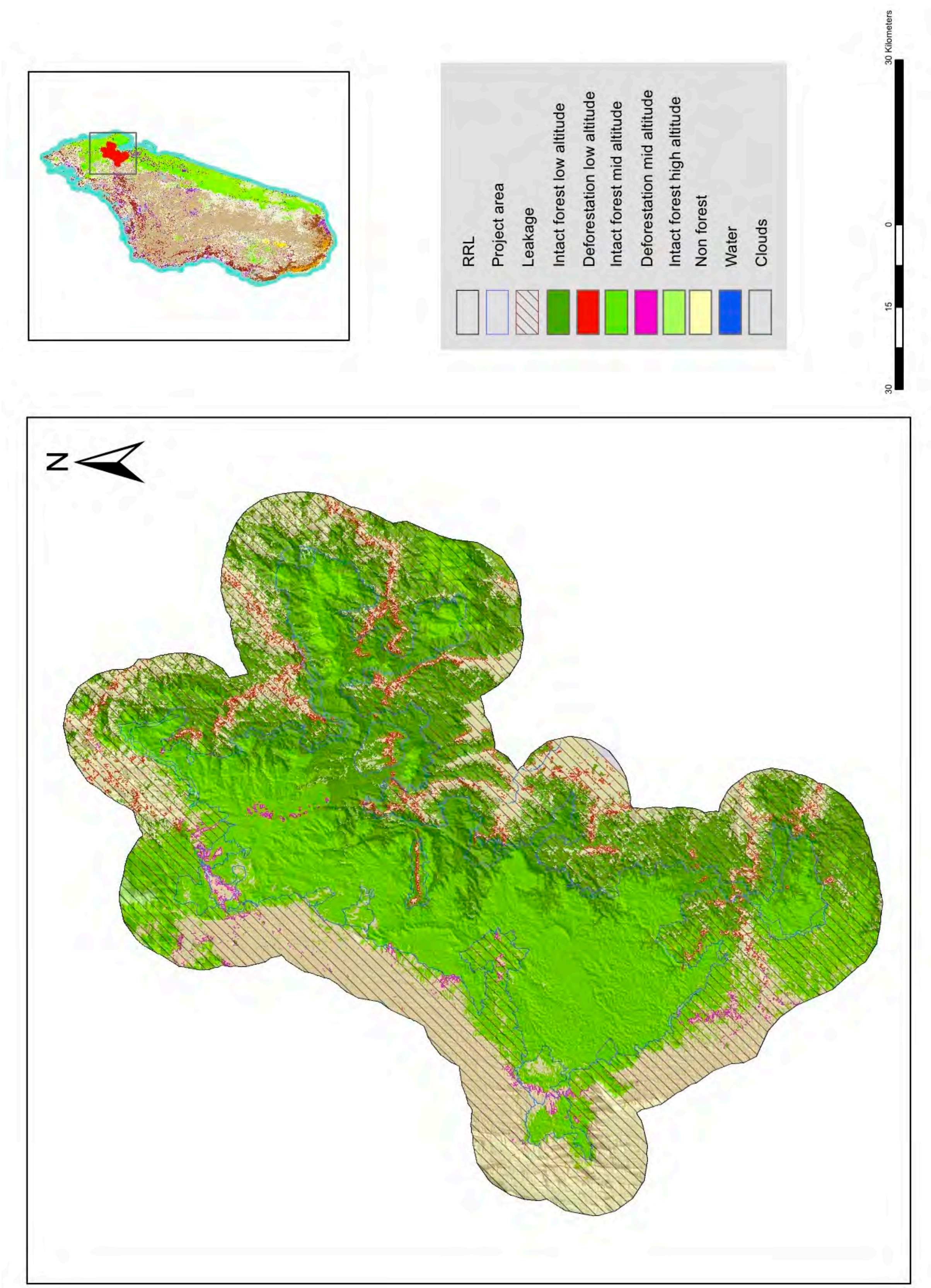
Based on the deforestation risk map produced by the best fitting model and the area of deforestation in the RRL, deforestation in project area and leakage belt was calculated through the following steps:

- In the Deforestation Risk Map, the pixels with the highest risk value whose total area is equal to the area expected to be deforested in Year 1 have been isolated. The result is the map of baseline deforestation for Year 1 over the entire reference area for location.
- The above pixel selection procedure has been repeated for each successive project monitoring period in order to produce a map of baseline deforestation for each future five-year period. This process has been completed for the entire 30-year project period. The maps of projected future deforestation for each one of the six 5-year monitoring periods of the project period are presented in figure 19.
- The six maps of projected deforestation in the RRL have then been used to determine projected areas of unplanned baseline deforestation over the entire project period in both the leakage belt and the project area seperately for the two forest strata (cf. section G 1.4). This was done by overlapping the maps of projected deforestation in the RRL with the boundaries of the project area and the leakage belt and the strata boundaries as demonstrated in figure 20 for the first monitoring period and in more detail in the "Mkira v4 – Crosstabs" Excel file. As we have been working with a progressively increasing rate of deforestation, the annual area of unplanned baseline deforestation in the RRL increased also each year. Consequently, deforestation projections based on the best fitting model had to be carried out separately for each year of the 30-year project period.

Table 21: Annual baseline deforestation in the project area per stratum for the entire project period

Year	Total deforested area [ha]		Year	Total deforested area [ha]	
	Stratum 1	**Stratum 2**		**Stratum 1**	**Stratum 2**
2005	350	467	2020	1,838	1,530
2006	375	500	2021	1,901	1,583
2007	401	534	2022	1,965	1,636
2008	426	567	2023	2,029	1,689
2009	451	601	2024	2,092	1,742
2010	716	667	2025	2,613	2,245
2011	754	702	2026	2,690	2,311
2012	792	737	2027	2,767	2,377
2013	830	773	2028	2,844	2,444
2014	868	808	2029	2,921	2,510
2015	1,163	1,022	2030	3,121	3,461
2016	1,211	1,064	2031	3,201	3,550
2017	1,260	1,107	2032	3,282	3,639
2018	1,309	1,150	2033	3,362	3,728
2019	1,357	1,193	2034	3,442	3,817
			Total	**52,330**	**50,151**

Figure 20: Projected deforestation in the RRL at the end of each monitoring period



- However, this process is pretty slow under LCM and as LCM works with deforestation rates and not annual areas of deforestation, we also noted some differences between the annual areas of unplanned deforestation from the deforestation regression. We therefore decided to use the values obtained for each 5-year monitoring period by the above mentioned overlapping process only as ratios in order to attribute the annual areas of deforestation calculated in section to the two forest strata in the project area and in the leakage belt. Calculations relative to this process are presented in detail in the “DefBaseline” tab in the “Makira v4 – carbon stock changes” spresdsheet.

The results of this process, annual areas of unplanned deforestation in the project area per forest stratum (cf. section G 1.4) for each year over the 30-year project crediting period, are presented in table 21 above.

Estimation of annual areas of unplanned baseline deforestation in the leakage belt:

As the reference area for localization of deforestation (RRL) included the leakage belt, 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 in the previous section. Based on the deforestation risk maps developed by modelling future deforestation in the RRL, annual deforested areas have been distributed over the entire RRL for the entire project period of 30 years.

Results of this application of the deforestation model to the leakage belt over the entire project area are presented separately for the two forest strata in table 22.

Table 22: Annual baseline deforestation in the leakage belt per stratum for the entire project period

Year	Total deforested area [ha]		Year	Total deforested area [ha]	
	Stratum 1	Stratum 2		Stratum 1	Stratum 2
2005	3,298	744	2020	4,960	1,783
2006	3,536	798	2021	5,132	1,844
2007	3,773	852	2022	5,304	1,906
2008	4,011	905	2023	5,475	1,968
2009	4,249	959	2024	5,647	2,030
2010	4,114	1,114	2025	4,954	2,050
2011	4,332	1,173	2026	5,100	2,110
2012	4,549	1,232	2027	5,246	2,171
2013	4,767	1,290	2028	5,393	2,231
2014	4,985	1,349	2029	5,539	2,292
2015	4,745	1,431	2030	5,035	1,995
2016	4,944	1,491	2031	5,164	2,046
2017	5,142	1,551	2032	5,294	2,098
2018	5,341	1,611	2033	5,423	2,149
2019	5,540	1,670	2034	5,553	2,200
			Total	**146,544**	**49,041**

Estimation of annual baseline carbon stock changes:

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 before and after deforestation discussed already in Section G 1.4:

Carbon stock in forest stratum 1:	544.89 t CO_2-e/ha
Carbon stock in forest stratum 2:	810.14 t CO_2-e/ha
Carbon stock in post deforestation stratum:	238.89 t CO_2-e/ha
Emission factor 1 (forest 1 to post-def.):	**306.00 t CO_2-e/ha**
Emission factor 2 (forest 2 to post-def.):	**571.25 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 23.

Table 23: Estimated 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 [ha]	
	Project Area	Leakage Belt		Project Area	Leakage Belt
2005	373,668	1,434,432	2020	1,436,270	2,536,221
2006	400,590	1,537,780	2021	1,486,003	2,624,042
2007	427,512	1,641,129	2022	1,535,736	2,711,862
2008	454,435	1,744,477	2023	1,585,469	2,799,683
2009	481,357	1,847,826	2024	1,635,202	2,887,503
2010	599,838	1,894,886	2025	2,081,863	2,686,753
2011	631,609	1,995,253	2026	2,143,312	2,766,056
2012	663,381	2,095,620	2027	2,204,761	2,845,359
2013	695,153	2,195,987	2028	2,266,210	2,924,662
2014	726,925	2,296,354	2029	2,327,659	3,003,965
2015	939,396	2,269,303	2030	2,932,085	2,680,184
2016	978,735	2,364,334	2031	3,007,500	2,749,120
2017	1,018,074	2,459,365	2032	3,082,914	2,818,055
2018	1,057,413	2,554,396	2033	3,158,329	2,886,991
2019	1,096,752	2,649,427	2034	3,233,743	2,955,926
			Total	**44,661,894**	**72,856,946**

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 increasing migration from and to the project zone, changes the dynamism of the population in Maroantsetra, improving exchanges and 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 centre - 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%)[41].
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.
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

[41] Monography of Analanjirofo, 2005

	also will results in impoverished and unhealthy communities. Local population have already observed a progressive decrease in water streams level over time (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 could contribute 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 Project current 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 managed 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 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)[42]. 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)[43], small mammals (Ganzhorn et al., 2003)[44] birds (Watson et al., 2004)[45], and amphibians (Vallan, 2000)[46]. 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 refuges 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 reduce key habitat and refuges, and will place pressure on already-sensitive and stressed flora and fauna. In the long term the forests will be

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42 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.

43 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.

44 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.

45 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.

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

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 refuges 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 emissions of slightly more than 38 million tonnes of CO_2-e over the 30-year project period by reducing carbon stock changes from deforestation in the project area. This will be achieved through the sustainable management of more than 700,000 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 management 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 G 2.1 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 agriculture.

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 main drivers of deforestation and forest degradation in the project zone, the Makira project has been implementing since late 2004 (cf. section on temporal boundaries on page 68 for detailed timeline) 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

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 December 2011, 46 GCF sites were in place, totalling approximately 195,000 ha; by 2013, 80 GCF sites will be transferred to local communities covering a total area of 351,037 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.
- Promote improved agricultural and production methods, including the use of agroforestry for tavy yield stabilization.

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 ministerial order issued in December 2011 (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'Etat) 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 21):

- 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

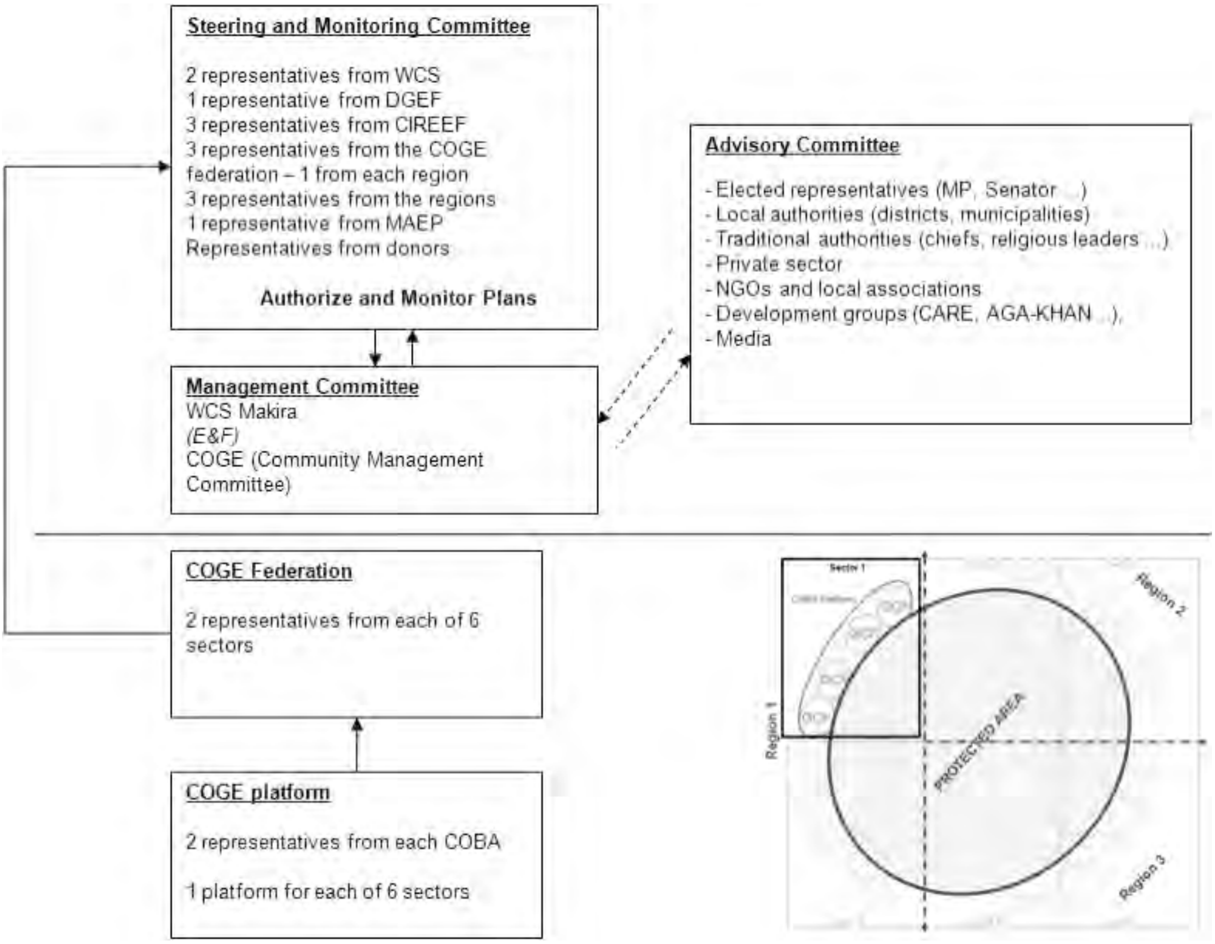
In this co-management structure, the GCF site management committees (known as COGEs) are organized into 6 platforms, with each providing representation to a COGE federation that directly engages in the Makira steering and management committees. The organization of the local communities within the Protection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

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.

Figure 21: Governance structures for the Makira Protected area and the surrounding protection zone



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.

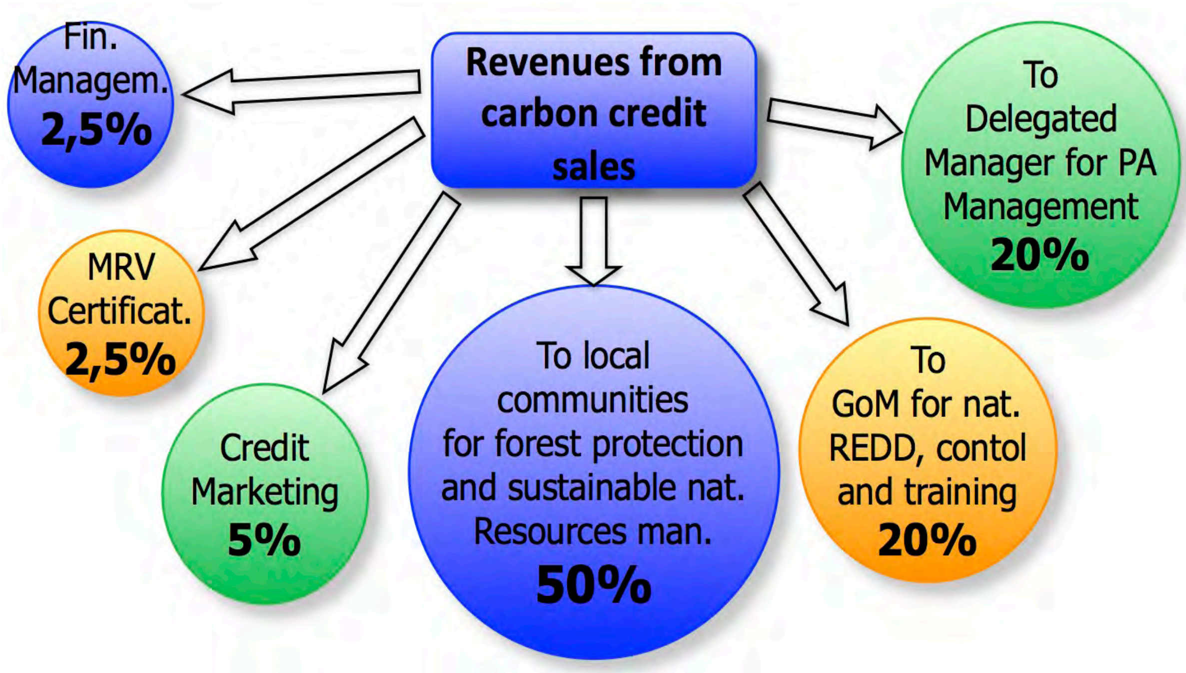
- In partnership with organizations that specialize in rural development, implement targeted development activities (agriculture, agroforestry, and natural forest management) at key locations to minimize leakage and to increase overall project success.
- Work with local communities in the identification 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;

- Identify and promote viable economic alternatives to unsustainable resources use and 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 general carbon revenue sharing and management mechanism for the Makira Project. Following this agreement, 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. The net proceeds for the sales of Makira emissions offsets will be allocated as indicated in figure 22. 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. Towards a more equitable benefit sharing, the project will work in collaboration with all stakeholders to create incentives motivating communities for improved resource stewardship and governance through conservation contracts and other forms of performance-based payment systems.

Figure 22: Proposed distribution of 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 observed 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 G1.3. The spatial boundaries of areas related to climate aspects are detailed and justified in Section G2.3.

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

Temporal boundaries of the Makira project are detailed in Section G2.3.

G3.5. Risks and mitigation measures

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

The VCS approach to risk analysis[47] 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

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

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 consent of the 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 settlements 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.

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/km^2[48], the population density for the five other districts of Makira are low: Andapa (32.6 hab/km^2)[49], Antalaha (30.2 hab/km^2), Befandriana Nord (17.5 hab/ km^2) and Mandritsara (20.1/km2)[50]. There is no risk of them exceeding 150 habitants/km^2 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 a 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".

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

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

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

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.

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 prospecting permits by interested actors; the Makira Project proponent has negotiated a definitive stop to prospecting 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 north-eastern 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 non-compliance 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

13% of the estimated Verified Emissions Reductions (cf. non-permanence risk assessment in annex 2 of the VCS PDD). The overall risk assessment shows the Makira Project to be of low risk; this is mainly due to external risks and to potential natural disaster (cyclones).

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 various 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 has been granted by the Government on June 19 2012 (cf. http://www.newsmada.com/communique-conseil-de-gouvernement-du-19-juin-2012-mahazoarivo/). 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 (cf. figure 22 above). 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 which can be distinguished 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 almost entirely dependent on the resources 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. 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.

Table 24 below shows 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 24: 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

Table 25 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 25: 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, and also on a more specific carbon related aspects of the project. Consultations of the different stakeholders at different levels and on different subjects/themes were carried out at different stages of the project. Thus, consultations of local communities on the PA delimitation were initiated since the very beginning of the project whereas consultations on potential carbon revenues were limited at the national level at the early stages of the project. Minutes and reports on these meetings and consultations with the different stakeholders are available upon request. While national level negotiations on the sale of carbon credits were still ongoing, WCS did not yet communicate and discuss potential revenues and their use with local communities in order to avoid creating overenthusiastic expectations. It has also be noted that the State and not WCS is the owner and final vendor of emission offsets generated by the Makira project and until very recently no official strategy for communicating on carbon benefits to local communities has been issued by the Ministry for Environment and Forests. However, negotiations on carbon sales advanced substantially on national in 2011 and based on them WCS developed a carbon communication plan, which is currently being implemented at local level (cf. section G3.9 and annex XIV).

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 December 2011, 46 GCF sites were in place totalling approximately 195,000 ha and by the end of year 2013, 80 GCF sites will be transferred to local communities, covering approximately 350,000 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.

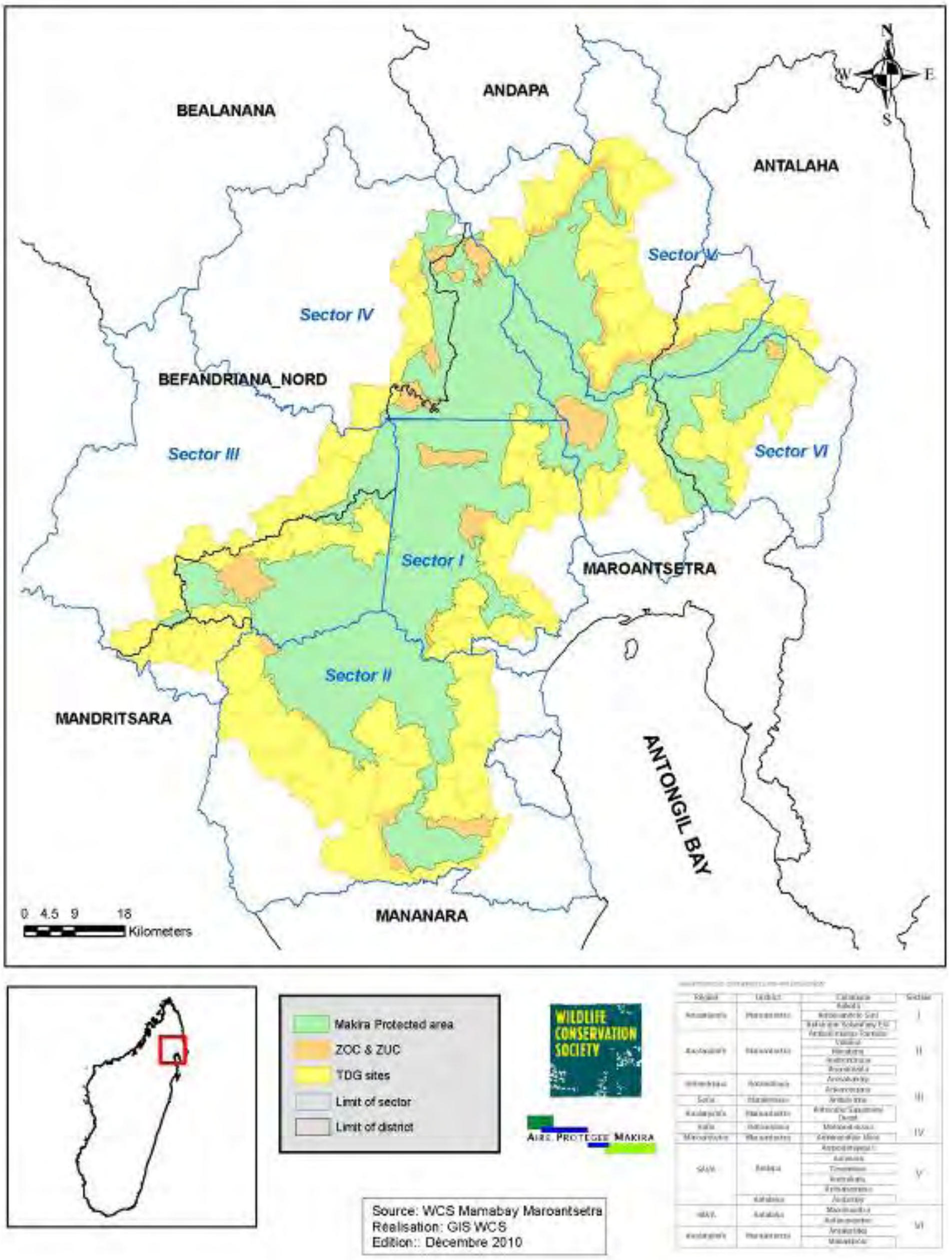
<u>Co-management of the Makira protected area</u>:

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 21 on page 106.

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

Figure 23: Sectors of the Makira 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 23 above) 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.

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.

Stakeholders consultations on carbon financing mechanism:

Consulting the local community on the carbon financing mechanism in general and on sharing of the potential carbon revenues of the Makira Project in particular, poses a number of challenges. The project proponent feels strongly that until the Makira Project Document 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.

At national level, consultations of various stakeholders including the Ministry of Environment and Forests, various Government agencies, and several other partners members of the SAPM commissions and the REDD National Committee were consulted.

A regional level, a first attempt on public consultations was done during the regional workshop in May 2010 at Fénerive-Est, region of Analanjirofo as part of the preparation for the development of the national REDD strategy. This workshop was organized by the National REDD committee (WCS is part of this committee) to inform, consult and get feedback from different stakeholders on the National REDD strategy. A small delegation from the communities in the Makira area were invited and participated in these consultations.

More formal stakeholders' consultations on the Makira carbon financing project at local level (villages, communes, districts and region) have been initiated all around Makira since February 2012. A document describing the strategies, methodologies and schedule for that program of stakeholder consultations is attached (Annex XV).

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

The Makira Project design document will be published on the CCBA website (http://www.climatestandards.org).

In order to correct for the project' failure to inform all stakeholders on the publication of the Makira PDD document during the CCBA public comment period, intensive Makira carbon communication campaigns have been carried out since February 2012 all around the Makira area targeting a wide range of stakeholders including local and regional authorities, partners and communities (See also carbon communication plan in appendix XV). The project will take advantage of these campaigns to inform local and regional stakeholders on Makira carbon projects and get feedbacks from them and allow them to raise and address any issues they may have. 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, and 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 at community level (through the project animators and heads of sector that live amongst the communities, through the management committee of each COBA), at regional level at WCS offices in Maroantsetra, Andapa and Mandritsara, or at the WCS office in Antananarivo. All comments are addressed and feedback provided. The Makira Project has very much benefited from this approach so far and will continue to maintain these options for input. In case of a more formal and written requests, written response to comments are 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 higher authorities, or the mediation by a third independent body or the courts if necessary. A monitoring and orientation committee[51] (COE), which is the supreme authority for the Makira Project will also deal and/or cut through difficult issues raised that could not be resolved at lower levels.

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[52], which has been developed very recently and will be available to the auditors, 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.

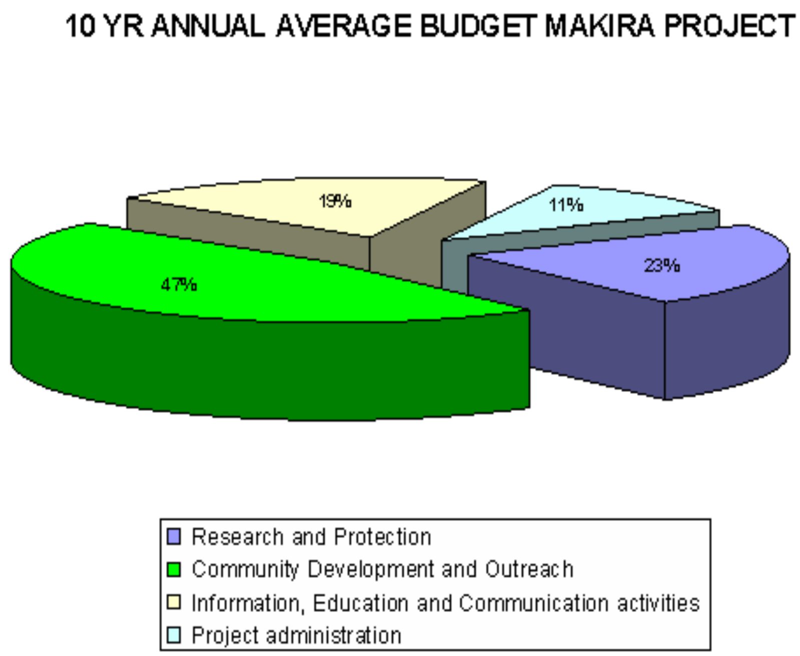
Revenue generated from the sale of Makira forest carbon offset credits will provide secure long-term financing for Protected Area management including all monitoring activities, community development supports, education and communications, and capacity building. For the future, total estimated costs

51 The COE is the supreme authority and is the decision making body for the Makira project. As such, it provides orientation and ensures monitoring of the implementation of the project. The COE is presided by the Director of the System of Protected Areas in Madagascar and is composed by regional and national authorities, representatives of government agencies, representatives of communities, other local and regional partners and WCS as the delegated manager of the Park.

52 WCS 2011, The Makira Project Business Plan.

and revenues for implementing the Makira project are presented in the 30-year financial plan[53] in appendix XIV. Revenues from sales of emission offsets generated by the Makira project were estimated based on the estimated emission reductions and VCUs presented in section CL 1.4 of the present PD and ongoing negotiations with the government and potential buyers. In addition, WCS is committed to continue searching for and securing non-carbon funds for Makira. With this data, the financial plan shows a clear surplus over the enire project period

Figure 24: Ten-year average annual budget for the Makira Project



Carbon revenue sharing and management mechanisms:

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.

53 WCS 2011, The Makira Project Financial Plan. This business plan has not yet been widely published but will be available at validation.

The Net Proceeds from sales of Makira emission offsets will be allocated in the following manner (cf. figure 22 above):

(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

Wildlife Conservation Society (WCS) is the project proponent. WCS provides and raises the funding for the project and ensures the totality of its implementation through WCS staffs. Main responsibility within WCS Madagascar lies with Dr Christopher Holmes who is the WCS Country Program Director, but he is supported by about 80 staffs in Antananarivo and in the Makira area including administrative, finance and technical staffs in the implementation of the activities.

Other key partners and management roles to ensure successful continuation of all project activities include the following

Entity	Roles	Contact
Wildlife Conservation Society	Lead the design, implementation and monitoring of the project. Also a the delegated manager of Makira PA, ensure long term management and conservation of the Parks	Dr. Christopher Holmes Country Program Director Wildlife Conservation Society BP 8500 Soavimbahoaka, Antananarivo 101 Madagascar Mobile/SMS: +261 - 331188022 E mail: cholmes@wcs.org Skype : cholmes_wcs.or
Government of Madagascar, Ministry of Environment and Forests (MEF)	Owner of the forests and Carbon property. Ensures the supervision and monitoring of the implementation of the project by WCS Through the Designated National Authority, ensures that all aspects of the Makira carbon project, including marketing and sales are coherent and are in accordance with National REDD policy	Pierre Manganirina Randrianarisoa General Secretary Ministry of Environment Forests Tel: ND Fax: +261 020 22.30488 BP. 3948 Antsahavola Antananarivo (101) MADAGASCAR
Comité d'Orientation et de Suivi	Monitoring and orientation of the Makira project	Laurette Rasoavahiny President of COE / Director of System of Protected Areas in Madagascar Nanisana, Antananarivo 101 Madagascar
Community Associations (COBAs, Platforms of COBAs, Federation of COBAs)	Main partners of WCS in the implementation of the project in the fields	46 community forest Management associations (COBA) have already been created by end 2011 out of an estimated total of 80 in the protection zone.
Designated Foundation	Distributing the net proceeds held in escrow, from sales of Allocated Makira Emission Offsets in accordance with well-defined allocations as described in the agreement between MCC and MEF (appendix XX). Details will be set out in an agreement between the foundation, the State and the delegated manager of the Makira protected area and supervised by a steering committee composed by all stakeholders, including local community representatives.	The designated foundation has to be set up by the state and negociations are currently still ongoing, However, the agreement between MCC and MEF provided in annex 5 of the VCS PD describes in detail the roles of the foundation and the process how this foundation is going to be defined, including detailed rules on how to proceed in the case of credit sales before the foundation is designated (escrow account in article 2.07.3 of the agreement in appendix XX).

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, and 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 of 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 behaviour 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.

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 officer 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
Sector 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	Assistance and 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

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.

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. The majority of the Makira staff come from the communities surrounding the protected area including the Park Director, the administrative and human resources, the finance officer, the community development officer, the research officer, the environmental education and communication officer, the population health assistant, and also all field agents. Currently in 2012, only few employees such as the GIS technician, the ecological monitoring officer and the assistant Environmental Education are not from the region.

In terms of gender approach, the project does not make any distinction between men and women when hiring a new staff. All positions are opened to both gender and staff is hired only based on its skills and capacity. As of January 2012, one third (1/3) of the staff in the project office in Maroantsetra are women and also about one fifth (1/5) of the whole project team, including field agents. The rather low number of women working in the fields could be explained by the difficulty associated with the field activities. WCS intends to sustain the equal opportunity practice to both men and women. Else, no under-represented groups are known from the Makira area.

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.

Potential risks

However, there are always potential risks for Park employees related to the difficulty associated with hilly relief with steep inclines of the Makira region, to the hostility of some people who do not like the PA establishment and also potential bites or stings from wild animals. The following risks are identified according to their origin.

Risks related to geographic and topographic conditions

The Makira forests are a mountainous region presenting cliffs and rocks faces in certain areas. The closest site is located at least 15 km from the administrative residence and no site can be reached from a conveyance. Access is often a narrow path crossing the steep mountainsides. An important part of the Makira region has no means of communication. Given these conditions, many risks could be imagined for staff working in the field such as

- Fall or fracture during a trip.
- Difficulties of evacuation in case of disease or accident.
- Difficulty of communication in case of emergency.
- Possibility of getting lost in the deep forest.

Risks related to weather

The Makira region is one of the wettest part of Madagascar, with high precipitation. Several cyclones pass through the region every year. All the pathways pass across rivers and there are only very few well built bridge. Very often, the rivers overflow during the rainy season, which makes crossing the rivers very difficult. These conditions present risks such as:

- Personal injury of the staff working in the forest
- Drowning in case of river flooding
- Isolation of the staff in forest in case of river flooding.

Risks associated to venomous wild animals

No very dangerous and deadly animal is known from the Makira area. . However some venomous animal notably arthropods such as scorpions, spiders, centipedes, or other insects could cause pain or even painful suffering for persons who are not very resistant.

Risks related to inadequate hygiene

There are no suitable drinking water supplies available in the field. Staff is obliged to use water courses, which exposes them to the risk of different diseases such as bilharziosis, taeniasis, and tuberculosis.

Risks related to the outsiders hostility

There is also a risk that the establishment of Makira PA could spark off discontent among some people who have to stop their illegal activities. It is possible that those people could offend and even assault the Park agents during their performance of their work.

Proposed measures to avoid or minimize risks

Taking into account these risks, the following measures will be adopted by the project (a detailed workers safety implementation plan is presented in appendix XIX):

POTENTIAL RISKS / PROBLEMS	PROPOSED MEASURES
Fall or fracture during a trip	• Agents to be equipped with boots to protect their feet during trips
Case of emergencies / accident	• Provide the staff with first aid kit for emergency care to victim before carrying him to the hospital • Train staff annually on first aid technique • Agents move at least in pairs and will be accompanied by at least one member of the local population to escort and help carry their luggage during their field mission
Problem of communication	• Install a communication station by sector; each will be equipped with a BLU and a satellite phone
Being lost in the deep forest	• Train all staff in technical navigation with compass and GPS • Equip all staff with a GPS, a compass and a lamp • A local guide should come with staff working in the forest
Cyclones, river flood.	• All employees stay in a secured area during cyclones • Canoes to be equipped with safety package (life jackets, rope,…) for all travels on big rivers
Bite of venomous animals	• Complete first aid kit with medicines to ease pain from venomous substances • Strengthen the annual training of first aid on healing technique against the bite of venomous animals
Lack of drinking water	• Equip all staff with a water filter • Provide staff with water purifiers pills and liquid • Agents should get vaccinated against Tuberculosis • Complete first aid kit of medicines for emergency treatment of Bilharziasis and Taeniasis
Risk related with the outsiders hostility	• Staff does not travel/go alone but always accompanied by at least one other person

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 Forest legislation
- The Decree №2001-122 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 forest law and customary contracts (called Dina) with the local communities and authorities. These different relevant 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." The Makira project that is being implemented by the State in collaboration with WCS can be considered as an implementation of this law.

Environmental Charter (Charte de l'Environnement):

Madagascar's Environmental Charter[54] was adopted in 1990. It defines 'environment', sets down A Madagascar's Environmental Charter[55] was adopted in 1990 and constitutes the legal foundation of Madagascar's environmental law. It governs the execution of the environmental policy. This Charter recognizes the environment as a priority preoccupation of the country's general interest, the duty of each Malagasy citizen to protect it, and the right of each person to be informed of and participate in decisions that could have influence on the environment. It defines 'environment', sets down fundamental principles and responsibilities and identifies the mechanisms for implementation. Towards the implementation of the objectives in the Charter, a National Environmental Action Plan (NEAP) was elaborated describing the actions to be realized to protect the environment and develop sustainable development. The Makira project has been developed as part of the implementation of the NEAP.

The article 10 of the charter introduces the requirement that projects presenting any risk to harm the environment should be subject to an Environmental Impact Assessment (EIA) – in conformance with the MECIE - relating to the national environmental policy and the promotion of the ecological and social equilibrium.

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

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[56] (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.

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[54] 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

[55] 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

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

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.

The MECIE decree designates the National Environment Office (Office National pour l'Environnement, ONE) as the authority to lead, setting norms and decide on the process and validate EIA study for new projects, award an environmental permit or certificate of conformity, follow-up and monitor the implementation of the project activities.

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 for Makira Environmental permit) and determination of contractual responsibilities (cahier des charges). Since the issuance of the environmental permit, the Makira project has been submitting reports to ONE on the implementation of the "cahier des charges".

Code des Aires protégées (COAP):

The COAP or Protected Area Law[57] describes the types of protected areas of the Madagascar Protected Area Network (Système des Aires Protégées de Madagascar, SAPM) and the procedures of creation of protected area. It also specifically prescribes zoning categories that each protected area manager in Madagascar must comply with 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.

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

The creation and management of the Makira protected area has carried out in accordance with the different steps described in the COAP law. In 2005, a Ministerial Order[58] (See Appendix VII) was issued by the Ministry of Environment and Forests to grant Makira a temporary protection status in compliance with the COAP regulations. After completion of all necessary steps for the creation of Protected area, a request – with a complete dossier - for a definitive protection status for the Makira park has been officially submitted to the Ministry of Environment. The dossier was validated by the SAPM commission in August 2011 and the dossier is currently waiting for the publication of the decree.

Gestion Locale Sécurisée des Ressources Naturelles Renouvelables (GELOSE):

In 1996, the Government of Madagascar passed GELOSE legislation[59] 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[60] 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

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 clarifies 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 Fokontany, 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 Department 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'Améngement defines zonation within a GCF site as well as an overview of allowable practices within each zone.

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58 Arrêté Ministériel n° 20.022-2005/MINENVEF

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

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

management to local communities through the 2001 decree, the "Gestion Contractualisée des Forêts de l'Etat" (GCF).[61] 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 (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.

International treaties and Agreements:

All the above national laws and regulations and the environmental policy in general were developed in accordance to several international treaties and agreements that Madagascar has ratified. Therefore, by complying with these national laws and regulations, the Makira project also complies with the international treaties and agreements, ratified by Madagascar, including :

- 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

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

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. The decree N°45.330/2011 of 14 December 2011 designates WCS as the manager of the Makira Protected area. In application of this decree, an agreement has been developed between the Government of Madagascar and WCS for the management of the Makira protected area for a first phase of 3 years until December 2014 and then renewable by tacit agreement every 5 years. Another agreement – reinforced by a decree no. 2008-704 du 6 October 2008 - has been developed between the Government of Madagascar and the Makira Carbon Company for the sale of carbon credits generated by the Makira Project for a first phase of 30 years. 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 (Attestation 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. These community uses are described in a convention signed between the protected area manager and the communities. Illegal activities consist mainly of deforestation for agriculture outside the customary use zone allocated for such activity, logging precious woods and mining. These two latter activities 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[62], 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 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 VIII), 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.

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

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.[63], and as discussed in an article by Takacs[64], "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 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.

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

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

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 (GHG) 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.

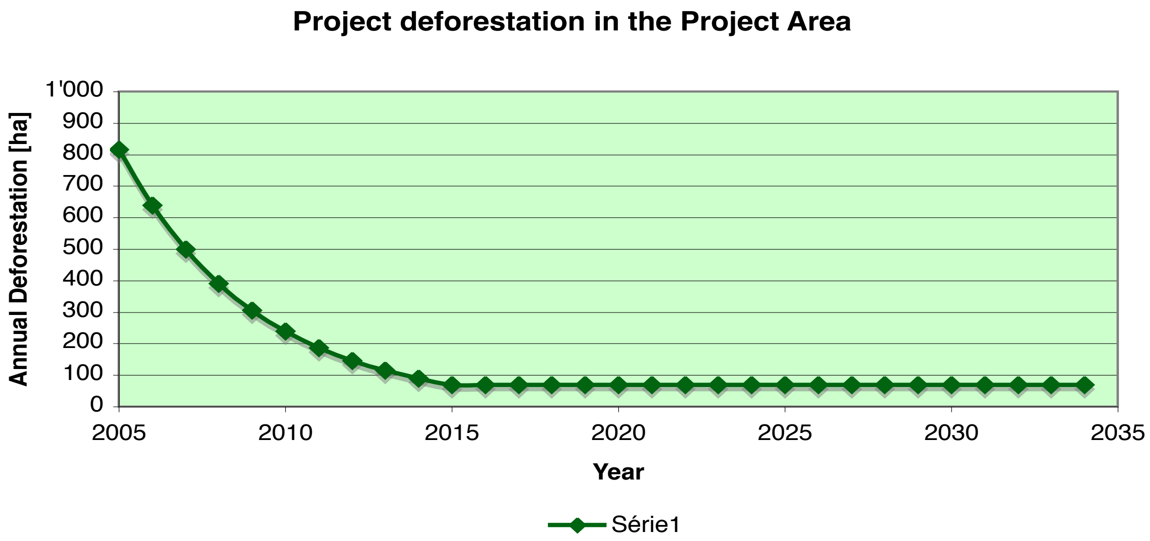
Future deforestation in the project area:

Experience in Madagascar indicates that the creation and effective management of protected areas can substantially reduce deforestation and forest degradation in an area.[65] For the Makira project, it is therefore expected that the project activities will lead to a progressive reduction of the annual areas of unplanned deforestation in the project area. As starting point we chose the baseline deforestation rate in the project area in 2005 at the beginning of the project period, which was estimated at 817 ha (0.23%) as presented in section G 2.3 (cf. table 21). It is expected that deforestation will be reduced over a 10-year period to about 70 ha/y, which corresponds to an annual deforestation rate of 0.02% currently observed in Masoala National Park (cf. figure 25).

This positive evolution seems to be credible as activities of the Makira project include development and implementation of robust management and control systems including local communities living inside and around the protected area. Although the forest management transfer process cannot apply to communities living in the two zones of controlled occupation, use of forest resources in these areas is regulated by specific management plans and local people will benefit from the same leakage management activities as the ones living in the leakage belt: improvement of agricultural production, creation of alternative income sources and benefit from carbon revenues. 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.

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

Figure 25: Expected evolution of annual deforestation in the project area



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 and results for the two considered forest strata over the entire project period are presented in table 26.

Table 26: Project deforestation in the project area per forest stratum for the entire project period

Year	Total deforested area [ha]		Year	Total deforested area [ha]	
	Stratum 1	Stratum 2		Stratum 1	Stratum 2
2005	350	467	2020	30	40
2006	274	365	2021	30	40
2007	214	286	2022	30	40
2008	168	224	2023	30	40
2009	131	175	2024	30	40
2010	103	137	2025	30	40
2011	80	107	2026	30	40
2012	63	84	2027	30	40
2013	49	66	2028	30	40
2014	39	51	2029	30	40
2015	30	40	2030	30	40
2016	30	40	2031	30	40
2017	30	40	2032	30	40
2018	30	40	2033	30	40
2019	30	40	2034	30	40
			Total	**2,076**	**2,767**

Future deforestation in the leakage belt:

In accordance with the M-MON module of the applied methodology, project deforestation in the leakage belt has been estimated using the following equation:

$$A_{DefLB,i,t} = \left(\sum_{t=1}^{t} (1 - PROP_{IMM}) * A_{BSL,LK,unplanned t} \right) * (1 - PROP_{LPA})$$

Where:

$A_{DefLB,i,t}$	=	Annual area of unplanned project deforestation in the leakage belt in stratum i at time t; ha
$PROP_{IMM}$	=	Estimated proportion of baseline deforestation caused by immigrant population; Proportion (from LK-ASU module)
$A_{BSLLK,unplanned,t}$	=	Annual area of unplanned baseline deforestation in the leakage belt; ha (cf. section 2.4.2.3)
$PROP_{LPA}$	=	Estimated proportion of baseline deforestation agents given the opportunity To participate in leakage prevention activities; proportion (cf. section1.8)
i	=	*1, 2, 3…m* strata
t	=	number of years elapsed since project start

It was demonstrated in section G 2.1 that small-scale subsistence agriculture from local farmers is the main deforestation driver. Immigrants contribute to forest degradation (illegal commercial logging and mining) but do not play a significant role in deforestation and therefore $PROP_{IMM}$ is equal to 0. It is further expected that at least 75% of populations in the leakage belt will participate in and benefit from leakage management activities and consequently the equation could be simplified:

$$A_{DefLB,i,t} = A_{BSLLK,unplanned,t} * 0.25$$

Table 27: Project deforestation in the leakage belt per forest stratum for the entire project period

Year	Total deforested area [ha]		Year	Total deforested area [ha]	
	Stratum 1	**Stratum 2**		**Stratum 1**	**Stratum 2**
2005	825	186	2020	1,240	446
2006	884	199	2021	1,283	461
2007	943	213	2022	1,326	477
2008	1,003	226	2023	1,369	492
2009	1,062	240	2024	1,412	507
2010	1,028	278	2025	1,238	512
2011	1,083	293	2026	1,275	528
2012	1,137	308	2027	1,312	543
2013	1,192	323	2028	1,348	558
2014	1,246	337	2029	1,385	573
2015	1,186	358	2030	1,259	499
2016	1,236	373	2031	1,291	512
2017	1,286	388	2032	1,323	524
2018	1,335	403	2033	1,356	537
2019	1,385	418	2034	1,388	550
			Total	**36,636**	**12,260**

Regarding the two identified forest strata, it was assumed that proportions of deforestation in each of them would be the same as in the case of unplanned baseline deforestation in the leakage belt (cf. section G2.3). Results for A_{DefLB} are presented in table 27 for the entire project period separately for the two forest strata.

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. Consequently extraction of timber for local use can be considered sustainable (cf section G 2.1).

There have been reports of illegal logging, especially of precious hardwoods like ebony (*Diospyros spp.*) and rosewood (*Dalbergia spp.*) from North-eastern Madagascar, particularly from 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 (cf section G 2.1).

Table 28: 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 -e]		Year	Carbon stock changes [t -e]	
	Project area	Leakage belt		Project area	Leakage belt
2005	373,668	358,608	2020	32,245	634,055
2006	292,472	384,445	2021	32,245	656,010
2007	228,919	410,282	2022	32,245	677,966
2008	179,176	436,119	2023	32,245	699,921
2009	140,242	461,956	2024	32,245	721,876
2010	109,768	473,721	2025	32,245	671,688
2011	85,916	498,813	2026	32,245	691,514
2012	67,247	523,905	2027	32,245	711,340
2013	52,634	548,997	2028	32,245	731,165
2014	41,197	574,088	2029	32,245	750,991
2015	32,245	567,326	2030	32,245	670,046
2016	32,245	591,083	2031	32,245	687,280
2017	32,245	614,841	2032	32,245	704,514
2018	32,245	638,599	2033	32,245	721,748
2019	32,245	662,357	2034	32,245	738,982
			Total	**2,216,142**	**18,214,236**

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 scenario presented in Table 28 have been calculates separately for the project area and for the leakage belt.

CL1.2. Net change in emissions of non- 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 and their contributions to the total potential of global warming effect from deforestation are considered insignificant (Houghton, 2005).[66] Consequently, CO_2 is the only greenhouse gas to be considered in the project case and is counted as carbon stock change. Non-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 42.4 million tons of carbon dioxide equivalents (cf. Table 29) in the project area, leading to direct net positive impacts on the climate. Under the baseline scenario, based on spatial modelling of unplanned deforestation, total forest loss under the baseline scenario in the

[66] 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.

project area during the lifetime of the project is estimated at 102,481 hectares (cf. Table 21 on page 95) equalling over 30% of the project area and resulting in total baseline emissions of more than 44.6 million tons of carbon dioxide equivalents (cf. Table 22 on page 97).

Under the with-project scenario, the total loss of forest in the project area during the project period is expected to be reduced to less than 5,000 hectares (cf. table 26) 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 2.2 million tons of carbon dioxide equivalents (cf. table 29). For deductions from total emission reductions due to displacement of carbon stock changes from the project area to the leakage belt refer to Section CL 2. below.

Table 29: 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 GHG emission reductions [t CO_2-e]
2005	373,668	373,668	0
2006	400,590	292,472	108,119
2007	427,512	228,919	198,594
2008	454,435	179,176	275,259
2009	481,357	140,242	341,115
2010	599,838	109,768	490,070
2011	631,609	85,916	545,694
2012	663,381	67,247	596,135
2013	695,153	52,634	642,519
2014	726,925	41,197	685,728
2015	939,396	32,245	907,151
2016	978,735	32,245	946,490
2017	1,018,074	32,245	985,829
2018	1,057,413	32,245	1,025,168
2019	1,096,752	32,245	1,064,507
2020	1,436,270	32,245	1,404,024
2021	1,486,003	32,245	1,453,757
2022	1,535,736	32,245	1,503,491
2023	1,585,469	32,245	1,553,224
2024	1,635,202	32,245	1,602,957
2025	2,081,863	32,245	2,049,618
2026	2,143,312	32,245	2,111,067
2027	2,204,761	32,245	2,172,516
2028	2,266,210	32,245	2,233,965
2029	2,327,659	32,245	2,295,414
2030	2,932,085	32,245	2,899,840
2031	3,007,500	32,245	2,975,254
2032	3,082,914	32,245	3,050,669
2033	3,158,329	32,245	3,126,084
2034	3,233,743	32,245	3,201,498
Total	**44,661,894**	**2,216,142**	**42,445,753**

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.

It has to be noted that 154,329 tCO_2-e of emission reductions from the Makira Project were sold upfront to help financing the establishment of the project. Contract for a first support phase, based on the sale of about 40,000 tCO_2-e of emission reductions generated by the Makira project and panned to last 15 months, was signed in December 2004 between CI and the Government. A second contract on about 100,000 tCO_2-e was signed in 2008 and is currently still ongoing.

These sales were carried out by the Conservation International Centre 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, 154,329 VCUs, the number equivalent to the total tCO_2-e of emission reductions already sold from the project will be deducted from the total VCUs generated by the Makira Project. The details of the WCS Makira Project 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 greenhouse gas 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 leakage 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 the applied methodology 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 tables 21 and 22 in section G2.3. above.

For ex-ante estimation of annual areas of unplanned deforestation in the leakage belt under the project scenario, it was assumed, based on guidance from the applied methodology, that the project interventions will reduce deforestation in the leakage belt by about 75%. This seems to be plausible mainly because it is expected that at least 75% of the population inside the leakage belt will participate in and benefit from the implemented leakage management activities presented in previous sections (cf. tables 27 and 28 in section CL1.1.).

For estimating annual areas of unplanned deforestation displaced from the project area to the leakage belt we assumed that at least 90% of the population in the project area will participate in and benefit from leakage management activities implemented by the project. In accordance with the applied methodology it is therefore expected that displacement of unplanned deforestation will be limited to about 10% of the baseline deforestation occurring in the project area. An exception has been made for 2005 as in this year deforestation in in the project area in the with-project case is assumed to be equal to baseline deforestation and leakage was accounted as zero (cf. figure 25 in section CL1.1.). Resulting numbers for unplanned deforestation displaced from the project area to the leakage belt in the with-project case are presented in Table 30.

For estimating annual areas of unplanned deforestation displaced from the project area to outside the leakage belt, the applied methodology requires an analysis of the proportion of immigrant and local deforestation agents. Deforestation agents living in the area for at least 5 years are considered local agents, while population living in the area for less than 5 years or only temporarily are considered immigrant deforestation agents. The potential for displacement of deforestation to outside the leakage belt is then considered equal to the proportion of immigrant deforestation agents.

The LK-ASU module of the applied methodology proposes a methodology of sampling local communities in and around the project erea in order to determine the percentage of deforestation attributed to immigrant deforestation agents. In the case of the Makira project this did not appear to be necessary, mainly because of the extensive socio-economic studies conducted and consultations conducted for the creation of the protected area and the management transfers in the protection zone. The analysis of deforestation drivers and their main agents presented above are also based on the permanent contacts WCS maintains with local communities through its network of 15 animators based in the villages in the PA and the protection zone. On this basis, it was concluded that immigrant agents do not play a role in deforestation and leakage to outside the leakage belt was neglected.

Table 30: Unplanned deforestation due to activity displacement (leakage)

Year	Total deforested area [ha]		Year	Total deforested area [ha]	
	Stratum 1	Stratum 2		Stratum 1	Stratum 2
2005	0	0	2020	184	153
2006	38	50	2021	190	158
2007	40	53	2022	197	164
2008	43	57	2023	203	169
2009	45	60	2024	209	174
2010	72	67	2025	261	224
2011	75	70	2026	269	231
2012	79	74	2027	277	238
2013	83	77	2028	284	244
2014	87	81	2029	292	251
2015	116	102	2030	312	346
2016	121	106	2031	320	355
2017	126	111	2032	328	364
2018	131	115	2033	336	373
2019	136	119	2034	344	382
			Total	**5,198**	**4,968**

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 defined by a 10-km buffer around the project area and therefore made up mostly of the community management areas surrounding the Makira Protected Area 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 areas. 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 into the leakage belt and forests outside the intervention zone of the project, as well as deforestation in the leakage belt under the project scenario will be reduced to the values mentioned in the previous section.

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 GHG 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 differences in annual areas of deforestation in the leakage belt between the baseline and the project scenario for the two considered forest strata have been combined with the corresponding emission factors. This produced the final emission reductions of slightly more than 38 million tons of CO_2-e over 30 years as presented in Table 31 below.

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 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.

Table 31: 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	373,668	373,668	0	0
2006	400,590	292,472	40,059	68'060
2007	427,512	228,919	42,751	155'842
2008	454,435	179,176	45,443	229'815
2009	481,357	140,242	48,136	292'979
2010	599,838	109,768	59,984	430'086
2011	631,609	85,916	63,161	482'533
2012	663,381	67,247	66,338	529'796
2013	695,153	52,634	69,515	573'003
2014	726,925	41,197	72,692	613'035
2015	939,396	32,245	93,940	813'211
2016	978,735	32,245	97,874	848'616
2017	1,018,074	32,245	101,807	884'021
2018	1,057,413	32,245	105,741	919'426
2019	1,096,752	32,245	109,675	954'831
2020	1,436,270	32,245	143,627	1'260'397
2021	1,486,003	32,245	148,600	1'305'157
2022	1,535,736	32,245	153,574	1'349'917
2023	1,585,469	32,245	158,547	1'394'677
2024	1,635,202	32,245	163,520	1'439'436
2025	2,081,863	32,245	208,186	1'841'432
2026	2,143,312	32,245	214,331	1'896'736
2027	2,204,761	32,245	220,476	1'952'040
2028	2,266,210	32,245	226,621	2'007'344
2029	2,327,659	32,245	232,766	2'062'648
2030	2,932,085	32,245	293,209	2'606'631
2031	3,007,500	32,245	300,750	2'674'505
2032	3,082,914	32,245	308,291	2'742'378
2033	3,158,329	32,245	315,833	2'810'251
2034	3,233,743	32,245	323,374	2'878'124
Total	**44,661,894**	**2,216,142**	**4,428,823**	**38,016,930**

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. 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 aerial imagery in combination with the medium resolution satellite data used for developing benchmark forest and baseline deforestation maps (cf. section G 2.3). High-resolution imagery (eg. Google Earth) will be acquired for verification of the mapping accuracy.

Based on the remote sensing data outlined above, mapping of deforestation will follow the same procedures as the ones outlines in Section G2.3. 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 the 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 (cf. section G2.3). 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 descriptions provided in the carbon stock inventory report (cf. Annex II).

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 ($A_{Deg,i}$).
- 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 areas undergoing natural disturbance:

Where natural disturbances occur ex-post in the project area such as tectonic activity (earthquake, landslide, volcano), extreme weather (hurricane), pest, drought, or fire that result in a degradation of forest carbon stocks, the area disturbed shall be delineated and the resulting emissions estimated. Emissions resulting from natural disturbances may be omitted if they are deemed de minimis through the use of the module T-SIG.

The net carbon stock change as a result of the disturbance is equal to the area disturbed multiplied by the emission per unit area. In situations where the impact of disturbances on forest carbon stocks in a stratum varies spatially, the stratum may be further stratified based on post-natural disturbance carbon stocks. Where this occurs, such stratification by carbon stocks will be maintained for the project life.

If the disturbance event occurs ex-post in the project area, the area disturbed will be delineated and the area of each post-disturbance stratum must be delineated. The area disturbed in the with-project scenario will be tracked directly using the remote sensing techniques described in the appropriate section of the monitoring plan.

For unplanned deforestation as in the case of the Makira project, the total area to be considered in the project area ($A_{DistPA,q,i,t}$) shall be equal to the area of overlap between the delineated area of the disturbance and the summed area of unplanned deforestation in the project area ($A_{BSL,PA,unplanned,t}$), summed to the year in which the disturbance occurred.

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 occurs 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.

As demonstrated above, the Makira project operates two vehicles (Toyota 4x4) that do not exceed 100km per month due to the limited road infrastructure on site, three 125cc motorcycles, and one metal boat with a 45 hp outboard engine. Also, the Makira Project does not intend to promote livestock production nor make any use of chemical materials and fertilisers in promoting improved agricultural practices. Project emissions from fossil fuel consumption and from nitrogen application are therefore considered insignificant and accounted as zero and will not be monitored.

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 types 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

Conversion of forest land to non-forest land using fire:

In the case of the Makira project, CO_2 emissions from conversion of forest land to non-forest land using fire are accounted for as carbon stock changes and will thus also be monitored as such through the monitoring of deforestation. Non-CO_2 emissions from fires have not been included in the baseline, but if fires occur ex-post in the project they will be monitored if they are significant. In this case, the area burned per stratum (A_{burn}) will be equal to the area deforested per stratum in the project area during the monitoring period (cf. section G2.3.).

Greenhouse gas emissions from converting forests to non-forests by fire will be estimated following guidance from the E-BB module of the applied methodology and based on the IPCC 2006 Inventory Guidelines.

Periodical burning of grassland or agricultural land after deforestation:

Periodical burning of grassland or agricultural land after deforestation is an important component of agricultural techniques (tavy) observed in the Makira region and the main reason why forests do usually not regenerate after deforestation. Burned areas of non-forest land in the project area will be assessed using the MODIS (Moderate Resolution Imaging Spectroradiometer) based fire alert system developed by the University of Maryland (UMD) and rolled out in Madagascar since 2006 with support from USAID. The MODIS sensor, installed on two NASA satellites, allows detecting fires with an extension of 50 m^3 or more with very high accuracy. Each satellite passes over Madagascar twice a day, which results in a relatively high periodicity of four observations per day and thus allows tracking of fire activities almost in real time. The system has a round resolution of 1 km meaning that each fire occurrence point detected represents an area of 1 km^2 and can in fact contain more than one fire. Although MODIS is an infrared based sensor, heavy cloud cover and canopy coverage can hinder fire detection and lead to underestimation of fire occurrence in a given time frame, especially in Eastern Madagascar where cloud cover is more frequent and forests are more dense.

This detection system is linked to a global fire alert system automatically generating once per day alert e-mails to subscribers of the system. In the case of Madagascar, a central unit based at the Ministry of Environment and Forests receives the fire data from UMD and transforms into GIS data easier to use by the end user. However, users having the required technical capacities can subscribe directly to UMD in order to obtain alerts on fire occurrence in a defined area directly and transform the data into GIS data for more detailed analysis. This process will allow WCS to monitor occurrence of fire in the project area and thus monitor emissions from periodic fires occurring in grasslands and agricultural land after deforestation and integrate them into the project scenario for estimating total emission reductions.

Burning in forest land remaining forest land:

Biomass burning inside forests remaining forest, for example for regenerating forest pastures, is not a practice observed in or around the Makira protected area and therefore considered non significant and will not be monitored. However, fires occurring inside natural forests can also be monitored using the MODIS based system developed by the University of Maryland presented in the previous section. As this system is going to be used for monitoring periodic fires in grassland and agricultural lands after deforestation, emissions from burning inside forests could also be taken into account during monitoring if the appear to be significant.

Monitoring responsibilities and documentation

Responsibilities for monitoring and documenting climate aspects of the Makira project are described in detail in sections 4.3.7 and 4.3.8 of the Makira VCS project description.

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

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. The analysis shows net positive impacts of the project on the communities. A summary of what could have happened without the project and what will happen with the project is provided in table 23.

Financial Capital:

The creation of Makira protected areas will certainly cause restrictions of the access to resources. As a matter of fact, if there was no creation protected area, there would not be a clear delimitation of a customary use zone for the community and there would be a possibility for local communities to extend their current activities inside the Makira forests. Without the Makira project, people will continue to practice their usual traditional production methods and sources of income will come from agriculture and collect of forests products. With high population growth, the decrease in the soil fertility and the competition with migrants, there will be over-exploitation of available resources. Therefore, sources of income will be limited, erratic and non sustainable. 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 but only within the customary use zone and following the cahier des charges specified in the GCF contract (See Section G5.1.). However, we should precise that the delimitation of the customary use took into account the needs of the communities currently living in these areas (See PGES, 2008, PAGS, 2011). 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). Therefore, the limitation mainly concerns the extension of current activities.

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:

Currently, there is no good cohesion and organisation of the communities and that leads to a rush of non residents in developing illegal activities inside the forests and an over exploitation of the resources.

Through the implementation of project activities, 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.

With the arrivals of tourists as a result of community ecotourism development in the green belt area, there is a risk of depravity of mores, lifestyles, habits and morals amongst local communities (increase in prostitution, changes and non respect of the customs and traditional culture. This particular impact will be strongly addressed in the Information – Education – Communication as well as the community-support program components of the project. The project will ensure that the local communities are well prepared before the arrival of tourists and also that the project will provide continuous support to communities.

Human Capital:

Currently, the combination of several factors including high population growth rate with traditional and poor production techniques, low education and limited access to health services, especially for remote areas obstruct the community development and result in an intense poverty of rural communities.

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 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.

The development of community ecotourism though the Makira project could negatively impact the lifestyle, the practice of traditional knowledge and an increase in sexually transmitted disease, 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 activities has led to 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.

The only negative impact related to the project implementation would be that the closing of some of the "sentiers de liaison" linking different villages in the peripheral zones of Makira protected area will certainly cause trouble and negatively impact the free movement of people and goods across the

Makira landscape. However, given that only shortcuts were closed for circulation and people still can use the main “sentier de liaison”, this should not too much impede the circulation and exchanges between the different communities inside and outside the project zone.

Natural Capital:

Without the project, people will continue to practice their traditional production techniques including slash and burn rice culture. Despite the legal texts prohibiting several destructive practices such as animal hunting, deforestation, illegal mining or logging, and so on, with the current weak law enforcement, these will result in a high rate of deforestation, poor soil, erosion and sedimentation of rivers, and even in long term, a drying up of water sources.

With the restriction of access to forest resources inside the protected area, there could be a risk of over exploitation of resources within the greenbelt / protection zone. However, the delegation of management of the sites in the greenbelt to local communities with a clear determination of community resources uses will certainly limit such over exploitation. In fact, through the Makira Project, over 250,000 ha of forest and forest resources will be under community management through 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.

Table 32: A Comparison of without and with project scenario

	Without Project	**With Project**
HUMAN CAPITAL		
Health	• Limited access to health services • High population growth rate	• Development of partnership with qualified institutions and Public health services to develop community health program • Limitation of birth rate as a result of family planning program
Education	• High rate of illiteracy as a result of limited access to education service • Low percentage of children in full-time education	• Promotion of literacy in rural areas • Reinforce education through capacity building of teachers and development of teaching aids, building and/or rehabilitation of schools, provide furniture for schools
Knowledge and skills:	• Persistence of traditional agriculture and production practices (hunting, slash and burn cultivation, collecting of forest products, fishing, cattle raising)	• Build capacity of farmers in new and improved production techniques (SRI/SRA, poultry farming, fish farming, silkworm rearing, …)
NATURAL CAPITAL		
Land and production	• Soil impoverishment caused by slash and burn agriculture • Soil erosion and sedimentation of rivers and the Antongil Bay due to the degradation of watershed	Introduction of improved agriculture techniques, including fertilization, culture rotation, and watershed protection techniques
Water &aquatic resources	• Rivers provide drinking water and there is not sufficient water for culture irrigation	Improve provision of healthy drinking water Building of small dams for land irrigation Watershed protection
Wildlife, timber and NTPF product	• Overexploitation of forest resources (alimentation, construction, firewood,) in absence of a control and monitoring system • Illegal mining	Controlled and regulated use of natural resources Empowering local communities in resources management through transfer of management system to the detriment of non

		residents exploiters
Environmental Services	Alteration of multiples ecosystems services including irregularity of rainfall, increase in cyclone frequency and intensity, rain fall, insufficient genetic exchange due to habitat fragmentation	The protected area will help maintain the integrity of the forests landscape and the ecosystem services, including regulation of hydrological regime, stabilisation of micro-climate, carbon storage, and so on.
SOCIAL CAPITAL		
Networks and connections	• Easy / free access to forest resources by migrants coming from outside to the detriment of local communities. This leads to a conflict between residents and non residents. • Land insecurity in the absence of formal/ legal land ownership	• Development of land use plan • Empowering local communities through transfer of management • In collaboration with other partners, develop a program that help local communities to register their land and get a land certificate
Formal and informal groups	• Almost all the associations of villagers are informal and not able to fight for their interest face to intruders	• The project helps the communities to formalize their associations
Mechanisms for participation in decision-making	• It is rare that local communities are involved in any decision making process. • Women are almost not at all involve in any decision making	• Communities will be involved in the planning and decision making process. Representatives from the communities will be part of the steering committee of the protected area
PHYSICAL CAPITAL		
Infrastructure - Transport - Roads, Vehicles	• Transport is mainly by foot or bicycles on trails through the forest and along /across rivers by canoe or motorboat. There are no roads suitable for vehicles. • A multitude of "sentiers de liaisons" exist all across the Makira forests that people from different parts of the region use to go from an area to another area.	• The situation will be the same even with project except that some of the "sentiers de liaisons" that are used as shortcuts will be closed and therefore, people will be obliged to only use the main "sentiers de liaisons" that will remain open
Infrastructure - Secure shelter & Buildings	• Most of the buildings use woods as the main materials. They does not resist long time and cause a destruction of forests	• The project promotes the building of permanent structure, especially for public infrastructure such as schools and health centre.

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.	• Important efforts have been done and will be done to provide drinking water and water for irrigation to all surrounding communities.
FINANCIAL CAPITAL		
Incomes/Wages	• Without the Makira project, people will continue to practice their usual traditional production methods. Sources of income will come from agriculture and collect of forests products. With high population growth, the decrease in the soil fertility and the competition with migrants, there will over-exploitation of available resources. Therefore, sources of income will be limited, erratic and non sustainable. • The population is not able to search for potential and develop market for their production	• 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 but only within the customary use zone and following the cahier des charges . • With the promotion of new improved production methods and development of income generating activities, sources of income will be more diverse and more sustainable. • Assistance will be provided to communities to facilitate access to market. • 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. • Various employments will be provided to members of communities
Savings/ Credit/debt - formal, informal, NGOs	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.	Development of a microfinance program in the project zone will help local communities' access micro-credit and promote savings

CM1.2. Impact on high conservation value

The community-related High Conservation Values identified for Makira are: HCV4, 5 and 6. The zones which provide critical ecosystem services (HCV4) fit inside the protected area, and zones that are fundamental to meet needs for the communities (HCV5) or critical zones for cultural identity (HCV6) are included inside community-managed forests. This integrative approach has increased community awareness of the long-term economic (including the existence value) and cultural value of their resources.

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. Deforestation leads to increased erosion, flooding and silting of drainages, which could have disastrous impacts on the local populations. These areas that provide basic ecosystem services are delimitated to fall inside the protected area. 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.

Through the activities of the Makira Project, especially the management of the Makira protected area, these HCV services will not be negatively impacts, but rather secured.

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 zoning for human settlement and use, was carried out with full engagement of local communities. Zoning between the 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. Outside the protected area in the protection zone, resources management is transferred to local community and this latter will receive organizational, technical and financial support from the project in performing its responsibilities. The Makira Project will therefore not compromise the local communities' ability to meet their needs from the forest; furthermore, it will maintain and even enhance this 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 limits of the Makira Project are based on extensive socioeconomic inventories and surveys. The zoning of the project zone, and especially the delimitation of the Makira Protected Area boundaries and those of its surrounding Protection Zone were realized in consultation with a wide range of stakeholders and especially the local communities. The limits were set to exclude from the protected area any localities of traditional cultural identity, such as tombs or traditional rituals. Those are delimited inside the protection zone that is properly managed by the community itself. 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 zoning 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:

- With the restriction and regulations of access to forest resources inside the project zone, there is a risk of over exploitation of resources outside the project zone.
- To a certain measure, there could be a limitation of access to land for offsite communities for commercial exploitation purpose. In fact, people that are mainly dependents to the Makira forests are regrouped inside the project zone.
- The closing of some of the "sentiers de liaison" linking different villages in the peripheral zones of Makira protected area will certainly cause trouble and negatively impact the free movement of people and goods across the Makira landscape. However, given that only shortcuts were closed and people still can use the main "sentier de liaison", this should not too much impede the circulation and exchanges between the different communities inside and outside the project zone.
- 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;
- Increase in the costs of living;
- 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 income generating activities, the population, health and environmental program, access to family planning products, awareness-raising campaigns and socio-cultural project development.

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. Likewise, through the collaboration with and capacity building of the various services at the Commune and District level, including environment and forests (DREF, CEF), population health (CSB at communes level, Health Services at the district level), services of livestock, services of agriculture, the Makira project activities also benefit the offsite communities. 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 will 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

A preliminary community monitoring plan has been developed as shown in table 33 to monitor the social and economic well-being of communities and stakeholder groups. This plan was developed using criteria and indicators that were chosen based on community livelihood needs identified during the preliminary socio-economic inventories and surveys. This monitoring plan will be further refined to examine particular community impacts that may become apparent during the implementation of the Makira Project. Thus, a more detailed plan will be developed and its implementation will be primarily led by the communities themselves but with the support from the project. A participatory approach will be adopted in the design of the monitoring plan with the participation of stakeholder through discussions, local villagers' focal groups, and household-level interviews. This will help identifying the appropriate principles, criteria, interventions, and indicators.

Table 33: 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 time	- Total household income increased - Number of person/household having access to microfinance increased - Nb. of employments (full and part time) created and offered to community members increased - Percentage of COBAs benefiting from the carbon revenues increased
Social Capital	Maintenance of a set of dynamic rules and norms	Measured annually during the project life time	- 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 access to health care and schooling	Measured every five years during the project life time	- Number of household having access to health care increased
			- Infant mortality rate 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 time	- Number of normalized water supplies increased
			- Small scale dam for agriculture improved and created
Natural Capital	Access to and management of natural resource goods and services is improved.	Measured every two years during the project life time	- suitable areas available for agricultural increased
			- areas transferred for community management increased

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

Areas that contain the HCV 4 fall inside the Makira protected area. Maintenance of the ecosystem services is directly related to the conservation of the biodiversity and their habitats; and their monitoring is integrated in the biodiversity monitoring plan in the section B.3.1 and B.3.2.

As for HCV 5, they are mainly located within the protection zone that is managed by the communities themselves and are subject to a participatory monitoring program carried out by the community with organizational, technical and financial support from the project. Through giving local communities a sense of responsibility to manage their own resources and through the development of a series of management tools including “dina” and management plan, the project ensured that the resources remains available, sustainably managed and is equitably shared amongst community members.

Each of the community management site that compose the protection zone will have its own monitoring plan. Monitoring plan will be developed using quantifiable measurements of set socio-economic indicators under an appropriate methodology. An inventory of resources is carried out during the process of putting in place of each GCF site and it serves as the baseline. A periodic measurements is then conducted as part of a participatory monitoring program after the conclusion of the management contract. Community monitoring plan could differ from one community managed site to another depending on the types of resources available and needs of the community but in general, the variables of importance would include :

- Amount of revenues issued from different resources uses
- Costs of products issued from forest resources
- Number of infractions related to resources extraction
- Amount of cut woods
- Number of harvesting permit issued
- Number of species of medicinal plant available for community uses

As for HCV6, there is no need for monitoring plan as the none of the traditional rituals has negative effects on the resources and that areas containing this category of HCV are entirely located within the protection zone that is managed by the communities themselves.

CM 3.3. Development of full monitoring plan

Wildlife Conservation Society commits to develop a full detailed monitoring plan that includes key biodiversity and community welfare indicators within twelve months of validation against the Standards and to make that plan as well as the results of monitoring available to the public on the internet. We will also communicate the plan to local communities and other stakeholders groups, as has been our approach to all communication throughout the project lifetime. Results will be disseminated using different means, such as 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 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.

Maintenance of forest cover and reduction of habitat 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.

No 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*).

Increase in targeted conservation species population:

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, cf. table 34).

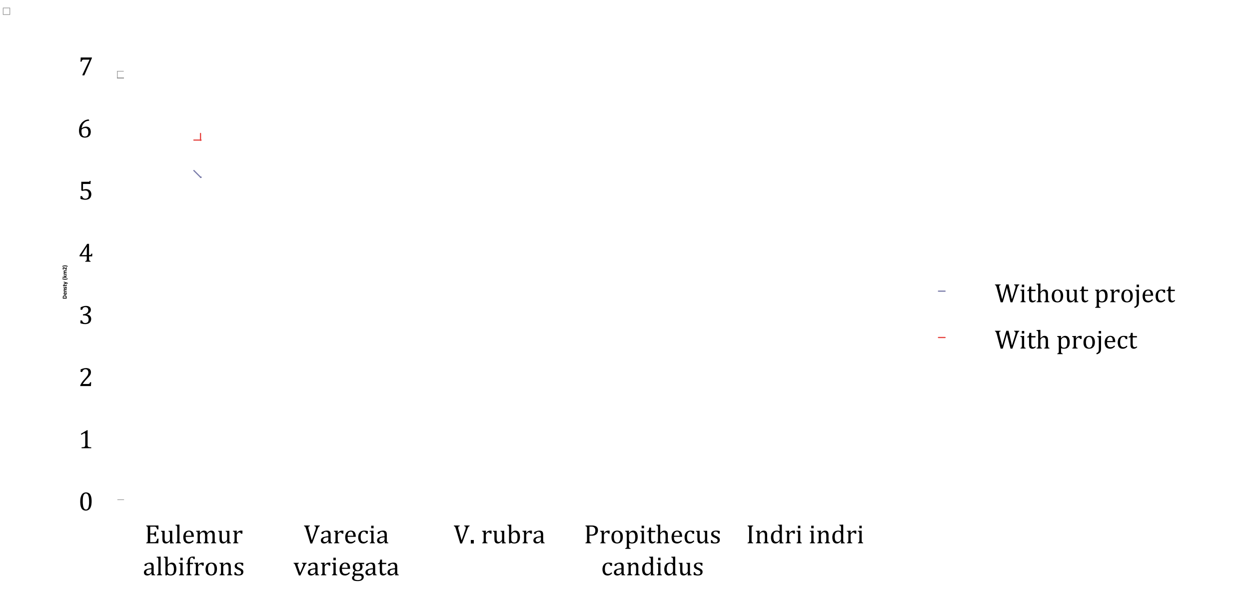
Table 34: The changes in some existing biodiversity attributes in the without- and with-project scenarios

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

Figure 26 below 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 26: 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.[67] 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 watercourses and the aquatic biodiversity that they support. The net positive impacts of the Makira Project are summarized in table 35.

Table 35: 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 0.02%/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, intensive 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 water, wetland and marine species to be maintained

[67] 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 Biodiversity related HCVs. On the contrary, given the project's conservation objectives, it is expected to enhance those HCVs.

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, refuges) 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. 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 zone 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. However, the creation of Makira protected area and the transfer of the management of the surrounding protection zone to local communities could indirectly cause negative impact on the biodiversity in the peripheral zones; where there is no organized resources management. Potential impacts could include an intensification of human activities and an overexploitation of forest resources outside the project zone including gathering of important amount of all sort of forest products for commercial purpose, animal hunting, selective logging, and/or illegal mining. As a result, there could be an impoverishment of the soil and the vegetation, destruction of animal habitats, decline of wild plants and animal populations

B2.2. Plan to mitigate negative offsite biodiversity impacts

As mitigation measures for possible offsite negative biodiversity impacts, the project will ensures that community support efforts are extended to offsite communities in the peripheral zone, so as to promote sustainable economic alternatives to destructive and unsustainable activities. A principal component of this effort will the development of an Information, Education and Communication (IEC) program that will raise offsite community awareness of the economic, health and human welfare benefits of environmental protection.

The presence of Makira Project will also 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.

B2.3 Unmitigated negative offsite biodiversity impacts

No potential unmitigated negative offsite biodiversity impacts as a result of the project activities are identified. With the continuous efforts to empower local authorities and support them in law enforcement, illegal activities both within the project zone and in the offsite zone will be reduced compared to what was the case before the project. There is not doubt on the net positive effect of the project on biodiversity.

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

To ensure the integrity of Makira's unique biodiversity, a multifaceted monitoring program has also been established, which includes a more scientific ecological monitoring inside the protected area and participatory ecological monitoring within the community managed protection zone.

a) Scientific ecological monitoring

The establishment of the Makira Forest Protected Area included identification and zoning of those areas critical to the continued existence of critically endangered and area-sensitive species. The scientific ecological monitoring aims to monitor the change of status of the biodiversity in general and the conservation targets identified for the Makira protected area in particular. These include the (i) dense humid forests habitats (low and mid elevation), (ii) the 8 diurnal lemur species (*Eulemur fulvus, E. rubriventer, E. albifrons, Vareciavarietaga, V. rubra, Propithecus candidus, Indri indri* and *Hapalemur griseus),* (iii) the fosa (*Cryptoprocta ferox*) population and (iv) the 5 main forests corridors.

In addition to these conservation targets, water quality of the main rivers will also be monitored as part of the ecological monitoring.

18 sites within the Makira protected covering different types of habitats and containing key target species are identified for this first type of monitoring. These include

- 6 sites targeting the most important forest corridors namely Besariaka, Manandriana, Maintimbato, Ampipoahantsatroka, Anjiahely and Lokaitra. These are the most fragile corridor given their size and the importance of the pressures they undergo.
- 6 sites containing key targeted diurnal lemur species. Those are Maherivatra, Soavera, Amparihibe, Anjanaharibe, Mangabe and Bevitsika. Each of these sites shelter one or more particular diurnal species.
- 6 sites chosen for the monitoring of forest cover: Makira Plateau, Andrianabe, Lohan'I Sahantaha, Vinanibe, Amponaomby et Amparihimolengy. These sites contain all types of habitats and include intact, slightly and more severely degraded forests.

Components of the scientific monitoring activities include the following (see also table 36 below):

Monitoring forest habitats:

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, annual 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 through groundtruthing 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"[68] 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. In addition; botanical inventory will be carried out annually on a 1Ha plot.

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.

Monitoring Diurnal lemurs species population:

Annual inventory will be carried out along transects to monitor the density of the 8 diurnal lemur species. In addition, given that hunting is the main pressure undergone by diurnal lemurs and carnivores in the project zone[69]. 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

[68] 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.

[69] 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

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.

Monitoring of Fosa

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.

Monitoring forest corridors and 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 park management teams in collaboration with local community.

Water quality:

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 kilometres 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 within the watershed. The parameters that were measured for in each sample basin include land use characteristics, stream temperature, conductivity, sediment load, and discharge rate, rainfall and total nitrogen[70].

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

Table 36: Biodiversity monitoring plan for the Makira Project

Threats to the Biodiversity	Monitoring methods	Time frame	Target
Forest Habitat (loss and fragmentation)	remote sensing aerial surveys field survey	2 years basis Annual annual	Deforestation rate below 0.02%/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
Diurnal lemur species population decline	Density of targeted species Monitoring the number of potential passive traps	Annual Bi- annual	Population density of targeted lemurs increase above 30% of the current value Zero traps inside the project area
Forest corridors and connectivity	Tree growth and width of sensitive narrow forest corridors	Bi-annual	Increase of corridor width
Water quality	Water quality parameters of major rivers and lakes	Bi-annual	Value to be compared to the benchmark value

b) Participatory Ecological Monitoring

Participatory ecological monitoring will be carried out along the protected area boundaries and within the community managed protection zone. The activities are led by members of the local communities that receive a special training on the matter and also benefit from a continuous support from the project. The proposed biodiversity monitoring methodologies draw 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.

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) status of key floral and faunal species, (ii) nature, importance and frequency of pressures, (iii) nature and frequency of infractions observed in the forests, (iii) types, abundance and locality of resources uses

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 (cf. table 37). 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 37: 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 0,02% 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 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. Likely 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 – including 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 refuge for plant species currently distributed in low elevation humid forests, all humid forest plant species are expected 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, Razafimpahanana 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 vertebrate 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 contraptions 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 modelled – 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 adaptation that were identified by communities during the assessment.

Impact	Adaptation	Barrier
Less cultivable land; soil erosion in highlands	Improved and intensified management 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 cycles	
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 centre 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 through 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 mitigation 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 Razafimpahanana reports the following impacts/scenarios for temperature, 23 indicator species and human agriculture practices.

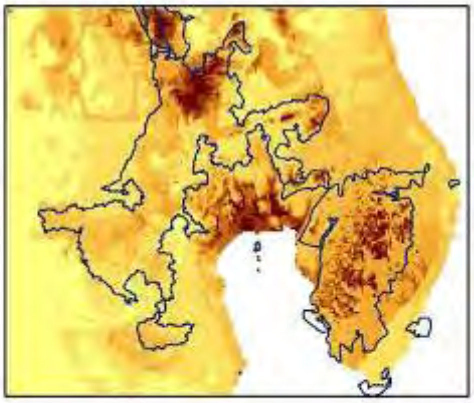
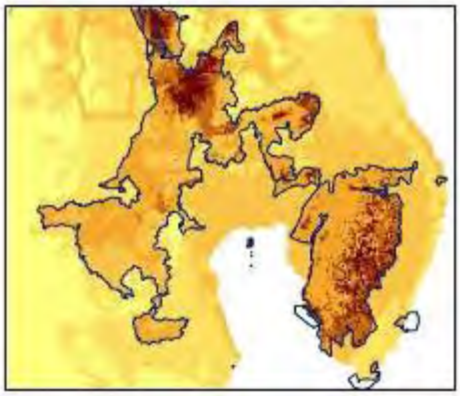
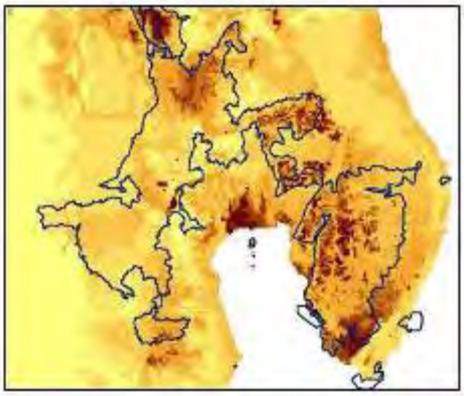
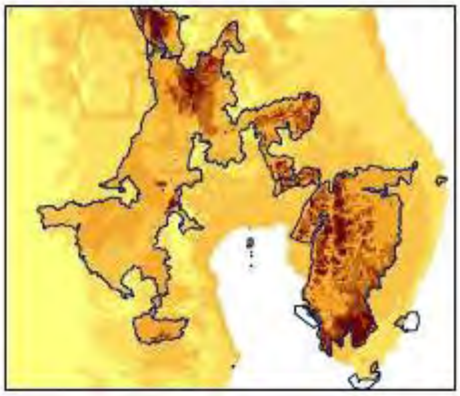
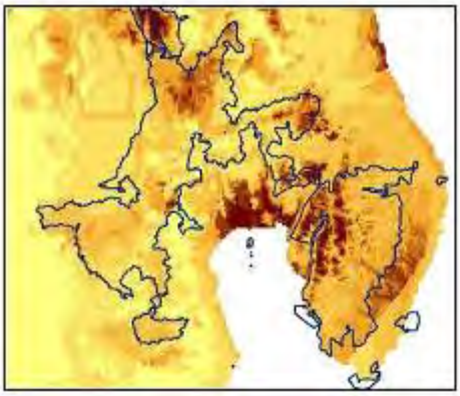
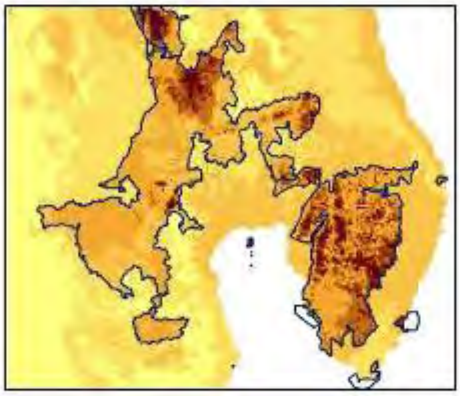
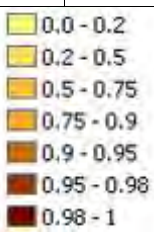
- There will be a mean yearly temperature increase between 2.06 and 3.26 degree C in the next century.
- Of 12 vertebrate species considered (4 mammal and 8 bird) all show significant range contractions over an 80-year, with some *Brachypteracias leptosomus*, *Euryceros prevostii*, *Mesitornis unicolor, Indri indri,* and *Varecia variegata* disappearing completely (Razafimpahanana, 2010).
- Of 11 plant species considered all show range contraptions 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 modelled – 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 through 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 activities and initiatives in concert will assure effective community stewardship over local natural resources that will lead to improved sustainable livelihoods in the face of climate change and climate variability.

Figure 27: ZONATION modelling of change in biodiversity within and around the Makira Protected Area over 80-year time period

<table>
<tr><td colspan="3">Indices of Biodiversity</td></tr>
<tr><td></td><td>Without Protected Area</td><td>With Protected Area</td></tr>
<tr><td>2000</td><td></td><td></td></tr>
<tr><td>2050</td><td></td><td></td></tr>
<tr><td>2080</td><td></td><td></td></tr>
<tr><td colspan="3">

Gradient of biodiversity concentration</td></tr>
</table>

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 refuge (cf. figure 27). As detailed in Section B1.1, principal net positive benefits of the establishment of the Makira Protected Area will be ensured connectivity and reduced deforestation, which directly support maintenance of biological and ecological integrity in the face of climate change and climate vulnerability.

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.

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 (cf. table 38). 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 endangered 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 endangered 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.

Table 38: Lemur species occurring within the Makira forests

Species Name	**Common Name**	**Conservation Status**
Indri indri	Indri	Endangered
Varecia variegata	Black and White Ruffed Lemur	Critically Endangered
Varecia rubra	Red Ruffed Lemur	Endangered
Eulemur fulvus .	Common Brown Lemur	Near threatened
Eulemur albifrons	White-fronted Brown lemur	Vulnerable
Eulemur rubriventer	Red-bellied lemur	Vulnerable
Hapalemur 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 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

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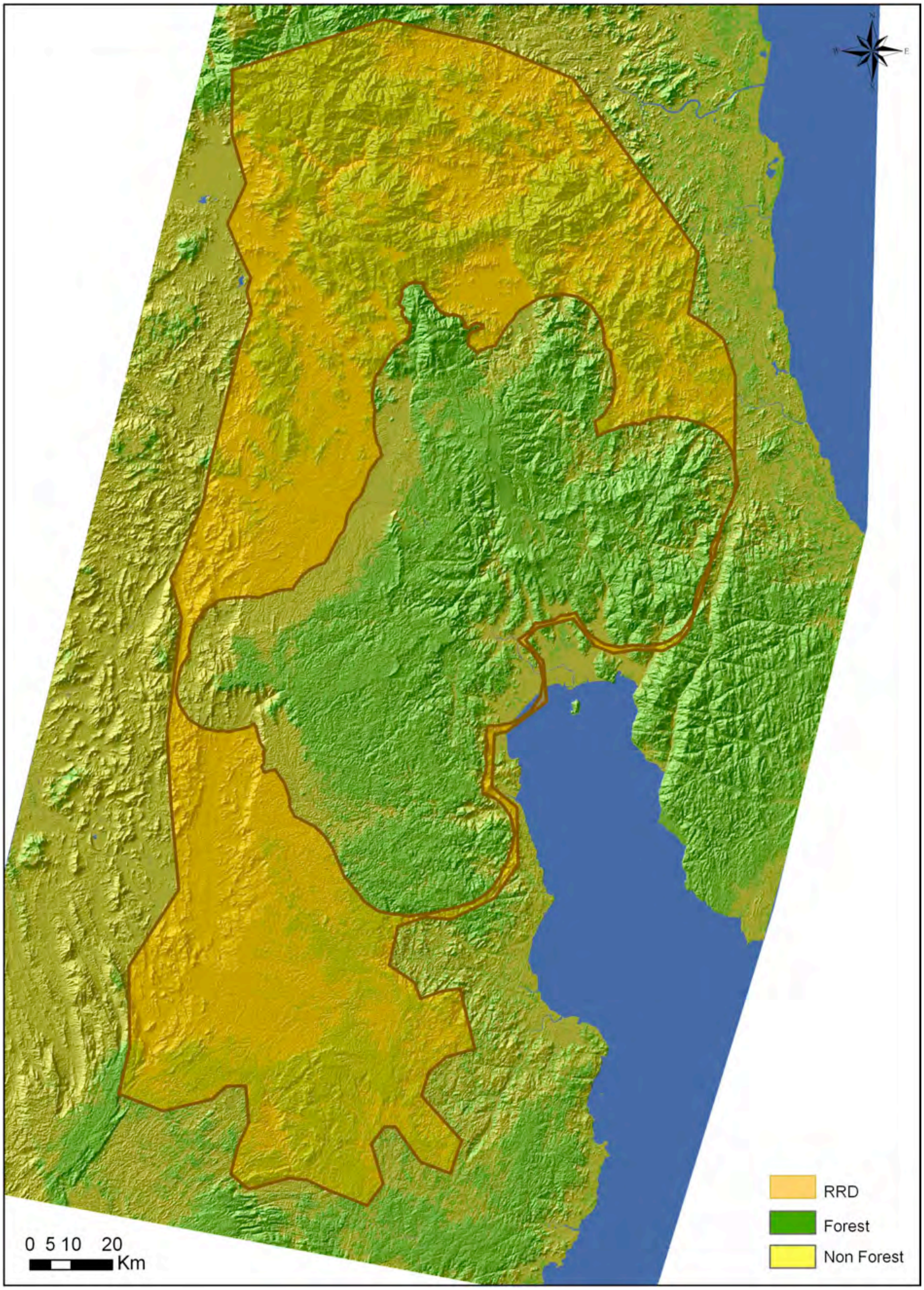
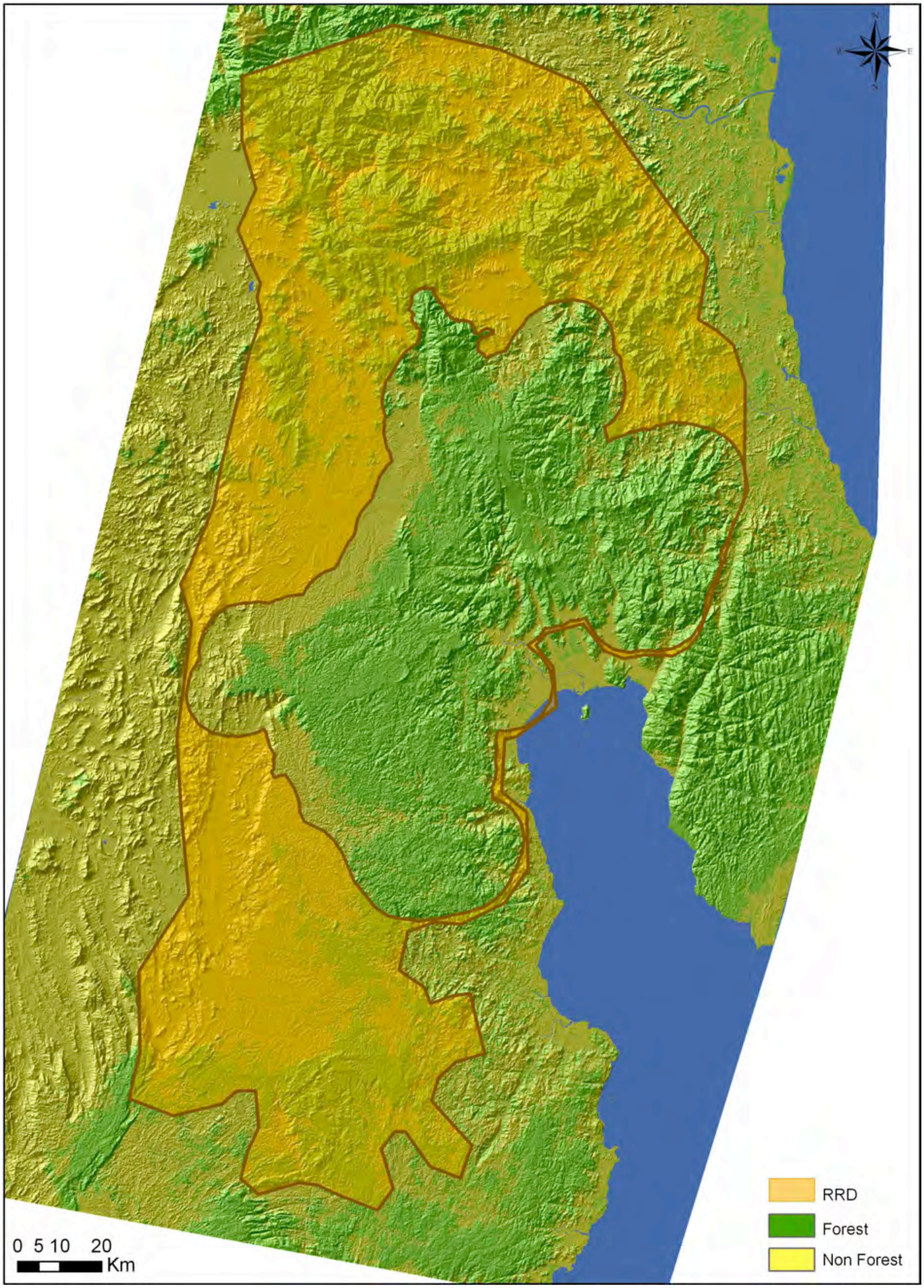
Appendix I

Maps

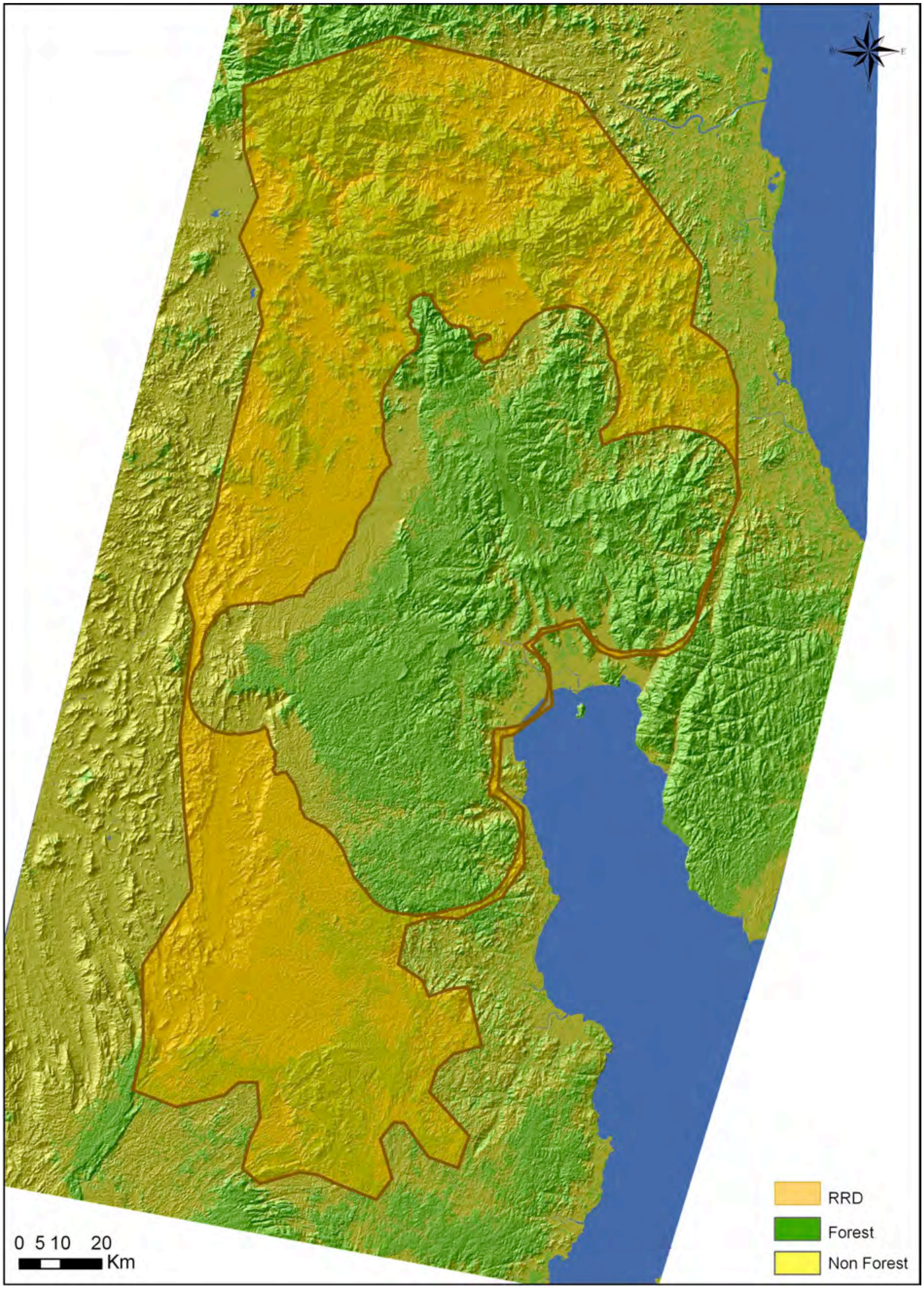
Forest Cover in 1995



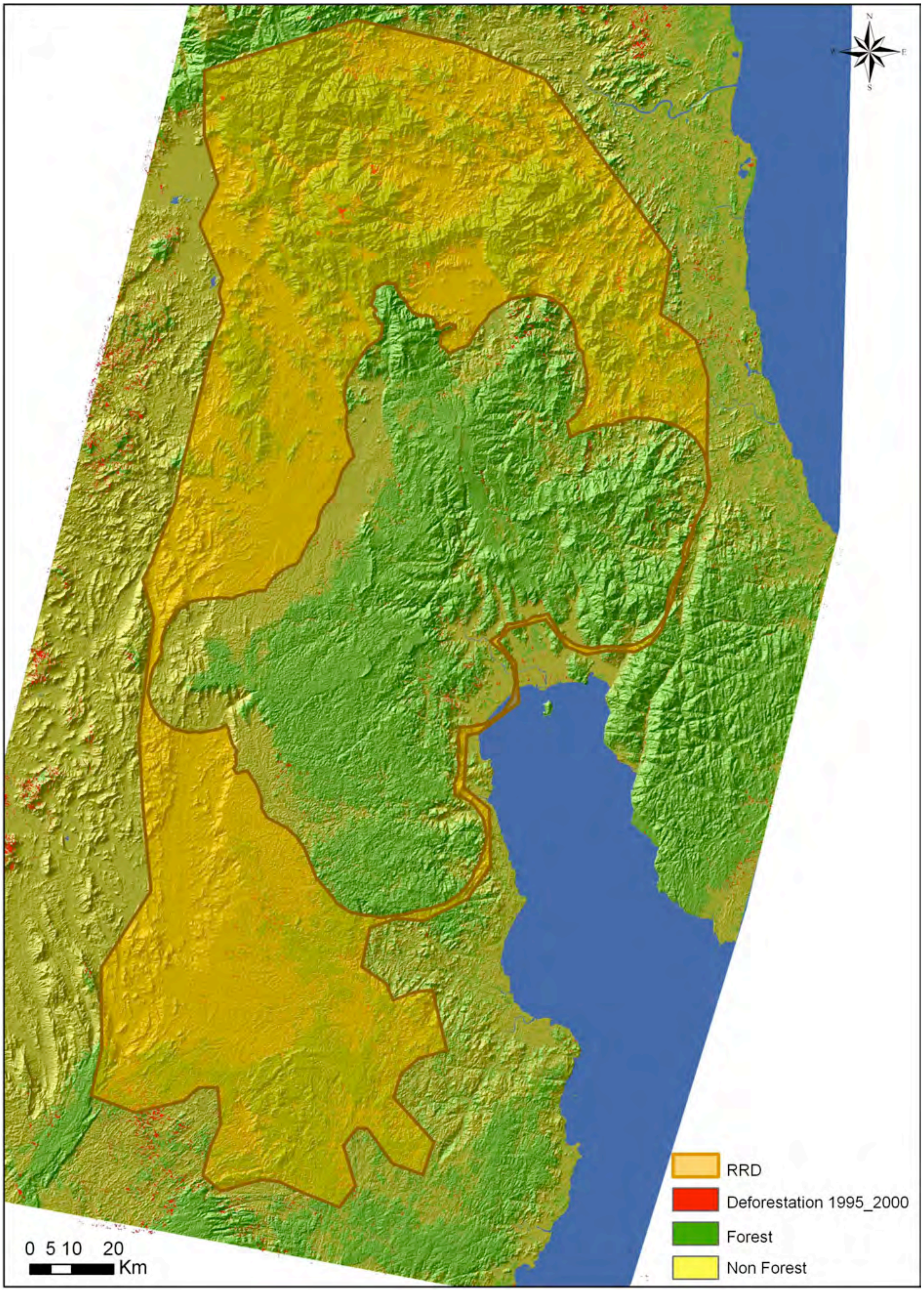
Forest Cover in 2000



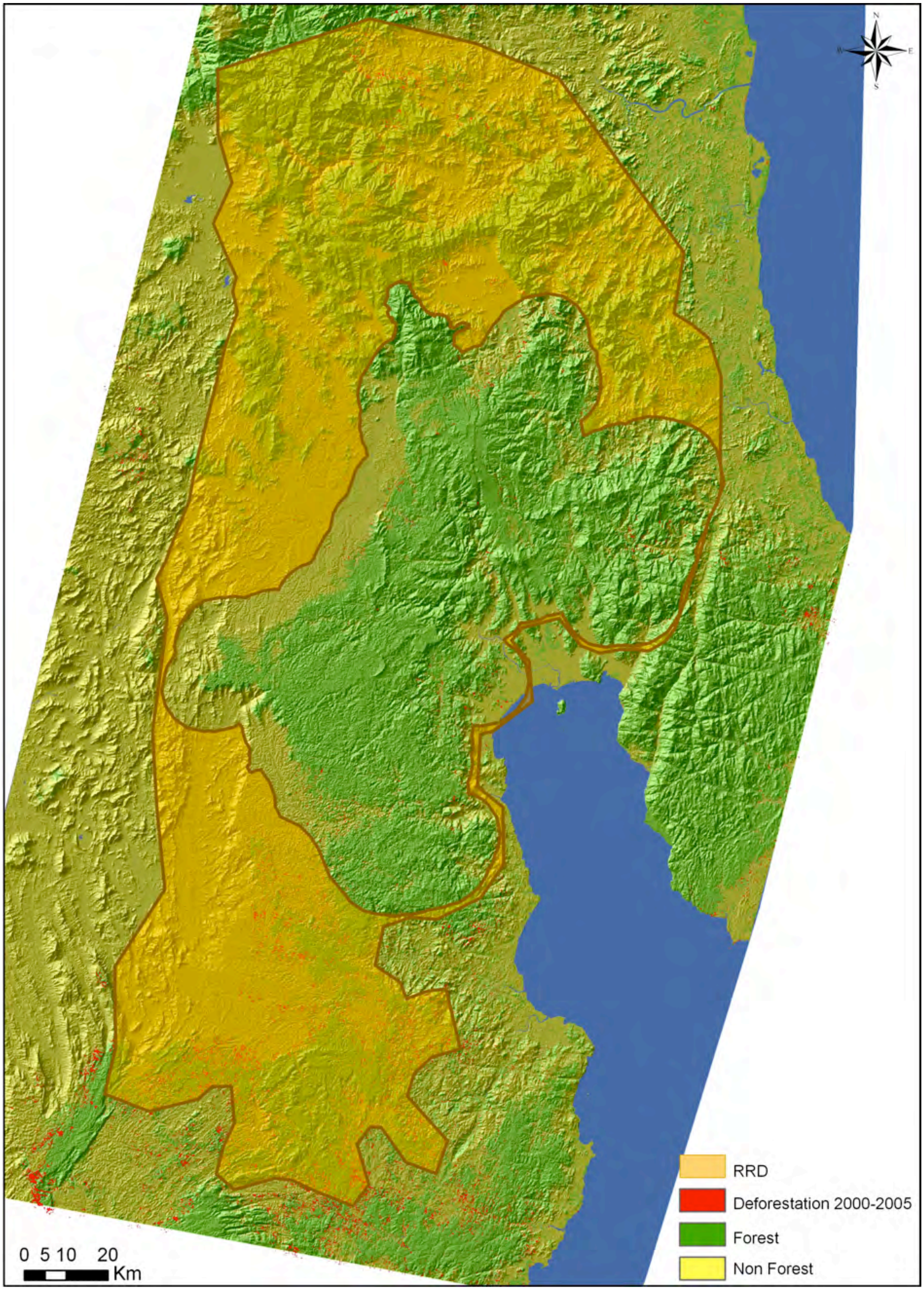
Forest Cover in 2005



Deforestation 1995 to 2000



Deforestation 2000 to 2005



Appendix II

WCS Technical Field Report of Makira Terrestrial Carbon Stock Measurements

A. Introduction

The present report outlines the methodologies used during field data collection/measurement. Detailed descriptions of the field measurement methods used can be found in Makira Terrestrial Carbon Stock Measurement Standard Operating Procedures. 2009. WCS Madagascar. These methods are based on the manual: Standard Operating Procedures for Measuring Terrestrial Carbon, Winrock International 2008[1].

B. Methods

B.1 Definition of classes of land-use and land-cover

Management of the Makira Protected Area is subdivided into different zones including a strict protection core zone and a buffer or protection zone. The Makira Project boundary strata 'low altitude intact forest' and 'mid-altitude intact forest' are also located within the 'Makira Protected Area Core Zone'. The core zone is generally surrounded by a buffer of mixed forest and agricultural land. These buffer forests have been managed by local communities since 2005 and represent the 'Protection Zone'. Historically the pressure exerted by the local communities on these buffer forests in the now defined Protection Zone has led to mid and low-altitude degraded forests as well as savoka.

Initial forest strata were determined using a combination of forest cover layers, high resolution aerial photography, expert knowledge, and field verification. GPS points were located on screen from the aerial images represented by the ENSOMOZAIC and verified in the field by groundtruthing. GIS layers (Madagascar FTM BD500 contour line, Kew Forest cover with strata altitudes, CI forest cover change of forest cover 1990-2005) were used to identify each stratum. ENSOMOSAIC very high resolution aerial imagery from 2007 was then used to confirm forest strata (intact/degraded).

The classes of land-use and land cover existing in the reference area, leakage belt and the project area were inspired from Kew forest classification (Atlas of vegetation of Madagascar (Justin Moat, Paul Smith). This classification distinguishes fragmented forest/agriculture; high altitude grassland, lowland (0-500m) and mid-altitude (500-1,200 m) humid evergreen forest, humid escarpment forest.

The official national differentiation of habitat zones, used mainly by the 1997 national forest inventory includes 'low-altitude forest' defined as 0-800 meters and 'mid-altitude forest' defined as forest from 800-1,800 meters[2]. The national forest inventory identifies in addition forest formations above 1,800 m altitude. However, the Makira forests culminate at about 1,200 m and this forest type has not been used. No consulted source makes a distinction between forests in the East and in the West of the Makira project area. Within the project area, using the expert opinion of WCS researchers, this national scale habitat zone map was further stratified based on the ease of human access and risk of deforestation. WCS-Makira field researchers have spent over three years carrying out field delimitation, habitat and forest type delineation and therefore have a thorough knowledge of the landscape.

B.2. Preliminary Inventory

The preliminary inventory had the following two main objectives: i) to verify if the creation of strata based on the degree of forest degradation (intact and degraded forests) was appropriate; and b) to determine the necessary number of samples to be measures in each strata in order to reach a given accuracy of the inventory results.

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1 S. Walker, T. Pearson, N. Harris, K. MacDicken, S. Brown (2008) Procédures opérationnelles standard pour mesurer le carbone terrestre. Winrock International.

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

Preliminary stratification:

For the preliminary carbon stock inventory, forest strata were first defined spatially based on their altitude with the 500 m level curve separating low altitude from mid-altitude and the 800 m level curve as upper altitude limit for the preliminary inventory. This relatively limited altitude range was chosen for the preliminary inventory for two reasons: i) altitudes below 800 m are still relatively easy to access while measuring samples in forests aboce 800 m seemed too chalenging in the cotext of a preliminary inventory.; and ii) recent studies (particularly Asner et al. 2011[3]) suggest that forest degradation in Madagascar happens mostly at altitudes between 500 (southern Madagascar) and 1,000 m (Northern Madagascar) and as the degree of degradation was one of the stratification criteria this range seemed appropriate.

In a second step we tried to distinguish between different density levels with intact strata representing the primary humid forest and degraded strata representing forests with lower tree density due to human interventions. This second stratification was based essentially on the Kew vegetation atlas mentioned above, mainly because although IEFN also distinguishes between intact and degraded forests spatial data was not available in shapefile format, which was the case for the Kew data. From these map-based exercises, the following five preliminary forest strata were identified (cf. figure 1):

- Low-altitude (0 – 500 m) intact forest (FIB):
  111,035.8 ha forest cover
- Low-altitude (0 – 500 m) degraded forest (FDB):
  20,241.6 ha forest cover
- Mid-altitude (500 – 800 m) intact forest (FIM):
  199,070.9 ha forest cover
- Mid-altitude (500 – 800 m) degraded forest (FDM): 11,407.8 ha forest cover
- Savoka (SVK) representing forest land cleared for agriculture and generally located at altitudes below 500 m.

Field Measurement Structure

Field Teams were trained by WINROCK INTERNATIONAL with theoretical training held in Antananarivo during 3 days and practical training conducted in Maroantsetra with 3 teams composed each by 1 crew chief with 6 to 8 crew member, depending on the size of the plots area. Field measurements took place between October 2008 and April 2009. The field teams were lead by Serge Stevens, WCS Makira Project Research and Conservation Officer.

Preliminary field plot location

Prior to the actual field data collection to estimate the carbon stocks of each stratum, the number of sample plots per strata required to achieve a given precision level was estimated through the field collection of preliminary data in each defined preliminary strata. The location of all preliminary measurement plots were identified in GIS and then uploaded to GPS units[4]. Ten plots per strata were purposely located in relatively accessible locations areas inside the project area and the leakage belt and were not randomly distributed (cf. figure 23).

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[3] Asner G.P, J.K. Clark1, J. Mascaro, R. Vaudry, K.D. Chadwick1, G. Vieilledent, M. Rasamoelina, A. Balaji, T. Kennedy-Bowdoin, L. Maatoug, M.S. Colgan and D.E. Knapp, 2011. *Human and environmental controls over aboveground carbon storage in Madagascar*. Carbon Balance and Management 2012, 7 :12.

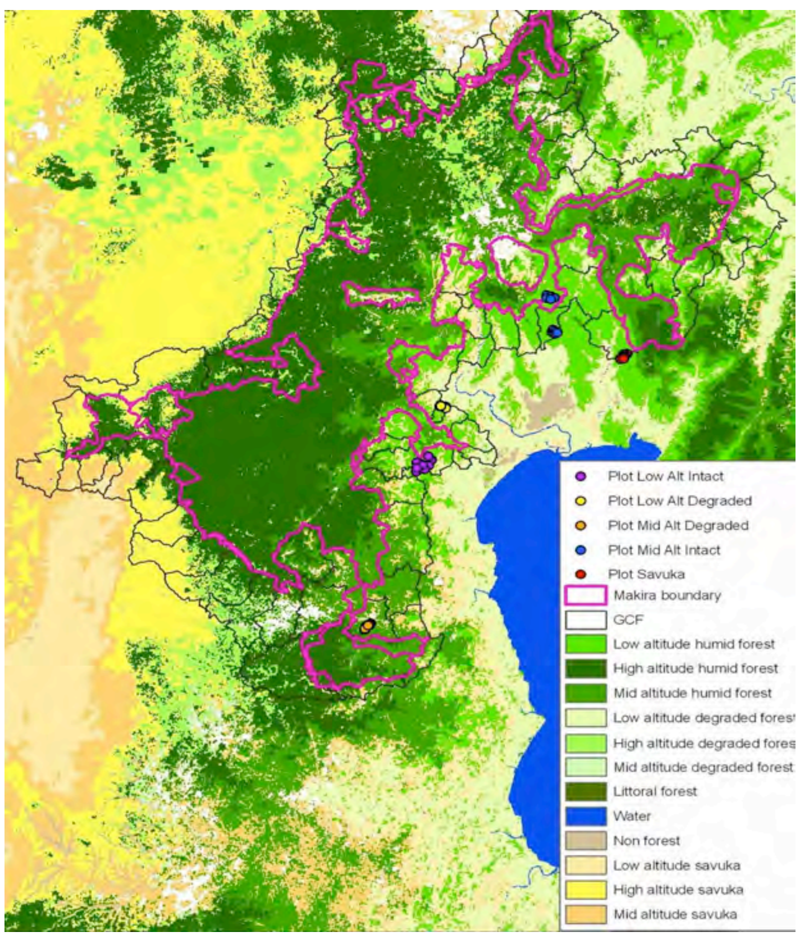
4 Garmin model GPSMAP 60cx

This distribution of sampling plots is quite usual for preliminary forest inventories and was chosen essentially in order to accelerate the preliminary inventory and move on more rapidly to the final inventory. However, this also meant that the sampling points from the preliminary inventory would not be used in a later stage for the final inventory, although the methodology used was the same in both inventories (see below).

Once in the field, the field teams navigated to the pre-identified field measurement plots. However, in certain cases the pre-identified field measurement plot was found to lie outside the forest stratum. In these cases, the team relocated to the closest point inside the forest stratum. The decision where to relocate the point was based on consultation of the available field maps and discussion among team members who were familiar with the terrain. Once the first plot for that identified stratum was in place and measurements taken, the team moved to the second identified plot, using the GPS. The reference land cover classification used at this stage was vegetation cover map developed by Kew in 2005, which seams to be the reason why the forest sampling plots determined based on the map did sometimes not match up with the real forest cover in the field.

Often local guides proved to be very knowledgeable about the forest and its different types and were trained to get the minimum of knowledge to be able to use forest tools like DBH meter, etc. The same procedures were followed until 10 plots per stratum were established on the ground.

Figure 1: Map of the identified forest strata and distribution of sample points for the preliminary carbon stock inventory conducted in the Makira forests



Preliminary StrataPreliminary Sampling Points

Table 1: Statistical values computed for the preliminary carbon stock inventory

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	4	68,068.3731	17,017.0933	1.37	0.2512
Error	75	929,115.7493	12,388.2100	-	-
Corrected Total	79	997,184.1223	-	-	-
	R-Square	**Coeff Var**	**Root MSE**	**AGCarbon Mean**	
	0.0683	38.4917	111.3023	289.1590	
Source	**DF**	**Type I SS**	**Mean Square**	**F Value**	**Pr > F**
Strata	4	68,068.3731	17,017.0933	1.37	0.2512
Source	**DF**	**Type III SS**	**Mean Square**	**F Value**	**Pr > F**
Strata	4	68,068.3731	17,017.0933	1.37	0.2512
Contrast	**DF**	**Contrast SS**	**Mean Square**	**F Value**	**Pr > F**
FDB vs. All	1	2,709.0688	2,709.0688	0.22	0.6414
FDB vs. FDM	1	21,914.8481	21,914.8481	1.77	0.1875
FDB vs. FIB	1	7,842.7801	7,842.7801	0.63	0.4287
FDB vs. FIM	1	11,049.2304	11,049.2304	0.89	0.3480
FDM vs. All	1	18,280.2496	18,280.2496	1.48	0.2283
FDM vs. FIB	1	55,977.7224	55,977.7224	4.52	0.0368
FDM vs. FIM	1	1,842.2401	1,842.2401	0.15	0.7009
FIB vs. All	1	18,280.2496	18,280.2496	1.48	0.2283
FIB vs. FIM	1	55,977.7224	55,977.7224	4.52	0.0368
FIM vs. All	1	26,918.4964	26,918.4964	2.17	0.1446

Dependent Variable: Above Ground Carbon (Tree, Standing and Lying Dead Wood)

Estimates of Carbon Stocks in Preliminary Plots

From the data measured in the field, forest carbon stocks have been estimated using one of the pan-tropical equations for dense humid forests proposed by Chave et al.[5] has been used. As tree height was 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:

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

Where:

C_{AB_tree}	=	Aboveground biomass of individual tree; t d.m./tree
ρ	=	Wood specific gravity; t d.m./m^3. 0.5 has been used for all species as this seemed to be a conservative value for species in dense humid forest in Madagascar
dbh	=	Diameter at breast height of individual tree; m

Analyses of pilot data collected from the 40 pilot plots (10 plots in each of the four forest strata) indicated that there was no statistically significant difference in the estimated carbon stocks (SAS proc GLM) between low-altitude intact (FIB) and degraded (FDB) forests nor was there significant difference between mid-altitude intact (FIM) and degraded (FDM) forests. Statistically significant difference was however detected between low-altitude (FIB and FDB) and mid-altitude (FIM and FDM) forests across the two degrees of degradation (cf. table 1).

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

From this results it was decided to remove the forest strata based on forest degradation from the strata classifications and reduce the number of forest strata under consideration to two, based essentially on altitude based essentially on the strata used in the national forest inventory (IEFN 1997): low altitude forest (0 – 500 m) and mid-altitude forest (800 – 1,800 m).

Estimation of needed sample size
Upon classifying the two forest strata based on altitude only, the number of sampling plots was determined with a view to reduce error in estimates of carbon stocks. The methodology described by Wenger[6] was used to calculate the total number of plots required to achieve a sampling error of below ±10%. The following equation was applied:

$$N_{Stratum,i} = t^2 * s\%^2 / E\%^2$$

$$s\% = \frac{100 * s}{\bar{y}}$$

$$E\% = \frac{s\%}{\sqrt{n}}$$

Where:

$N_{Stratum,i}$ = Minimum number of sampling plots to be measured in Stratum i
$E\%$ = Relative Standard Error for above ground biomass to be achieved in stratum i
t = t value for ±10% precision; as the number of degrees of freedom (n-1) was not yet known at that point and t was estimated at 1.7
$s\%$ = Variation Coefficient for AGBiomass in stratum i (from preliminary inventory)
s = Standard Deviation for AGBiomass in stratum i (from preliminary inventory)
y = Arithmetic mean for AGBiomass in stratum i (from preliminary inventory)
n = Number of samples in stratum i (from preliminary inventory)

As mentioned these calculations have been conducted for the two maintained forest strata and the results suggested that 88 samples were needed in low altitude forests and 44 samples in mid altitude forests in order to achieve an overall accuracy for estimates on above ground carbon stocks in both forest strata of below 10%. Considering the statistics regarding the main results of the carbon stock inventory it has to be noted that while the required accuracy was achieved through the 88 samples for the low altitude forest stratum, this was not the case for the mid-altitude forest stratum. The reason for this is probably that diversity of the samples in the final inventory was higher than diversity of the samples of the initial inventory.

B.3. Final Inventory

Distribution of sampling plots

Given the difficult terrain of the Makira Project area a clustered sampling approach, grouping four sampling plots into one sampling cluster or point as shown in figure 2 below, seemed to be the most appropriate. In total 33 sampling points were identified: 22 clusters in the predetermined low altitude forest stratum and 11 clusters in the predetermined mid altitude forest stratum. The spatial distribution of the inventory clusters was also selected taking into account the difficult terrain. It has to be noted that no available data suggests differences in carbon stocks inside the two forest strata.

As shown in figure 24, at each point four subplots were identified for a total of 132 data collection points. The field methods used to estimate the carbon stocks for both preliminary and additional plots can be found in the following section.

6 Wenger, K.F. (eg). 1984. Forestry handbook (2nd edition). New York: John Wiley and Sons.

Field Measurements in the forest strata

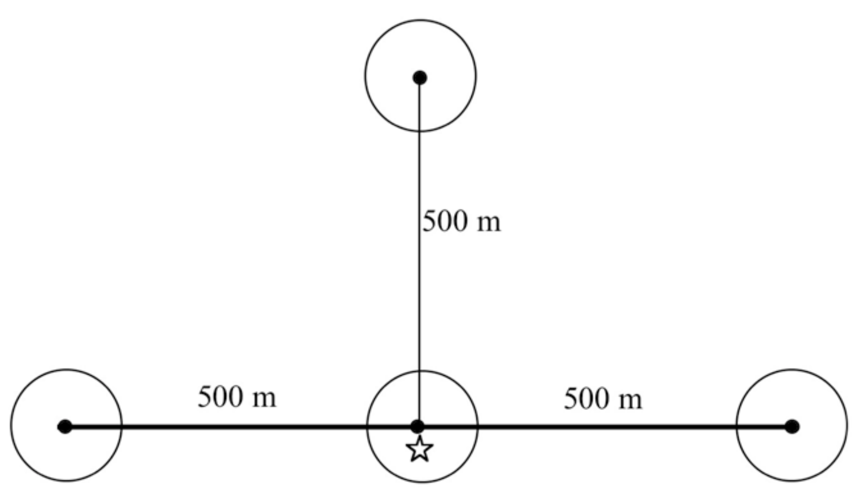
Location of plots in the pre-deforestation strata :

The location of all 33 field measurement clusters were identified in GIS randomly by using Hawth' tool in ARCGIS and then uploaded to GPS units[7]. The field teams navigated to each GPS point in the field and assessed the area to determine if the vegetation conditions matched the GIS determined stratum. At each GPS point, 4 subplots were created (in figure 3 below red dots indicate the location of the clusters within the low altitude forest stratum and blue dots indicate clusters within the mid altitude forest stratum).Once at the initial coordinates, to establish the first plot centre the team walked additional 10 steps in the direction of travel and took a new GPS point. This additional step reduces bias in choosing the plot centre. The other three plots were cantered 500 m away from the first point in three of the four cardinal directions, this being determined randomly. If this point was not located in the forest, the team would move to another cardinal point.

Layout of each field measurement plot in pre-deforestation strata :

- Once all four sub-plots were identified and measurements taken, the team navigated to the next GPS point using the GPS unit.
- All field measurement plots had a unique code that was based on geographical location, forest stratum, and individual plot:
- The first digit indicates the geographical location within which the field measurement plot exists. The number was attributed according to the commune, e.g. Manambolo = 1, Ambinanitelo =2.
- The three-letter code indicates the forest stratum structure, FHP for low altitude forest and FBP for mid altitude forest.
- The following number is a unique number corresponding to the stratum, e.g. 1 = mid-altitude intact, 2 = low-altitude intact, 3 = mid-altitude degraded, 4 = low-altitude degraded, 5 = savoka.
- The last three digits identify the specific plot in the stratum.
  As an example from the preliminary plot data collection : 2 FDB 4011 = Location 2 (Ambinanitelo Commune), Low Altitude Degraded Forest, Stratum number 4, plot 011.

Figure 2: Disposition of the sampling clusters



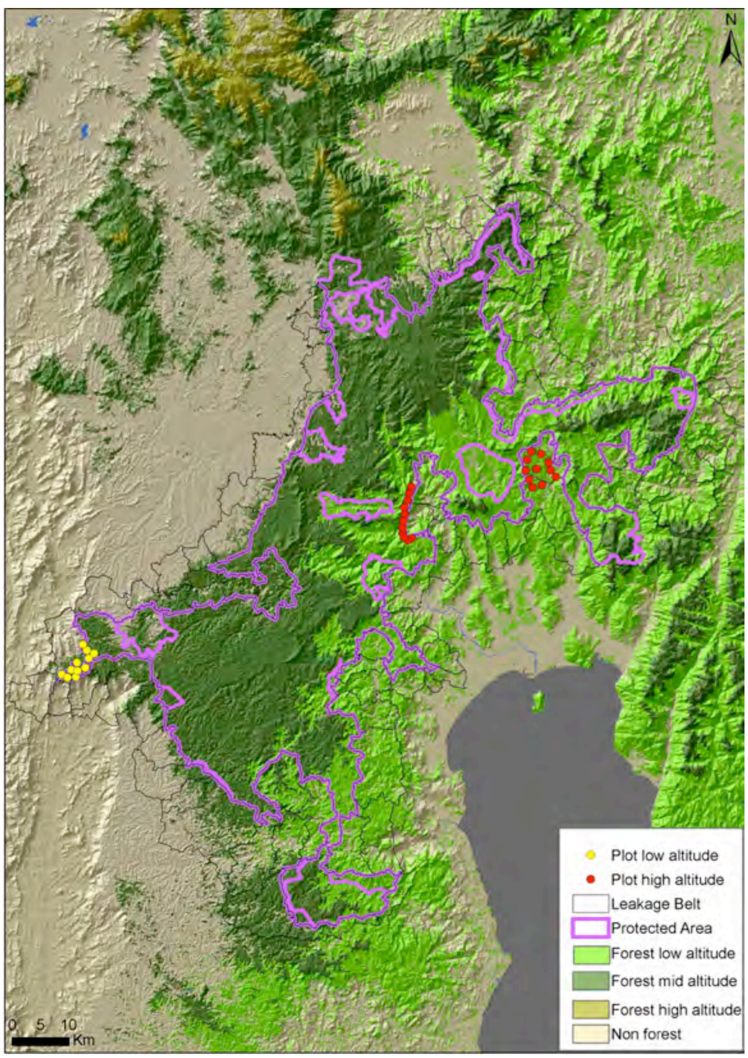
Size and shape of the nested live tree plots :

The size and shape of the field measurement plots is determined by the required level of certainty in the results as well as the time, effort and resources available for fieldwork.

Rectangular plots are difficult to delimit in humid forests because of errors related to ensuring exact length and width of the plots, the corner angles and most important, the narrowness of the rectangle to be delimited. Very large plots are also difficult to delimit because of the constraints of the sampling equipment and the extremely variable slope of the landscape found in Makira. Therefore, circular plots and subplots were used.

The boundaries of each circular subplot were established using the Haglöf DME 201 Cruiser, an ultrasonic range finder. In the event that the field measurement plots were located between a flat surface and a slope, the plot was moved slightly so that it was located entirely either on slope or on a flat surface. For field measurement plots located on a slope, the gradient's angle was measured with a clinometer and recorded. When the field measurement plot was located on a slope over 10%, the gradient of the slope was quantified, so as to correct the area of the plot at the time of data entry and analysis.

Figure 3: Map showing location of the sampling clusters for the Makira carbon stock inventory



Nested subplots of different radius were used to measure different tree sizes in the forest strata. Field testing was conducted to determine the most efficient nest radius and tree class size to properly capture the variability of tree biomass in the forest. For each nested plot size, a goal of around 8-10 trees should be present. In each forest stratum the following nested plot approach was applied:

- Saplings (Less than 5 centimetres in diameter and more than 1.3 meters in height): a 2-meter radius nested plot around the centre of the plot was used and all re-growth measured.
- Trees over 5 centimetres in diameter: a 4-meter radius nested plot around the centre of the plot was used and all tree dbh recorded.
- Trees over 15 centimetres in diameter: a 14-meter radius nested plot was used and all dbh recorded.
- Trees over 30 centimetres: a 20-meter radius nested plot was used and all dbh recorded.

Procedures for measurement of carbon stocks :

Measurements at each subplot followed standard operation procedures. Field measurements were taken for the following carbon pools in the nested plots: above ground live tree biomass, non-tree vegetation, standing dead wood biomass, and lying dead wood. The DBH, trunk height, and total height of each tree of the appropriate size was measured in the nested plots. Non-tree vegetation was sampled using destructive sampling. Lying dead wood was measured using the line-intersect method. The field methods used are delineated in the “Makira Terrestrial Carbon Stock Measurement Standard Operating Procedures”[8].

Measurements conducted at each sample point were base mainly on the carbon pools considered by the Makira REDD project. In the forest strata they included below and above ground live tree biomass and standing as well as lying dead wood biomass. In the post deforestation stratum above ground non-tree biomass was included additionally. Litter biomass and non-tree biomass in forests were initially measured but excluded later because they did not appear to be significant. Below ground tree biomass was not measured directly but deduced based on the above ground tree biomass.

The following provides a summary of the measurements conducted.

- **Trees:**

  Standing live trees were measured in all strata. The tree DBH was measured for all trees of the appropriate size in each nest class.

- **Non-tree vegetation:**

  Measuring non-tree vegetation was initially included in the inventory but later abandoned because the stocks did not appear to be significant. Non-tree vegetation was sampled by cutting all non-tree vegetation originating within plots of a defined size (50 cm x 50 cm square). Plots were located randomly outside the main inventory plots. A sub-sample of the cut vegetation was weighed, collected, dried, and then reweighed to obtain a wet-to-dry ratio that was then used to estimate the dry weight of the total non-tree vegetation sample.

- **Lying Deadwood:**

  Lying dead wood was measured outside of the circular field measurement plot using the linear transect method. A 100-m transect was established. Along the transect only dead wood with a lateral view at least 50% above the ground were measured. Moreover, the sampling/transect line must cut through at least 50% of the dead wood’s diameter, and the diameter had to be over 5

8 Makira Terrestrial Carbon Stock Measurement Standard Operating Procedures. 2009. WCS Madagascar.

centimetres in order for the dead wood to be included in the plot measurements. For all deadwood of this profile and over 5 cm diameter encountered along the transect, the diameter was recorded using a dbh tape. For each measurement the dead wood was classified as solid, partially rotten or rotten dead wood.

- Lying dead wood was classified into 3 categories: solid dead wood, partially rotten dead wood, and rotten dead wood. For each category at least 10 samples were collected so as to determine the density of each class of dead wood. To determine dead wood density a cross-section (disk) was taken from each sample. Each disk was then measured for diameter and thickness to estimate volume. These samples were then weighted, and the weight recorded. The samples were then taken to a laboratory were they were dried and the dry weight recorded.

- **Standing dead wood pool:**

  Standing dead wood was measured using the same sub-plots (4 m, 14 m and 20 m radius) and diameter criteria as for the standing lving trees. Dead wood on still standing trees was placed into one of two categories :

  - Category 1: Trees with branches and twigs which looks like a living tree but without leaves.
  - Category 2: Trees ranging from those with big to small branches, to those with only the trunk.

  Categorizing the trees into these two groups allowed for a conservative estimation of biomass. The tree height, the basal diameter, the diameter at 1.3 meter, and the diameter at the top of the category 2 dead wood were measured. Wood density of standing dead wood was also assessed using the same three categories and corresponding wood densities as mentioned above for lying dead wood.

Field Measurements in the post-deforestation stratum

Location of post-deforestation measurement plots:

The Kew Gardens forest cover 2005 (Atlas of the Vegetation of Madagascar, Justin MOAT, Paul SMITH) map was used to identify the location of current non-forested areas surrounding the Makira Project. The Hawth' tool in ARCGIS 9.3 was then launched to randomly distribute 30 plots in locations that are currently non-forest and accessible for field data collection (cf. figure 4). These points were uploaded to a GPS and points navigated to.

Once at the location, the plot was classified into one of the following land use/ land covers (LU/LC):

- Active annual crop,
- Young non active field (recent fallow land),
- Old non active field (old fallow land),
- Agroforestry field (e.g. vanilla, clove, coffee)

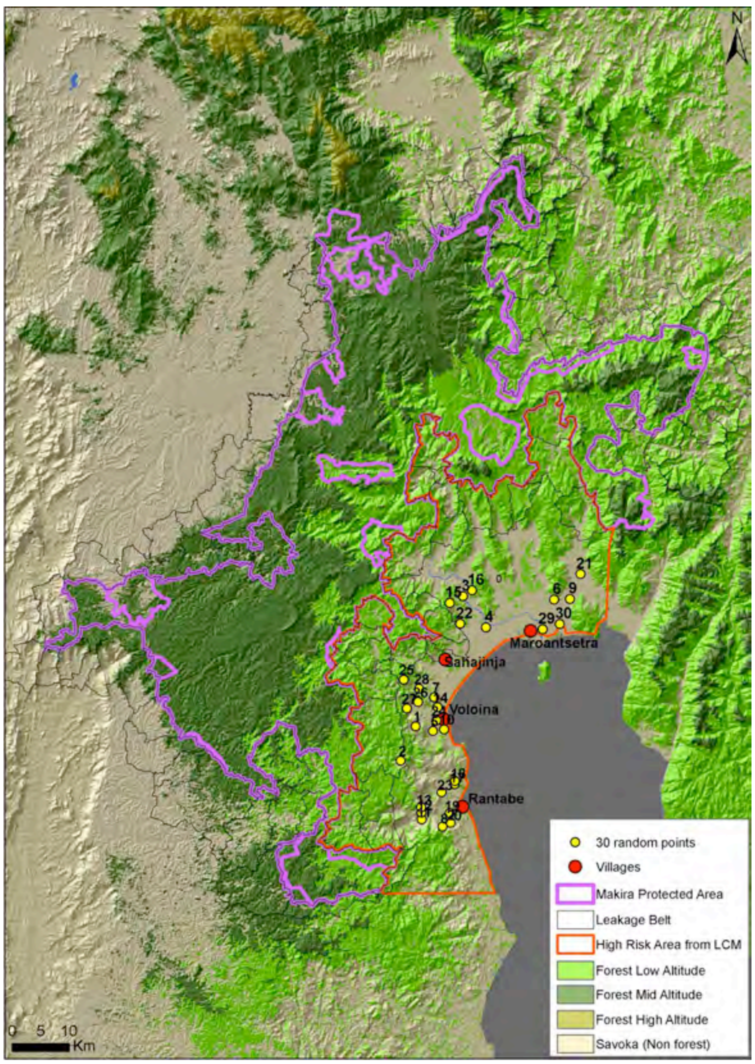
If the plot covered more than one post-deforestation stratum, the plot radius was either reduced or the plot centre moved so that the entire plot was within one stratum. The map in figure 4 shows the location of the 30 plots measured in the post deforestation stratum. It has to be noted that all plots are located outside the Makira project area (PA) and most of them also outside the leakage belt. The fact that many of the measured plots lay in areas deforested quite some time ago lead to relatively high biomass stocks that can be considered relatively conservative regarding potential emission reductions.

Size and shape of the nested live tree plots :

Nested plots, sample plots containing smaller sub-plots of various shapes and sizes (nested plots), were used to measure tree biomass. In each of the post deforestation stratum plots, the following nested plot approach was employed:

- Saplings with a stem diameter below 5 cm were measured in a circular subplot with 2 m radius. Saplings were measured only in very young forests or where the situation called for it.
- Small trees with a diameter at breast height (DBH) of more than 5 cm but less or equal to 10 cm were measured in a circular sub-plot with 5 m radius.
- Medium trees with a diameter at breast height (DBH) of more than 10 cm but less or equal to 20 cm were measured in a circular sub-plot with 15 m radius.
- Big trees with a diameter at breast height (DBH) of more than 20 cm were measured in a circular sub-plot with 20 m radius.

Figure 4: Map showing location of the post deforestation sampling plots



Procedures for measurement of carbon stocks

Measurements at each subplot followed standard operation procedures. Field measurements were taken for the following carbon pools in the nested plots: above ground live tree biomass, non-tree vegetation, standing dead wood biomass, and lying dead wood. The DBH, trunk height, and total height of each tree of the appropriate size was measured in the nested plots. Non-tree vegetation was sampled using destructive sampling. Lying dead wood was measured using the line-intersect method. The field methods used are delineated in the "Makira Terrestrial Carbon Stock Measurement Standard Operating Procedures"[9].

The following provides a summary of the measurements conducted.

- **Trees:**

  The tree DBH, was measured for all trees of the appropriate size in each sub-plot.

- **Non-tree vegetation:**

  Non-tree vegetation was sampled by cutting and weighing all non-tree vegetation originating within plots of a defined size (50 cm x 50 cm square). Plots were located randomly within the tree plots. A sub-sample of the cut vegetation was weighed, collected, dried, and then reweighed to obtain a wet-to-dry ratio that was then used to estimate the dry weight of the total non-tree vegetation sample.

- **Lying Deadwood:**

  Lying dead wood was measured using the linear transect method. A 100-m transect was established. For all deadwood over 10 cm diameter encountered along the transect, the diameter was recorded. For each measurement the dead wood was classified as solid, partially rotten or rotten dead wood. The wood density classes used were the same as the ones applied in the forest strata.

- **Standing dead wood pool:**

  Standing dead wood was measured similarly to live trees in the circular field measurement sub-plots, in the 5 m, 15 m and 20 meter radius nested plot. Dead wood on still standing trees was placed into one of two categories :

  - Category 1: Trees with branches and twigs which looks like a living tree but without leaves.
  - Category 2: Trees ranging from those with big to small branches, to those with only the trunk.

  Categorizing the trees into these two groups allowed for a conservative estimation of biomass. The tree height, the basal diameter, the diameter at 1.3 meter, and the diameter at the top of the category 2 dead wood were measured. Wood density of standing dead wood was also assessed using the same three categories and corresponding wood densities as mentioned above for lying dead wood.

C. Results

The results of the carbon inventory allowed us to compute values for the carbon stocks in the different considered carbon pools. The following sections describe the methodologies used in this last step and present the main results separately for all three strata.

9 Makira Terrestrial Carbon Stock Measurement Standard Operating Procedures. 2009. WCS Madagascar.

C.1 Methodologies

In order to develop carbon stock values we first had to transform the different field measurement data into biomass for the different considered carbon pools. More detail on the different equations and wood densities used is provided in section 2.4.2.2 of the Makira Project Description.

Above ground live tree biomass:

Above ground tree biomass (AGT) was estimated using allometric equations. As the overall tree height of live trees was not measured during the field measurements, we used allometric equations with the DBH as sole measured entry value. Initially the one entry (DBH) equation proposed by Chave et al. for humid tropical forests and used in the preliminary inventory was applied, but at a latter stage in the PD development process a national allometric equation developed by Veilledent et al.[10] became available. We used equation Mada I.1 proposed for moist-wet forests. The equation works with DBH and height as entry values, but the authors also developed a DBH-Height relationship for humid forests, which was used to estimate tree height based on the DBH for each individual tree.

Another essential parameter in allometric equations is the dry wood density. Initially we used a relatively conservative generic wood density of 0.5 tons per cubic meter, but when adopting the new allometric equation we started using species specific wood density provided by Veilledent et al. and by Rakotovao et al. Only for unknown species (no scientific name could be attributed to the local names used in the field inventory) the average wood density of 0.5 t/m^3 was maintained.

This equation and specific tree densities were used for estimating biomass in the above ground live tree pool for all three considered strata. For the Forest strata this was relatively easy as the database for these strata was developed on a individual tree basis. It became however more complicated for the post deforestation stratum because no data on individual trees was available. Species-specific wood densities could not be used and we maintained the initial value of 0.5 tons per cubic meter of wood. Experience with changing the equation for the two forest strata showed that use of the new equation led to a reduction of the total biomass per hectare of about 25% and consequently we applied the same reduction to the biomass per hectare values available for each sample in the post deforestation stratum.

Finally, and in accordance with the applied methodology, the biomass per hectare values obtained from these calculations have been transformed into tons of carbon dioxide equivalents per hectare (tCO_2-e/ha). This was done by multiplying biomass with a carbon fraction of 47% (tons of carbon per ton of biomass) and then multiplying the result with the ratio of molecular weight of CO_2 to carbon (44/12).

Below ground live tree biomass:

Below ground live tree biomass could not be measured directly and in accordance with the applied methodology was deduced from above ground live tree biomass using an appropriate root to shoot ratio. Based on the BL-UP module of the applied methodology, the root to shoot ratio of 24%, proposed for tropical rainforests with an above ground biomass stock of more than 125 t/ha was used for both forest strata. For the post deforestation stratum the 20% root to shoot ratio proposed for tropical rainforests with less than 125 t/ha of above ground biomass was used.

Conversion of biomass stock per hectare into stock of carbon dioxide equivalents per hectare (tCO_2-e/ha) was performed separately for each stratum using the same carbon fraction and molecular weight ration used for above ground live tree biomass.

[10] Vieilledent, G., R. Vaudry, S. F. D. Andriamanohisoa, S. Rakotonarivo, H. Z. Randrianasolo, H. N. Razafindrabe, C. B. Rakotoarivony, J. Ebeling and M. Rasamoelina, 2011. A universal approach to estimate biomass and carbon stock in tropical forests using generic allometric models

Standing and lying dead wood biomass

Standing dead wood was measured following the procedures presented above. For volume determination, different equations have been used for the two classes:

- For class 1 trees, presenting a general shape similar to living trees, the same allometric equation was used as for standing live trees.
- For class 2 trees, without any twigs and only very few or no branches, volume was estimated using the volume equation for a frustum (truncated cone) with base diameter, top diameter and total height as entry values.

The volume of lying dead wood was estimated using the same equation as for standing class 2 trees with diameter and overall length as entry values. Biomass was then estimated applying wood density estimated based on the field samples taken for three classes of wood. The following density values were thus determined for the three dead wood categories:

- Solid dead wood: 0.64 t/m^3
- Partially rotten dead wood: 0.38 t/m^3
- Rotten dead wood: 0.19 t/m^3

These values have been applied to standing and lying dead wood.

C.2 Results

Low altitude forest stratum

Main results of the carbon stock inventory conducted in the low altitude forest stratum are presented in table 2 below. Total carbon stocks in the stratum are estimated at 148.61 tons C per hectare corresponding with 544.89 tCO_2-e/ha or 316.18 tons of biomass per hectare. About 72% of the total carbon stocks (391.78 tCO_2-e/ha, 106.85 tC/ha, 227.34 tBM/ha) of the stratum are contained in the above ground living tree biomass pool, with below ground biomass and dead wood contributing only with 17% and 11% respectively to the total carbon stocks. This repartition of carbon seems to be consistent with experience on international level.

The relative confidence interval for above ground and for total biomass at a 95% probability is about 10% of the mean. The inaccuracy of the inventory results appears thus to be below the maximum threshold of 15% at 95% probability requested by the applied methodology.

Compared with recent studies on biomass and carbon stocks in natural forests conducted in Madagascar, these results for low altitude forests seem to be relatively low. In their analysis of the Manompana low altitude forest located about 100 km to the south of Makira, Plugge et al.[11] found above ground biomass of 293.2 and 184.0 t/ha for closed and open forests respectively, with an overall mean of 272.5 tons of above ground biomass per hectare. In a study conducted in 2011 also in the Manompana forest, Eckert et al.[12] found even higher above ground biomass stocks of 619.18 t/ha for intact forests and 418.76 t/ha for degraded low altitude forests.

It is probable that low altitude forests measured in Makira are exposed to relatively high human pressure and seem to be somewhat degraded. In any case, the results for the low altitude forests found in the carbon stock inventory for the low altitude forest stratum can be considered relatively conservative.

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11 Plugge, D., T. Baldauf, H. Rakoto Ratsimba, G. Rajoelison and M. Köhl, 2010. Combined biomass inventory in the scope of REDD. Madagascar Conservation and Development, volume 5 issue 1, page 23.

12 S. Eckert, H. Rakoto Ratsimba, L. Rakotondrasoa, G. Rajoelison and A. Ehrensperger, 2011. Deforestation and forest degradation monitoring and assessment of biomass and carbon stock of lowland rainforest in the Analanjirofo region, Madagascar. Forest Ecology and Management 262, 1996-2007

Table 2: Mean carbon stocks (in tCO_2-e) and statistics for different carbon pools per cluster and total for the low altitude forest stratum

Cluster #	AGTree [tCO_2-e/ha]	BGTree [tCO_2-e/ha]	SDW [tCO_2-e/ha]	LDW [tCO_2-e/ha]	Total [tCO_2-e/ha]
12	375.31	90.07	11.79	33.55	510.72
13	304.57	73.10	39.21	36.86	453.74
14	354.60	85.10	15.54	64.57	519.81
15	303.30	72.79	7.62	23.55	407.27
16	463.59	111.26	23.98	28.37	627.20
17	388.69	93.29	16.03	40.84	538.85
18	501.05	120.25	6.71	90.26	718.27
19	419.45	100.67	29.14	13.32	562.57
20	419.70	100.73	14.19	51.55	586.17
21	482.98	115.91	18.31	16.56	633.77
22	481.01	115.44	9.88	36.55	642.87
23	554.06	132.97	26.26	57.06	770.35
24	624.17	149.80	21.68	67.16	862.81
25	373.59	89.66	5.32	48.27	516.85
26	290.64	69.75	7.75	39.72	407.87
27	260.09	62.42	1.65	24.85	349.01
28	412.64	99.03	3.91	49.72	565.30
29	296.76	71.22	80.87	49.47	498.33
30	332.56	79.82	7.35	50.95	470.68
31	280.55	67.33	4.10	37.03	389.01
32	287.31	68.95	11.28	30.98	398.52
33	412.61	99.03	4.38	41.59	557.61
Mean	**391.78**	**94.03**	**16.68**	**42.40**	**544.89**
Stand. Dev.	94.62	22.71	16.84	17.31	126.00
Var. Coeff.	24.15	24.15	100.96	40.83	23.12
St.Err.	20.17	4.84	3.59	3.69	26.86
CI 95% (CO_2)	41.96	10.07	7.47	7.68	55.87
CI 95% (%)	10.71%	10.71%	44.77%	18.10%	10.25%
CI 95% upper	433.74	104.10	24.15	50.08	600.76
CI 95% lower	357.07	85.70	10.50	34.72	498.66

Mid altitude forest stratum

Results obtained for the mid-altitude forest stratum presented in table 3 differ significantly from those for low altitude forests discussed above. Total carbon stocks in the stratum are estimated at 220.95 tons C per hectare corresponding with 810.14 tCO_2-e/ha or 470.10 tons of biomass per hectare. About 75% of the total carbon stocks (609.05 tCO_2-e/ha, 166.25 tC/ha, 253.73 tBM/ha) of the stratum are contained in the above ground living tree biomass pool, with below ground biomass and dead wood contributing only with 18% and 7% respectively to total carbon stocks. There is some difference with low altitude forests in this respect but repartition of carbon still seems to be consistent with experience on international level.

Because of the lower number of samples measured in the mid-altitude forest stratum (44 samples against 88 samples measured in the low-altitude forest) the statistical values for the mid-altitude forest stratum show a reduced accuracy. The relative confidence interval for above ground and total biomass at a 95% probability is about 25% of the mean. The inaccuracy of the inventory results appears thus to be above the maximum threshold of 15% at 95% probability requested by the applied methodology. This result has

Table 3: Mean carbon stocks (in tCO_2-e) and statistics for different carbon pools per cluster and total for the mid-altitude forest stratum

Cluster #	AGTree [tCO_2-e/ha]	BGTree [tCO_2-e/ha]	SDW [tCO_2-e/ha]	LDW [tCO_2-e/ha]	Total [tCO_2-e/ha]
1	506.99	121.68	102.13	18.31	749.11
2	486.55	116.77	68.48	16.16	687.97
3	1'142.00	274.08	4.71	78.52	1'499.30
4	571.35	137.12	44.43	16.90	769.80
5	521.95	125.27	42.62	14.77	704.60
6	469.33	112.64	17.05	18.04	617.06
7	957.99	229.92	7.17	10.56	1'205.65
8	465.68	111.76	17.94	7.82	603.20
9	440.99	112.59	15.15	5.08	567.06
10	783.47	188.03	22.85	8.67	1'003.02
11	359.21	86.21	31.41	28.00	504.83
Mean	**609.59**	**146.92**	**33.99**	**20.26**	**810.14**
Stand. Dev.	233.82	55.71	28.00	19.39	291.14
Var. Coeff.	38.36	37.92	82.37	95.70	35.94
St.Err.	70.50	16.80	8.44	5.85	87.78
CI 95% (CO_2)	157.07	37.42	18.81	13.02	195.58
CI 95% (%)	25.77%	25.47%	55.33%	64.29%	24.14%
CI 95% upper	766.66	184.34	52.80	33.28	1,005.72
CI 95% lower	452.52	112.27	15.18	7.23	614.57

been taken into account during the uncertainty analysis (cf. section 2.4.2 of the Makira project description) and might lead to uncertainty deductions in the ex-ante estimation of verified carbon units (VCUs).

Compared with the two studies conducted in the Manompana forest mentioned in the previous section the results of the carbon stock inventory in the mid-altitude forest stratum appear to be medium. The 365.11 t/ha estimated for above ground biomass are about 25% higher than estimates provided by Plugge et al. (2011) for closed forest, but more than 40% lower than the estimates developed by Eckert et al. (2011) for intact forests and more than 10% below estimates for degraded forests provided by the same authors. Although these results can therefore also be considered conservative as it can be assumed that they will not lead to overestimation of carbon stocks and thus can be used for estimating historic and potential future carbon emissions in the Makira project as well as potential and real emission reductions generated by the project.

Post deforestation stratum

For the post-deforestation stratum, one of the sampling plots (number 9SVK8230) was removed from the final calculations because its carbon stocks indicated that the plot was located in more or less intact low altitude forest and not in a post deforestation land use.

Table 4: Mean carbon stocks (in tCO_2-e) and statistics for different carbon pools per cluster and total for the post deforestation stratum

Cluster #	AGTree [tCO_2-e/ha]	BGTree [tCO_2-e/ha]	Dead Wood [tCO_2-e/ha]	AGNon-Tree [tCO_2-e/ha]	Total [tCO_2-e/ha]
1	130.95	37.85	13.44	0.49	204.07
2	283.57	162.80	23.42	1.23	845.01
3	600.91	25.96	11.11	1.93	140.35
4	78.99	20.82	1.41	0.52	128.21
5	70.89	42.87	10.90	0.67	238.64
6	133.49	29.72	27.84	1.06	177.35
7	420.48	21.19	33.93	1.32	113.84
8	157.71	42.37	7.92	0.58	266.47
9	678.32	29.57	2.73	1.17	156.28
10	108.17	18.80	5.49	0.72	101.17
11	86.76	71.78	19.44	1.19	371.83
12	178.63	39.72	15.67	1.47	232.44
13	123.85	55.90	23.13	0.65	326.84
14	88.29	9.32	3.19	1.16	56.23
15	176.53	47.41	46.72	0.85	266.14
16	123.21	17.06	1.98	1.52	147.06
17	78.34	27.33	2.15	1.88	144.79
18	299.06	36.98	0.00	0.99	206.84
19	165.51	61.99	25.96	1.25	395.01
20	232.94	8.36	37.06	0.94	51.79
21	38.85	7.83	1.59	6.47	53.57
22	197.56	7.18	16.68	4.49	42.75
23	71.06	37.85	56.75	2.19	204.07
24	113.86	162.80	1.33	2.28	845.01
25	154.07	25.96	12.00	3.79	140.35
26	258.31	20.82	72.38	2.33	128.21
27	34.84	42.87	2.36	6.22	238.64
28	32.63	29.72	8.71	4.40	177.35
29	29.91	21.19	0.71	4.94	113.84
Mean	**177.51**	**42.60**	**16.76**	**2.02**	**238.89**
Stand. Dev.	153.78	36.91	17.84	1.68	193.05
Var. Coeff.	86.63	86.63	106.45	83.08	80.81
St.Err.	28.56	6.85	3.31	0.31	35.85
CI 95% (CO_2)	58.48	14.04	6.78	0.64	73.42
CI 95% (%)	32.95%	32.95%	40.48%	31.60%	30.73%
CI 95% upper	235.99	56.64	23.54	2.66	312.31
CI 95% lower	119.02	28.57	9.97	1.38	165.48

Results of the carbon stock inventory conducted in the post deforestation stratum are presented in table 4. Total carbon stocks in the stratum are estimated at 65.15 tons C per hectare corresponding with 238.89 tCO_2-e/ha or 138.62 tons of biomass per hectare. About 74% of the total carbon stocks (177.51 tCO_2-e/ha, 48.41 tC/ha, 103.00 tBM/ha) of the stratum are contained in the above ground living tree biomass pool, with below ground biomass dead wood and non-tree biomass contributing only with 16%, 6% and 1% respectively to total carbon stocks.

Table 5: IPCC proxies of carbon stocks for different post-deforestation land uses

Land Use	Biomass [t/ha]	Carbon* [t C/ha]	Emissions* [t CO_2-e/ha]
Small-scale Agroforestry	250.00	118.75	562.66
Industrial Agroforestry	150.00	71.25	261.25
Shrub Savannah	98.00	46.55	170.68
Post-Deforestation Cropland	21.05	10.00	36.67
Grassland	16.10	7.65	28.04

* One ton of biomass contains 0.475 tons of C_{12}

** One ton of C_{12} corresponds with 3.667 tons of CO_2 equivalents

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The statistical values calculated for the different carbon pools in the post deforestation stratum presented in table 4 show a relatively high variability between samples leading to a relatively high uncertainty of 32% of the mean at 95% probability. This was also taken into account in the uncertainty analysis (cf. section 2.4.2 of the Makira VCS project description).

Compared with international experience, the carbon stocks estimated for the post-deforestation stratum are considered relatively high and much closer to an agroforestry land cover than to any agricultural land use (cf. table 5). As emission factors for the transition from forest to non-forest result from the subtraction of the post deforestation carbon stocks from the forest carbon stocks this can be considered conservative.

Emission factors

Emission factors are the estimated amounts of carbon dioxide emitted during a conversion from one land cover to another per unit area and are usually expressed in tons of CO_2 equivalents per hectare. They can be estimated easily by subtracting the remaining carbon stocks in the post deforestation stratum from the carbon stocks of the initial forest cover, low and mid-altitude forests in the case of the Makira project. Emission factors could be estimated separately for the two forest strata as follows:

- Emission factor for transition from low altitude forest to non-forest: 306.00 tCO_2-e/ha
- Emission factor for transition from mid-altitude forest to non-forest: 571.25 tCO_2-e/ha

These emission factors have been applied to the annual areas of unplanned deforestation in the project area and in the leakage belt in order to estimate potential baseline and project emissions and emission reductions.

Appendix III

Article 39 de la Loi constitutionnelle n° 2007-001 du 27 avril 2007

Article 39 - Toute personne a l'obligation de respecter les valeurs culturelles, les biens publics et l'environnement.

L'Etat et les Collectivités territoriales décentralisées assurent la protection, la conservation et la valorisation de l'environnement par des mesures appropriées

Appendix IV

Malagasy Environnemental Charter

CHARTE DE L'ENVIRONNEMENT ET SES MODIFICATIFS

(Loi n° 90-033 du 21 décembre 1990 modifiée par les lois n° 97-012 du 06 juin 1997 et n° 2004-015 du 19 août 2004)

Loi n° 90-033 du 21 décembre 1990 modifiée par les lois n° 97-012 du 06 juin 1997 et n° 2004-015 du 19 août 2004 relative à la Charte de l'Environnement malagasy

TITRE PREMIER

GENERALITES

Article premier.– La présente loi et son annexe constituent la Charte de l'Environnement malagasy. Elle fixe le cadre général d'exécution de la politique de l'environnement dont les modalités seront définies par des textes réglementaires d'application.

Art.2. – On entend par environnement l'ensemble des milieux naturels et artificiels y compris les milieux humains et les facteurs sociaux et culturels qui intéressent le développement national.

TITRE II

PRINCIPES FONDAMENTAUX

Art. 3. – L'environnement constitue une préoccupation prioritaire de l'Etat.

Art.4. – La protection et le respect de l'environnement sont d'intérêt général. Il est du devoir de chacun de veiller à la sauvegarde du cadre dans lequel il vit.

A cet effet, toute personne physique ou morale doit être en mesure d'être informée sur les décisions susceptibles d'exercer quelque influence sur l'environnement et ce directement ou par l'intermédiaire de groupements ou d'associations.

Elle a également la faculté de participer à des décisions.

TITRE III

MISE EN OEUVRE

Art.5. – Le plan d'action environnementale, traduction de la politique nationale de l'environnement, constitue le fondement de toute action dans le domaine de l'environnement .

Art.6. – L'objectif essentiel est de réconcilier la population avec son environnement en vue d'un développement durable.

A cet effet, le plan se donne les objectifs suivants :

- Développer les ressources humaines
- Promouvoir un développement durable en gérant mieux les ressources naturelles:

- Réhabiliter, conserver et gérer le patrimoine malagasy de biodiversité ;
- Améliorer le cadre de vie des populations rurales et urbaines ;
- Maintenir l'équilibre entre croissance de la population et développement des ressources ;
- Améliorer les outils de gestion de l'environnement ;
- Aider à la résolution des problèmes fonciers.

Art.7. – La gestion de l'environnement est assurée conjointement par l'Etat, les

Collectivités décentralisées, les organisations non gouvernementales égulièrement constituées, les opérateurs économiques, ainsi que tous les citoyens.

Art.8. – Il appartient notamment à l'Etat :
- de définir la politique environnementale
- d'organiser des campagnes de sensibilisation en collaboration avec les Collectivités décentralisées et les organisations non gouvernementales concernées
- de faire participer les partenaires ci-dessus évoqués aux décisions en matière de gestion de l'environnement ;
- de coordonner les actions environnementales ;
- de procéder ou faire procéder à un suivi et à une évaluation des actions menées dans le domaine de l'environnement ;
- de veiller à la compatibilité des investissements avec l'environnement.

Art.9. – La gestion de l'environnement repose sur une structure nationale comprenant :
- une instance de conception chargée notamment de l'élaboration de la politique environnementale nationale
- une organe de gestion, de coordination, de suivi et d'appui aux programmes et actions environnementaux publics et privés.
- Cette instance doit être consultée pour toute question relative à l'environnement.

Art.10. - Les projets d'investissements publics ou privés susceptibles de porter atteinte à l'environnement doivent faire l'objet d'une étude d'impact, compte tenu de la nature technique de l'ampleur desdits projets ainsi que de la sensibilité du milieu d'implantation.

Les projets d'investissement soumis à autorisation ou à approbation d'une autorité administrative font également l'objet d'une étude d'impact dans les mêmes conditions que les autres projets.

Un décret précisera les modalités des études d'impact, la procédure applicable en la matière, et l'organe habilité à la mise en oeuvre de ces études et procédures.

TITRE IV

DISPOSITIONS DIVERSES

Art.11. – Les opérateurs exerçant des activités engendrant des effets néfastes sur l'environnement seront soumis :

- Soit à des obligations compensatrices,

- Soit au paiement de pénalités au profit de l'Etat et dont les taux et les modalités de perception seront déterminés ultérieurement

Art.2, loi n° 2004-015 – L'exécution du Programme Environnemental III est confiée à des maîtres d'œuvre dont les modalités de nomination seront fixées par voie réglementaire.

Art. 3, loi n° 2004-015 – Toutes dispositions contraires à celles de la présente loi sont abrogées notamment celles du chapitre III du titre IV, des chapitres I, IV et V du titre V de l'annexe de la loi modifiée n° 90-033 du 21 décembre 1990.

Art. 4, loi n° 2004-015 - La présente loi sera publiée au Journal Officiel de la République. Elle sera exécutée comme loi de l'Etat.

Antananarivo, le 19 août 2004

Marc RAVALOMANANA

Appendix V

Makira¶s Environmental Permit

(January 22nd, 2009)

OFFICE NATIONAL POUR L'ENVIRONNEMENT
Direction Générale
N° ... / 09- MEFT/ONE/DG /PE.

REPOBLIKAN'I MADAGASIKARA
Tanindrazana - Fahafahana - Fandrosoana

Antananarivo, le 22 JAN 2...

PERMIS ENVIRONNEMENTAL

FAHAZOAN-DALANA MOMBA NY TONTOLO IAINANA

- Vu le décret n° 99-954 du 15 décembre 1999 relatif à la mise en compatibilité des investissements avec l'environnement, modifié par le décret n° 2004-167 du 03 février 2004 ;
Araka ny didim-panjakana laharana faha-99-954 tamin'ny 15 desambra 1999 mikasika ny fampifanarahana ny fampiasam-bola amin'ny tontolo iainana, novain'ny didim-panjakana laharana faha-2004-167 tamin'ny 03 febroary 2004 ;

- Vu le rapport d'évaluation environnementale du dossier d'étude d'impact environnemental (EIE), et après avis technique favorable des membres du Comité Technique d'Evaluation ad hoc (CTE) sur le projet :
Araka ny tatitra mikasika ny fanombanana momba ny tontolo iainana ny antontan-taratasy mikasika ny fanadihadiana momba ny fiantraika amin'ny tontolo iainana (FMFTI), ary rehefa nahazo ny hevitra ara-teknika arahim-pankasitrahana ny mpikambana ao amin'ny Komity Teknika momba ny Fanombanana sahaza (KTF) mikasika ny tetik'asa :

De création de la Nouvelle Aire Protégée Makira

Fametrahana valan-javabohary vaovao Makira

Régions (*Faritra*): Analanjirofo, SAVA et Sofia

A.- Conformément aux dispositions des articles 2, 6 et 27 (nouveaux) du décret modifié n° 99-954 du 15 décembre 1999, il est octroyé un Permis environnemental.
Araka ny fepetra voalazan'ny andininy faha-2, faha-6 sy faha-27 (vaovao) amin'ny didim-panjakana izay novaina laharana faha-99-954 tamin'ny 15 décembre 1999 dia omena ny Fahazoan-dàlana momba ny tontolo iainana.

Au nom de : Wildlife Conservation Society (WCS)
Amin'ny anaran'ny

Domicilié à : -II A78D, Villa Ifanomezantsoa, Soavimbahoaka Antananarivo 101
Monina ao

Avenue Rainilaiarivony Antaninarenina - ANTANANARIVO 101 - MADAGASCAR
... 822 - ☎ (261 20) 22 259 99 - (261 20) 22 641 06 / 07 / 11 - Fax : (261 20) 22 306 93
E-mail : one@pnae.mg

Sous réserve du respect du Plan de Gestion Environnementale et de Sauvegarde Sociale (PGESS) valant Cahier de charges environnementales qui est annexé au permis environnemental, à peine de sanctions prévues par les articles 34 à 37 (nouveaux) du décret modifié n° 99-954

Izay miaraka amin'ny fanajana ny *Drafitra Itantanana ny Tontolo Iainana sy Sosialy (DITIS)izay manan-danja ho toy ny Bokin'andraikitra momba ny tontolo iainana izay mitovana amin'ny fanomezan-dàlana momba ny tontolo iainana, raha tsy izany dia hiharan'ny sazy voalaza ao amin'ny andininy faha-34 ka hatramin'ny faha-37 (vaovao) amin'ny didim-panjakana izay novaina laharana faha-99-954 ;*

B.- Le présent Permis environnemental est valable :

Ity Fahazoan-dàlana momba ny tontolo iainana ity dia manan-kery :

(i) sous réserve de l'envoi par an à l'ONE par le Promoteur du rapport de mise en œuvre du cahier des charges environnementales.

L'ONE, en concertation avec les membres du CTE, peut modifier ou ajuster le cahier des charges environnementales, en fonction des rapports périodiques établis par le Promoteur ou suivant les contrôles et suivis effectués par l'ONE ou les Ministères sectoriels concernés par l'activité.

raha voahajan'ny tompon-kevitra mpanorina ny fandefasana isan-taona any amin'ny Foibem-Mpirenena momba ny Tontolo Iainana ny tatitra fampiharana ny Bokin'andraikitra momba ny tontolo iainana.

Ny Foibem-Mpirenena momba ny Tontolo Iainana, miaraka amin'ireo mpikambana ao anatin'ny Komity Teknika momba ny Fanombanana, dia afaka manova na manintsy ny bokin'andraikitra momba ny tontolo iainana, arakaraka ny tatitra ara-potoana ataon'ny tompon-kevitra mpanorina na ny fanaraha-maso ataon'ny Foibem-Mpirenena momba ny Tontolo Iainana na ireo Ministera voakasiky ny tetikasa ;

(ii) jusqu'à l'obtention d'un quitus environnemental, en cas de fermeture du projet (cf. art. 30 (nouveau) du décret modifié n° 99-954)

hatramin'ny fahazoana ny fanafahana andraikitra momba ny tontolo iainana, raha misy ny fifaranan'ny tetik'asa (jereo and. 30 (vaovao) amin'ny didim-panjakana izay novaina laharana faha-99-954)

(iii) le cas échéant, jusqu'à la modification de l'envergure effective du projet dont les cas seront précisés par voie réglementaire (cf. art. 14 (nouveau) du décret modifié n° 99-954)

amin'ny tranga izay mety hiseho, hatramin'ny fanovana ny tena halehiben'ny tetik'asa ka ny tranga momba izany dia ho faritana amin'ny alalan'ny didy amam-pitsika (jereo and. 14 (vaovao) amin'ny didim-panjakana izay novaina laharana faha-99-954)

Par délégation,

LE DIRECTEUR GENERAL
DE L'OFFICE NATIONAL POUR L'ENVIRONNEMENT

RAKOTOARY Jean Chrysostome

Appendix VI

Madagascar¶s Protected Area Code (COAP)

REPOBLIKAN'I MADAGASIKARA
Tanindrazana - Fahafahana - Fandrosoana

PRESIDENCE DE LA REPUBLIQUE

LOI N° 2001- 05 du 11 février 2003

Portant CODE DE GESTION DES AIRES PROTEGEES

L'Assemblée Nationale et le Sénat ont adopté en leurs séances respectives en date du 26 juillet 2001 et du 07 août 2002

LE PRESIDENT DE LA REPUBLIQUE,

Vu la Constitution

Vu la décision n°01- HCC/D.3 du 05 Février 2003;

Promulgue la loi dont la teneur suit

TITRE I

Dispositions générales

CHAPITRE I
Définitions
Section 1

Des Aires Protégées

Article premier :

Une Aire Protégée (AP) est un territoire délimité, terrestre, côtier ou marin, eaux larges saumâtres et continentales, aquatique, dont les composantes présentent une valeur particulière et notamment biologique, naturelle, esthétique, morphologique, historique, archéologique, cultuelle ou culturelle, et qui de ce fait, dans l'intérêt général, nécessite une préservation contre tout effet de dégradation naturelle et contre toute intervention artificielle susceptible d'en altérer l'aspect, la composition et l'évolution.

Article 2 :

Les aires protégées peuvent être classées en trois catégories : la Réserve Naturelle Intégrale (RNI), le Parc National (PN) et la Réserve Spéciale (RS). Toutefois, d'autres catégories peuvent être créées autant que de besoin.

Article 3 :

La classification se fait en fonction de la valeur particulière des composantes des aires protégées et de l'importance du risque de dégradation naturelle ou artificielle auquel ces composantes sont exposées.

Une Réserve Naturelle Intégrale désigne une aire représentative d'un écosystème particulier dont le but est de protéger la flore et la faune dans un certain périmètre. Elle est placée sous le contrôle de l'Etat et ses limites ne peuvent être changées, ni aucune de sa partie aliénée, sauf par l'autorité compétente.

Un Parc National désigne une aire dont le but est de protéger et de conserver un patrimoine naturel ou culturel original tout en présentant un cadre récréatif et éducatif. Elle est placée sous le contrôle de l'Etat et ses limites ne peuvent être changées, ni aucune de sa partie aliénée, sauf par l'autorité compétente.

Une Réserve Spéciale est une aire créée principalement dans le but de protéger un écosystème ou un site spécifique ou une espèce animale ou végétale particulière. Elle peut désigner certaines autres aires protégées telles que la réserve de faune ou de flore, la réserve partielle, la réserve sanctuaire, la réserve des sols, des eaux, et des forêts. Elle est placée sous le contrôle de l'Etat et ses limites ne peuvent être changées, ni aucune de sa partie aliénée, sauf par l'autorité compétente.

Parmi les Réserves Spéciales, on distingue :

- " la réserve de faune " qui désigne une aire mise à part pour la conservation, l'aménagement, et la propagation de la vie animale sauvage, ainsi que pour la protection et l'aménagement de son habitat et dans laquelle la chasse, l'abattage ou la capture de la faune sont interdits, sauf par les autorités de la réserve pour un motif entrant dans leurs attributions ou sous leur direction ou leur contrôle, et où l'habitation et les autres activités humaines sont réglementées ou interdites.

- " la réserve partielle " ou " sanctuaire " qui désigne une aire mise à part pour la protection de communautés caractéristiques d'animaux sauvages ou pour la protection d'espèces animales et/ou végétales particulièrement menacées, notamment celles qui figurent dans les conventions internationales ratifiées par Madagascar, ainsi que pour la protection des habitats indispensables à leur survie, et dans laquelle tout autre intérêt ou activité est subordonné à la réalisation de cet objectif.

- " la réserve des sols, des eaux, et des forêts " désigne des aires mises à part pour la protection de ces ressources particulières.

Article 4 :

L'ensemble des aires protégées existantes et à créer relevant de la propriété de l'Etat et dont la gestion peut être confiée à un organisme autonome suivant la politique environnementale de l'Etat, constitue le réseau national d'aires protégées régi par la présente Loi.

Les textes législatifs ou réglementaires relatifs à chaque type d'écosystèmes ou secteur d'activités relevant des aires protégées demeurent applicables dans leurs dispositions non contraires à la présente Loi ; notamment, les aires protégées forestières restent soumises au régime forestier.

Article 5 :

Une aire protégée est constituée de deux zones, le noyau dur d'une part et la zone tampon d'autre part.

Article 6 :

Le noyau dur est une zone sanctuaire d'intérêt biologique, culturel ou cultuel, historique, esthétique, morphologique et archéologique, qui représente le périmètre de préservation intégrale. Il peut, dès lors, être institué au sein des catégories d'aires protégées suscitées. Toute activité, toute entrée et toute circulation sont strictement réglementées dans le noyau dur.

Article 7 :

La zone tampon est une zone jouxtant le noyau dur, dans laquelle les activités sont limitées pour assurer une meilleure protection de l'aire protégée et dont les modalités sont fixées par voie réglementaire.

Peuvent faire partie d'une zone tampon, notamment les zones d'occupation contrôlée (ZOC), les zones d'utilisation contrôlée (ZUC) et les zones de service :

- la zone d'occupation contrôlée (ZOC) est une zone d'habitation des populations, à l'intérieur de l'aire protégée, et existantes antérieurement à sa création ; cette zone est soumise à des cahiers de charges dont le contenu et les modalités sont définis par voie réglementaire ;
- la zone d'utilisation contrôlée (ZUC) est une zone dans laquelle l'utilisation des ressources est réglementée et contrôlée ;
- la zone de service est une zone destinée à l'implantation des infrastructures touristiques, éducatives ou fonctionnelles de l'aire protégée.

Section 2

Des zones entourant l'Aire Protégée

Article 8 :

Les zones entourant l'aire protégée sont la zone de protection et la zone périphérique.

La zone de protection est déterminée dans le décret de création de l'aire protégée. Dans le cas contraire, un décret complétant celui de création sera pris à cet effet. La zone périphérique est déterminée par le plan de gestion.

Article 9 :

La zone de protection est la zone jouxtant l'aire protégée dans laquelle sont admises les activités agricoles et pastorales ou d'autres types d'activités autorisées à titre exceptionnel par l'organisme chargé de la gestion du réseau des aires protégées et n'entraînant pas d'impact néfaste sur l'aire protégée.

Article 10 :

La zone périphérique est la zone jouxtant la zone de protection, dans laquelle les activités humaines peuvent avoir des influences directes sur l'aire protégée et réciproquement, notamment par des pressions anthropiques, par l'existence de collectivités humaines en partie tributaires de l'aire protégée, par la participation de celles-ci à la conservation de l'aire protégée; et où des mesures peuvent être prises pour permettre un ensemble de réalisations et d'améliorations d'ordre social, économique et culturel tout en rendant plus efficace la protection de la nature dans l'aire protégée.

Toutes activités autres que celles déjà traditionnellement menées dans la zone périphérique doivent faire l'objet d'une approche concertée impliquant toutes les entités concernées ainsi que l'organisme chargé de la gestion du réseau des aires protégées ou le gestionnaire opérationnel.

CHAPITRE II

Principes généraux

Article 11 :

Les aires protégées ont pour vocation la conservation, la recherche, la mise en valeur du patrimoine naturel et culturel, l'éducation et la récréation des citoyens, la promotion de l'écotourisme et la contribution au développement économique et social durable.

La mise en valeur de la biodiversité se fera notamment par la recherche et par l'écotourisme.

Article 12 :

Les aires protégées du réseau national relèvent du domaine privé et du domaine public de l'Etat et sont imprescriptibles et inaliénables. A cet effet, les limites des aires protégées seront matérialisées par l'organisme chargé de la gestion des aires protégées.

Article 13 :

La coordination et la facilitation de toutes les activités ou opérations relatives aux aires protégées sont assumées par un organisme chargé de la gestion du réseau des aires protégées, prévu par la Loi et placé sous la tutelle du Ministère chargé de l'Environnement.

TITRE II

Création des Aires Protégées

CHAPITRE I
Critères

Article 14 :

Des parties du territoire de la République peuvent être classées en aire protégée lorsque leurs composantes telles que la faune, la flore, le sol, les eaux, et en général le milieu naturel présentent une sensibilité ou une qualité particulière représentative de la biodiversité ou de l'écosystème malgache, ou une valeur culturelle spécifique, et qu'il est nécessaire de les conserver en les soustrayant, autant que faire se peut, à toute intervention artificielle susceptible de les dégrader.

CHAPITRE II
Procédure

Article 15 :

L'organisme chargé de la gestion du réseau national des aires protégées participe aux différentes étapes de la création de ces aires, en tant que coordinateur responsable et facilitateur. Le Ministère chargé de l'Environnement assure, en tant que Ministère de tutelle, la coordination de la contribution des Ministères, la participation des Provinces Autonomes et des Collectivités Territoriales Décentralisées concernés par les étapes touchant des domaines d'activités relevant de leur responsabilité respective.

Article 16 :

Toute personne physique ou morale peut suggérer le classement d'un territoire en aire protégée. Les suggestions y afférentes sont collectées par l'organisme chargé de la gestion du réseau des aires protégées ou ses représentants, transmises pour avis au Ministère chargé du secteur concerné, et adressées au Ministère chargé de l'Environnement afin d'entamer la procédure d'instruction du dossier y relatif.

Article 17 :

La procédure de création d'une aire protégée comporte plusieurs étapes dont les modalités sont fixées par voie réglementaire.

Article 18 :

La décision de création, qui clôt la procédure, se fera par voie de décret pris en Conseil de Gouvernement.

Article 19 :

Les aires protégées du réseau national sont immatriculées au nom de l'Etat.

Article 20 :

Il est possible d'accorder une protection temporaire à une aire en attendant que l'on décide d'une protection définitive. Les modalités de protection temporaire, notamment la durée de cette protection, sont fixées par voie réglementaire.

Ladite protection devient définitive dès la publication du décret portant création de l'aire protégée concernée

TITRE III

Changement de statut

Article 21 :

L'aire protégée peut faire l'objet d'un surclassement ou d'un déclassement, selon des critères bien déterminés.

Article 22 :

Le surclassement est un changement de statut faisant accroître l'importance des mesures de conservation affectant tout ou partie d'une aire protégée.

Article 23 :

Le déclassement est un changement de statut faisant diminuer l'importance des mesures de conservation affectant tout ou partie d'une aire protégée.

Article 24 :

L'organisme chargé de la gestion du réseau national des aires protégées participe aux différentes étapes du processus de changement de statut de ces aires, en tant que coordinateur responsable et facilitateur. Le Ministère chargé de l'Environnement assure, en tant que Ministère de tutelle, assure la coordination de la contribution des Ministères et des autorités locales concernés par les étapes touchant des domaines d'activités relevant de leur responsabilité respective.

Article 25 :

Le changement de statut comporte plusieurs étapes dont les modalités sont fixées par voie réglementaire.

Article 26 :

La décision de changement de statut se fera par voie de décret pris en Conseil de Gouvernement.

Article 27 :

En cas de changement de limites, celles-ci sont matérialisées par l'organisme chargé de la gestion du réseau des aires protégées conjointement avec les entités concernées.

TITRE IV

Gestion des Aires Protégées du réseau

CHAPITRE I
Principes de gestion

Article 28 :

Les aires protégées du réseau national étant la propriété de l'Etat, ce dernier en détermine les orientations principales de gestion du dit réseau.

L'Etat peut en confier la gestion à un organisme national et autonome.

Article 29 :

Cet organisme est nommé par voie de décret pris en Conseil de Gouvernement. Il a pour mission d'établir, conserver et gérer de manière durable le réseau national de parcs et réserves représentatifs de la diversité biologique et du patrimoine naturel et culturel, propre à Madagascar.

Article 30 :

Les obligations et droits de l'organisme sont définis dans un cahier des charges dont le contenu sera fixé par voie réglementaire.

Article 31 :

L'organisme peut subdéléguer la gestion opérationnelle à une autre entité publique ou privée, après examen de ses capacités techniques et financières, et avis favorable du Ministère chargé de l'Environnement.

Article 32 :

La gestion opérationnelle est la gestion sur le terrain d'une aire protégée pour assurer notamment, son fonctionnement au quotidien et le respect des réglementations propres à cette aire.

CHAPITRE II
Modalités de gestion

Article 33 :

Chaque aire protégée du réseau national doit être dotée d'un plan de gestion, préétabli, périodique et approuvé par l'organisme chargé de la gestion du réseau national des aires protégées et comprenant un règlement intérieur. Le plan de zonage et le règlement intérieur doivent faire l'objet de la publicité la plus large au niveau de chaque aire protégée.

Article 34 :

Dans le cadre des dispositions prévues par les articles 28, 29 et 31, l'organisme chargé de la gestion du réseau national des aires protégées est autorisé à :

1. contracter des conventions à caractère commercial ou autres avec toute personne physique ou morale, et exercer de sa propre initiative ou en partenariat, dans le cadre de la mise en valeur de l'aire protégée du réseau national ou de ses composantes ,toutes activités susceptibles de générer des revenus supplémentaires, sans aller à l'encontre des objectifs de protection ou de conservation, et conformément à la politique de décentralisation, notamment pour :

   - la gestion d'une aire protégée du réseau national ou une portion de celle-ci ;

   - l'exécution de prestations de service ;

   - les appuis à la recherche, à la formation ou au financement ;
2. aménager l'aire protégée du réseau national, selon le plan de gestion défini à l'article33, par la mise en place d'infrastructures adéquates pour en améliorer la gestion pour permettre la mise en valeur de l'aire protégée ou des ses composantes, et pour en renforcer la conservation ;
3. percevoir des droits, notamment des droits d'entrée, des droits de recherche, des droits de propriété intellectuelle, des droits de filmage dont les modalités de perception sont fixées par voie réglementaire.

Article 35 :

L'organisme chargé de la gestion du réseau national des aires protégées ou le gestionnaire opérationnel exerce la police écologique au sein du réseau national des aires protégées, si besoin concurremment avec les agents des administrations concernées.

Article 36 :

La police écologique vise à prévenir, interdire et à contrôler certaines activités humaines perturbatrices du milieu naturel. Elle vise à assurer l'intégrité et la pérennité des écosystèmes au sein des aires protégées.

La répression des infractions est organisée conformément aux dispositions du Titre VII de la présente Loi.

TITRE V

Droits et obligations de l'organisme chargé de la gestiondu réseau des aires protégées

Article 37 :

L'organisme chargé de la gestion du réseau national des aires protégées peut bénéficier d'un soutien de l'Etat.

L'organisme chargé de la gestion du réseau national des aires protégées est tenu de rendre compte au Ministère chargé de l'Environnement de l'exécution de sa mission qui doit être conforme aux dispositions prévues dans le cahier des charges pour le réseau national des aires protégées, et conforme au plan de gestion pour chaque aire protégée, sur le plan technique, scientifique et financier. Le compte rendu est public. Tout intéressé a accès aux documents y afférents.

Article 38 :

En cas d'inexécution de la mission ou de non-respect dûment constaté de cahiers des charges, préjudiciables à la conservation de l'aire protégée ou de ses composantes, le Ministère chargé de l'Environnement prend toutes les mesures nécessaires, nonobstant les dispositions dans le cahier des charges, pour remédier à la situation.

Article 39 :

Le Ministère chargé de l'Environnement, le Ministère chargé du secteur concerné ou l'organisme chargé de la gestion du réseau national des aires protégées peut effectuer un contrôle de l'exécution du plan de gestion par le gestionnaire opérationnel.

L'administration ou l'organisme chargé de la gestion du réseau national des aires protégées peut par ailleurs, à tout moment, effectuer des contrôles techniques sur terrain.

TITRE VI

Droits et obligations des tiers

Article 40 :

Conformément aux impératifs de conservation du patrimoine naturel et culturel auxquels sont soumis les aires protégées du réseau national, toute activité de quelque nature que ce soit et toute circulation y sont interdites, sous réserve des dispositions ci-dessous.

Dans une aire protégée du réseau national, il est interdit de résider, de pénétrer, de circuler ou de camper, ou de survoler à moins de mille mètres d'altitude au-dessus de ladite aire, sans autorisation spéciale écrite de l'autorité compétente.

Les recherches scientifiques, les éliminations d'animaux et de végétaux en vue de maintenir un écosystème, n'y pourront être effectuées qu'avec la permission de l'autorité compétente.

Article 41 :

1- Sous réserve des droits d'usage, les activités dans une aire protégée du réseau national sont réglementées en fonction du statut de l'aire protégée concernée et en fonction des zones prévues dans les dispositions des articles 5, 6 et 7 définis ci-dessus.

Les droits d'usage sont des prélèvements à but non commercial pour les besoins domestiques, vitaux et/ou coutumiers, réservés à la population riveraine.

Les droits d'usage doivent s'exercer dans le cadre d'une convention formelle conclue entre le gestionnaire opérationnel et les bénéficiaires.

Les droits d'usage peuvent s'exercer au sein des zones tampon.

Toute activité autorisée, notamment dans le cadre des droits d'usage dans une aire protégée, est subordonnée à la réalisation des impératifs de conservation.

2- Sont strictement interdits, sur toute l'étendue d'une Réserve Naturelle Intégrale, toute sorte de chasse ou de pêche, toute exploitation forestière, agricole ou minière, toute fouille ou prospection, sondage, terrassement ou construction, tout pâturage, tous travaux tendant à modifier l'aspect du terrain ou de la végétation, toute pollution des eaux, et d'une manière générale, tout acte de nature à apporter des perturbations à la faune ou à la flore, toute introduction d'espèces zoologiques ou botaniques, indigènes ou importées, sauvages ou domestiquées.

3- Dans un Parc National ou une Réserve Spéciale qui sont destinés à la protection, la conservation, l'aménagement de la végétation et des populations d'animaux sauvages, ainsi qu'à la protection des sites, des paysages ou des formations géologiques d'une valeur scientifique ou esthétique particulière, dans l'intérêt et pour la récréation du public, une autorisation d'accès doit être demandée auprès de l'autorité chargée de la gestion du parc national ou de la réserve spéciale concerné.

La circulation ainsi que le camping à l'intérieur d'un parc national ou d'une réserve spéciale sont réglementés.

4- Toutefois, dans toutes les catégories d'aires protégées, pour satisfaire les besoins vitaux des populations riveraines ou pour le respect de leur tradition, et dans le cas où aucune autre alternative n'est possible, certaines activités peuvent être effectuées à titre exceptionnel, après autorisation préalable du gestionnaire opérationnel, notamment en cas de prélèvement d'une plante médicinale à usage non commercial ou en cas de rite mortuaire.

En outre, l'abattage, la chasse et la capture d'animaux et la destruction ou la collecte de plantes y sont interdits, sauf pour des raisons scientifiques ou pour les besoins de l'aménagement ou de l'ordre public, et à condition que de telles opérations aient lieu sous le contrôle et la direction de l'organisme gestionnaire de l'aire protégée concernée.

Article 42 :

Les conditions d'utilisation et de bénéfice des résultats de recherches sont régies par la législation et la réglementation en vigueur dans ce domaine et par les conventions spécifiques entre le Ministère chargé de la Recherche Scientifique, le Ministère chargé de l'Environnement, l'organisme chargé de la gestion du réseau des aires protégées, et les institutions de recherche concernées.

TITRE VII

Des infractions, de la procédure et des pénalités

Article 43 :

Constituent des infractions à l'encontre des aires protégées du réseau national, toutes actions ou omissions portant atteinte à l'intégrité du patrimoine naturel ou culturel protégé dans le cadre de cette Loi, notamment les atteintes irréparables au milieu protégé, les comportements perturbateurs, les comportements incompatibles avec la vie naturelle. Constituent également des actes répréhensibles les infractions prévues par les autres législations et réglementations en la matière, notamment forestière, cynégétique, minière, halieutique et en matière de pêche, commises dans les aires protégées.

CHAPITRE I

Infractions dans les Aires Protégées

Article 44 :

Sont qualifiées crimes les infractions suivantes commises au niveau d'une aire protégée du réseau national :

- l'altération irréparable de végétaux, d'animaux, de sites, de monuments ;
- l'introduction de végétaux ou d'animaux exogènes pouvant entraîner une altération irréparable à d'autres espèces ;
- la commercialisation d'un ou de plusieurs animaux sauvages ;
- les sévices sur les animaux pouvant entraîner la réduction ou la disparition de la capacité reproductive de l'animal ;
- les recherches scientifiques sans autorisation ;
- le prélèvement, la détention, le transport, la vente ou l'achat, et le recel de minéraux ou fossiles ;
- les activités de construction entraînant une altération irréparable d'écosystèmes et/ou d'espèces animales ou végétales ;
- les activités industrielles ou minières ;
- les feux entraînant une altération irréparable d'écosystèmes et/ou d'espèces animales ou végétales ;
- les défrichements avec ou sans incinération ;
- la chasse ou la pêche sans autorisation ;
- la chasse sous marine ;
- l'abandon, le dépôt, le rejet, le déversement, l'immersion dans l'aire protégée de produits chimiques ou radioactifs, de matériaux, de résidus, de détritus de quelque nature que ce soit, pouvant nuire à la qualité des eaux, de l'air, du sol ou du site et/ou à l'intégrité de la faune et de la flore
- l'occupation illicite.

En tout état de cause, constitue un crime toute infraction commise dans une Réserve Naturelle Intégrale ou dans le périmètre d'un noyau dur de toute autre aire protégée.

Article 45: Sont qualifiées délits les infractions suivantes commises au niveau d'une aire protégée du réseau national :

- l'enlèvement, le recel de végétaux, d'animaux ou de nids d'animaux ;
- la détention, le transport de végétaux ou d'animaux sauvages ;
- l'introduction de végétaux ou d'animaux exogènes sans autorisation ;
- l'apport de nourritures aux animaux sans autorisation;
- le dérangement conscient d'animaux ;
- la mutilation de végétaux ;
- le pâturage et autres activités agricoles ou assimilées sans autorisation ;
- le survol à moins de mille mètres d'altitude sans autorisation ;
- les activités de construction sans autorisation ;
- le camping, le bivouac et le caravanage sans autorisation ;
- la plongée sous-marine sans autorisation ;
- les prises de vue et le tournage de film sans autorisation;
- le prélèvement ou l'endommagement de concrétions dans une grotte ;
- la destruction ou détérioration des infrastructures touristiques et éducatives ;
- le refus d'obtempérer aux contrôles des agents de l'aire protégée ;
- l'entrave à la procédure d'enquête ;
- le refus d'honorer les engagements prévus dans les travaux d'intérêt général ou de remise en état de site ;
- les sévices sur les animaux ;
- tout feu de brousse sans autorisation ;
- le captage ou prélèvement d'une certaine quantité d'eau, sans autorisation. Certaines des activités suscitées peuvent néanmoins faire l'objet d'autorisation administrative à titre exceptionnel dans les conditions fixées par la réglementation en vigueur.

CHAPITRE II
Procédure
Section 1

Constatation des infractions

Article 46 :

Outre, les agents et officiers de Police Judiciaire et le personnel des services concernés, notamment du service forestier qui sont habilités à constater les infractions, le Ministère chargé de l'Environnement peut, dans le cadre de la réalisation de sa mission de service public de protection de l'environnement, désigner sur proposition de l'organisme chargé de la gestion du réseau d'aires protégées, des gardes d'aires protégées assermentés qui seront habilités à prévenir, à rechercher, à constater et à poursuivre des infractions commises au sein des aires protégées.

Article 47 :

Toutefois, jusqu'à la mise en place de gardes d'aires protégées prévus à l'article précédent, les infractions dans les aires protégées sont constatées par les agents de l'Etat habilités à cet effet, ou par toute autre personne commissionnée par décret, en collaboration avec le Ministère chargé de l'Environnement et les ministères concernés par ladite infraction, et ce conformément aux dispositions de l'article 128 du Code de Procédure Pénale.

Article 48 :

Les agents habilités pour dresser des procès-verbaux ne peuvent entrer en fonction qu'après avoir prêté serment devant le Tribunal.

Article 49 :

Les procès-verbaux une fois dressés et clos par les agents habilités sont adressés au Ministère chargé de l'Environnement pour conclusion avec copie aux ministères concernés par la dite infraction, selon le type d'aire protégée et selon le type d'infraction.

Article 50 :

Les agents habilités pour dresser procès-verbal défèrent au parquet de la juridiction compétente:

- tout individu qui fait volontairement obstacle à l'accomplissement de leur mission, d'une façon passive ou active, notamment en refusant de donner son identité, ou qui se livre contre eux à un acte de rébellion ;
- toute personne soupçonnée d'avoir commis une infraction punissable d'une peine privative de liberté qu'il y ait ou non flagrant délit.

Article 51 :

Les agents habilités ont le droit de requérir directement la force publique et les membres du fokonolona qui ne pourront refuser leur concours pour la constatation de toutes les infractions en matière d'aires protégées, ainsi que pour la recherche et la saisie des produits prélevés, vendus ou achetés en fraude ou circulant illicitement. Les réquisitions peuvent être écrites ou verbales.

Article 52 :

Les agents habilités peuvent être dotés d'armes dans l'exercice de leur fonction. Les conditions du port d'armes seront fixées par voie réglementaire.

L'administration est tenue d'activer la motivation des agents verbalisateurs dans l'exercice de leur fonction.

Article 53 :

Les agents habilités peuvent pénétrer, en respectant la réglementation en vigueur, dans tous les lieux qu'ils jugent utiles pour le traitement du contentieux. Ils peuvent effectuer des fouilles sur tout matériel de transport.

Article 54 :

Les agents habilités, en vue de la répression des infractions en matière d'aires protégées, saisissent et mettent sous séquestre tous produits, plantes ou animaux constituant l'objet ou le produit des infractions, ou les instruments, les matériels ayant servi à commettre les infractions.

Dans tous les cas où il y a matière à confiscation, le procès-verbal qui constate l'infraction doit énoncer les produits, plantes ou animaux saisis. Il doit être joint au dossier à transmettre à la juridiction compétente.

Article 55 :

En cas de mise sous séquestre, l'agent verbalisateur en dresse procès-verbal dont il notifie un exemplaire au gardien séquestre. Le gardien séquestre peut être le chef d'une collectivité publique de droit ou, à défaut, le chef d'une collectivité rurale coutumière.

Article 56 :

Le Président de la juridiction compétente peut, sur demande de l'organisme chargé de la gestion du réseau des aires protégées, donner main levée des objets, animaux ou végétaux, saisis, s'il y a menace sur l'intégrité ou la survie de ceux-ci.

Les animaux, végétaux ou tout autre produit, objet de la saisie seront remis à l'organisme chargé de la gestion du réseau des aires protégées qui en disposera de la façon qu'il jugera appropriée.

Section 2

Actions et poursuites

Article 57 :

Les actions se prescrivent conformément aux dispositions du Droit Commun.

Article 58 :

Les agents verbalisateurs ont le droit d'exposer l'affaire devant les juridictions compétentes, et sont entendus pour soutenir leurs accusations. Ils assistent à l'audience et siègent à la suite du procureur.

Article 59 :

Les infractions en matière d'aires protégées sont prouvées soit par procès-verbal, soit par tout moyen de droit en cas d'insuffisance de procès-verbal.

Article 60 :

L'organisme chargé de la gestion du réseau national des aires protégées peut se constituer partie civile en cas d'infraction en matière d'aires protégées.

Section 3

Des sanctions et pénalités

Article 61 :

Les infractions prévues à l'article 44 sont punies d'une peine de travaux forcés de cinq (5) à vingt (20) ans et d'une amende de cinq millions (5 000 000) à un milliard (1 000 000 000) de FMG, sans préjudice des indemnités et dommages-intérêts que le tribunal peut toujours prononcer au bénéfice des parties civiles.

Les infractions prévues à l'article 45 sont punies d'une peine de six (6) mois à deux (2) ans de prison et d'une amende de cinq cent mille (500 000) à cent millions (100 000 000) de FMG ou de l'une de ces deux peines seulement.

Les règlements intérieurs peuvent édicter des sanctions complémentaires, en nature ou financières ou les deux.

Les sanctions relatives aux infractions prévues dans la présente Loi ne font pas obstacle à l'application des sanctions complémentaires telles que la réalisation de travaux d'intérêt général dûment acceptés et les travaux de remise en état du site.

Article 62 :

Sauf en qui concerne les peines d'emprisonnement, le principe de non-cumul des peines n'est pas applicable aux infractions en matière d'aires protégées.

Article 63 :

Les complices sont punis comme les auteurs principaux et condamnés solidairement aux amendes, frais, dommages-intérêts et restitutions prononcés, et à toutes autres peines complémentaires.

Article 64 :

En cas d'insolvabilité du délinquant dûment constatée par l'autorité compétente, les amendes, la réparation civile et les frais seront convertis en travaux d'intérêt général et/ou de réhabilitation du site.

Section 4

Des décisions de justice

Article 65 :

Le recours contre une décision de justice est réputé valablement formé par un télégramme ou tout autre procédé de télécommunication adressé au greffe de la juridiction compétente, sous réserve d'une confirmation par lettre.

Les délais de recours sont ceux prévus par le Code de Procédure Pénale.

Section 5

Transaction

Article 66 :

Le représentant du Ministère chargé de l'Environnement est autorisé à transiger. Les transactions sont arrêtées définitivement par le Ministre chargé de l'Environnement.

Ces transactions ne peuvent avoir lieu qu'avant jugement.

Article 67 :

Ne peuvent faire l'objet de transaction les infractions prévues à l'article 44.

Article 68 :

Les personnes déclarées civilement responsables peuvent être appelées à transaction, concurremment avec les délinquants. La transaction ne leur est opposable que si elles y acquiescent. En cas de non-acquiescement, ou de non-acquittement du montant de la transaction, elles ne peuvent être astreintes au paiement qu'après condamnation.

Article 69 :

Au cas où le délinquant accepte de se libérer par des travaux en nature, le représentant du Ministère chargé de l'Environnement qui a accordé la transaction fixe lesdits travaux.

Il est adressé au délinquant admis à se libérer en nature un acte de transaction précisant les modalités du ou des travaux qu'il devra exécuter, ainsi que la date du début et de la fin des travaux. En cas d'inexécution, de négligence, de malfaçon dans l'exécution des travaux, le représentant du Ministère chargé de l'Environnement peut déclarer le délinquant déchu de sa libération par le travail.

Article 70 :

Le montant des transactions consenties ou les travaux tenant lieu de transaction doivent être acquittés ou réalisés dans les délais fixés par l'acte de transaction.

Dans le cas contraire, il est procédé soit à la reprise des poursuites, soit à l'exécution du jugement.

TITRE VIII

Des aires protégées hors réseau national ou aires protégées agréées

Article 71 :

Des aires protégées volontaires peuvent exister en dehors du réseau national.

Il s'agit de territoires appartenant à des personnes autres que l'Etat, publiques ou privées, telles que les Provinces Autonomes, les Régions, les Communes ou des territoires antérieurement concédés par l'Etat, et répondant aux critères susmentionnés d'une aire protégée mais dont l'intégration au réseau n'est pas jugée pertinente.

Afin de protéger dans les propriétés privées, le patrimoine naturel ou culturel présentant un intérêt scientifique, écologique, culturel, ou cultuel, les propriétaires peuvent demander que leurs propriétés soient agréées à titre précaire et révocable comme aires protégées volontaires par le Ministère chargé de l'Environnement conjointement avec le Ministère chargé du secteur concerné, après avis de l'organisme chargé de la gestion du réseau national des aires protégées.

Ces aires protégées ainsi agréées offriront à leurs propriétaires ou aux ayants droit une opportunité de protection de ces territoires, ainsi qu'un terrain d'études et d'observations permettant de mieux connaître et apprécier les richesses naturelles et culturelles malgaches.

Article 72 :

Les conditions dans lesquelles l'agrément est accordé aux aires protégées volontaires, les dénominations qu'elles peuvent porter et les droits et obligations conférés par l'agrément seront fixés par voie réglementaire.

Article 73 :

Les aires agréées sont soumises au contrôle technique de l'organisme chargé de la gestion du réseau des aires protégées ou du Ministère chargé de l'Environnement ou du Ministère chargé du secteur concerné, et leurs responsables sont tenus de respecter les recommandations techniques de cet organisme sous peine de retrait de l'agrément.

Article 74 :

L'organisme chargé de la gestion du réseau des aires protégées contribue à la promotion de la création d'aires protégées autres que nationales et assure, dans la mesure de ses possibilités, l'appui technique aux aires protégées agréées.

TITRE IX

Dispositions diverses et transitoires

Article 75 :

Des textes réglementaires sont pris, en tant que de besoin, en application de certaines dispositions de la présente Loi.

Article 76 :

En cas de silence de la présente Loi, les dispositions législatives ou réglementaires régissant chaque type d'écosystèmes ou secteur d'activités demeurent applicables.

Article 77 :

Toutes dispositions antérieures contraires à celles de la présente Loi sont et demeurent abrogées.

Article 78 :

La présente Loi sera enregistrée et publiée au Journal Officiel de la République.

Elle sera exécutée comme Loi de l'Etat.

Antananarivo, le 11 Février 2003

Marc RAVALOMANANA

ANNEXE A LA LOI N° 2001-005 du11 Février 2003
portant CODE DE GESTION des AIRES PROTEGEES
ENONCE DE POLITIQUE

de GESTION des AIRES PROTEGEES

Considérant que l'Homme et l'Environnement sont indissociables et que la survie de ce dernier est étroitement liée à la santé de l'environnement et au respect du patrimoine,

Que toute personne et la collectivité où elle vit, ont le devoir de respecter l'environnement,

Que l'Etat, avec la participation des Provinces Autonomes et des Collectivités Territoriales Décentralisées, assure la protection, la conservation et la valorisation de l'environnement par des mesures appropriées,

Qu'il est dans la politique de l'Etat de créer et de gérer des aires protégées en vue de conserver le patrimoine naturel et culturel,

Que suivant cette politique, un organe de gestion est chargé d'établir, conserver et gérer, de manière durable, un réseau national de parcs et réserves représentatifs de la diversité biologique et du patrimoine naturel propres à Madagascar,

Qu'il convient, d'une façon générale, de favoriser la création d'aires protégées complémentaires à celles du réseau national,

Que ces aires protégées, sources de fierté nationale pour les générations présentes et futures, doivent être des lieux de préservation, d'éducation, de récréation et contribuer au développement des communautés riveraines et à l'économie régionale et nationale,

Qu'il est important que la politique de gestion des aires protégées prévoie les problèmes et les opportunités liées à cette gestion et permette aux autorités compétentes d'agir et de réagir quand le besoin s'en fait sentir,

Et conformément à la Constitution et à la Charte de l'Environnement,

L'énoncé de politique suivant est proposé :

1. Principes stratégiques :

Ils constituent les objectifs du réseau national des aires protégées.

La protection de l'intégrité écologique dans la création, la gestion et l'administration des aires protégées est une préoccupation essentielle. Le principe de durabilité écologique doit être mis en relief dans cette politique de conservation**.** Cette protection doit se reposer sur de solides pratiques de gestion des écosystèmes et du patrimoine culturel dans les aires protégées, dans le strict respect des cadres institutionnel et légal existants ou à mettre en place.

Les aires protégées ne sont pas des îlots, mais font partie intégrante d'écosystèmes et de paysages culturels. Les prises de décisions les concernant doivent donc être fondées sur la connaissance de l'ensemble de ces écosystèmes et de ces paysages.

Les décisions de gestion pour la mise en valeur de la biodiversité, s'appuient sur les meilleures connaissances disponibles et sur un large éventail de recherches, ainsi que sur un engagement à assurer une surveillance scientifique intégrée.

Les recherches effectuées au sein des aires protégées doivent profiter en premier lieu aux Malgaches et contribuer largement à la valorisation de la biodiversité. Pour ce faire, les conditions de recherches, d'utilisation et de bénéfice des résultats de ces recherches doivent être prévues formellement dans une convention établie entre l'organisme chargé de la gestion du réseau d'aires protégées et l'institution de recherche concernée.

L'éducation est un outil majeur de conservation. Eduquer c'est faire apprécier et faire comprendre la valeur du patrimoine naturel et culturel, et faire adopter des pratiques respectueuses de ce patrimoine en facilitant l'accès du public aux aires protégées et leur appréciation par la mise en place d'aménagements appropriés.

L'Homme et son environnement sont indissociables. L'orientation et la mise en valeur des aires protégées doivent tenir compte des modes de vie et des besoins des populations riveraines.

En tant qu'aires de récréation, d'appui majeur au développement du tourisme et à la création d'entreprises respectueuses de l'environnement et de lieux privilégiés de recherches biologiques, les aires protégées contribuent au développement économique et social, développement qui est un facteur non négligeable de conservation.

En particulier, la gestion des aires protégées doit permettre le développement de l'écotourisme qui se caractérise par son souci de la conservation de la nature et ses retombées bénéfiques sur les populations locales, sans déculturation. A cet effet, l'installation d'infrastructures écotouristiques doit être compatible avec les impératifs liés à la conservation du patrimoine naturel et culturel national et sous réserve de l'accord préalable avec l'entité gestionnaire de l'aire protégée.

2. Principes opérationnels :

Ce sont les moyens pour atteindre les objectifs précités.

La protection des aires protégées nécessite la collaboration de nombreux organismes, établissements et institutions publics, notamment des ministères concernés, du secteur privé, des collectivités territoriales et des populations locales. Ces relations facilitent l'intégration régionale, les partenariats, les conventions de coopération, ainsi qu'un dialogue ouvert.

L'utilisation des terres adjacentes ou avoisinantes ayant des répercussions sur les aires protégées d'une part, mais la gestion de ces aires protégées ayant également une influence sur ces terres adjacentes d'autre part, la recherche d'ententes et/ou de conventions sera privilégiée afin d'encourager des activités écologiquement acceptables sur les terres adjacentes ou avoisinantes, et de décourager celles qui ne sont pas compatibles avec celles-ci.

L'identification, la sélection, la désignation et la création des aires protégées d'importance nationale s'appuient sur des pratiques ouvertes, systématiques, rigoureuses, mises au point en concertation, et fondées sur les connaissances du milieu.

Les aires protégées sont identifiées en consultation avec les ministères concernés et les autorités territoriales, les populations locales et les autres intervenants.

Il est possible d'accorder une protection temporaire à une aire en attendant la décision d'une protection officielle.

L'efficience de ce processus de création des aires protégées rend indispensable que l'organisme chargé de la gestion des aires protégées facilite et coordonne ce processus. Ce qui n'est que l'extension de son rôle de gestionnaire stratégique du réseau national des aires protégées que lui confère la Loi n° 90-033 du 21 Décembre 1990 portant Charte de l'Environnement Malgache et ses modificatifs.

A cette fin, les pratiques suivantes doivent être respectées :

- La mise à disposition du public des informations objectives, claires, précises, mises à jour, et pertinentes ;
- L'indication des enjeux relatifs à la politique, à la législation et aux conventions relatives aux aires protégées et à l'environnement ;
- La prise en compte des avis du public, notamment dans l'élaboration des plans de gestion où la participation du public aux niveaux national, régional et local est essentielle ;
- Et la présentation périodique de compte-rendu des activités.

Les plans de gestion au niveau du réseau national, comme au niveau de chaque aire protégée, sont essentiels à l'administration des aires protégées et constituent un engagement envers la Nation pour la protection et l'utilisation durable de ces aires. Ils en précisent les objectifs de gestion de manière assez exhaustive et indiquent comment une aire protégée permet de mettre en valeur les ressources naturelles et culturelles de sa région. Ces plans doivent également spécifier le genre et le degré des mesures à prendre pour assurer l'intégrité écologique et la gestion durable des ressources naturelles et culturelles au niveau des aires protégées, définir le genre, le caractère et l'emplacement des services et des activités à mettre en œuvre, et en identifier les clientèles potentielles.

Les opérations relatives aux aires protégées se déroulant pour l'essentiel au niveau régional et local, le système appliqué à leur gestion doit correspondre au processus de décentralisation.

La gestion durable de ce réseau exige des ressources fiables et pérennes. La recherche de la pérennisation se fait par la diversification des sources de revenus. La diversification peut être obtenue par l'optimisation des ressources existantes, par l'institution d'un partenariat avec les opérateurs privés, les organismes nationaux et internationaux.

La garantie de l'effectivité de la mission de l'organisme chargé de la gestion du réseau national des aires protégées passe par la participation de cet organisme au processus de contrôle de l'application de la Loi régissant les aires protégées, en étroite collaboration avec les entités déjà habilitées à procéder à un tel contrôle, justifiant ainsi la nécessité de mettre en place des gardes d'aires protégées du réseau national assermentés.

Il doit également pouvoir pratiquer des activités génératrices de revenus, percevoir des droits et bénéficier, dans la mesure du possible, d'un soutien financier de l'Etat.

Appendix VII

Arrêté n°20.022 /2005-MINENVEF

by the Ministry of Environment, Water and Forests, providing temporary protection status to Makira

REPOBLIKAN'I MADAGASIKARA
Tanindrazana – Fahafahana – Fandrosoana

Ministère de l'Environnement, des Eaux et Forêts

ARRETE N° 20.022 /2005-MINENVEF

PORTANT PROTECTION TEMPORAIRE DE L'AIRE PROTEGEE EN CREATION DENOMMEE « MAKIRA »,

DISTRICT DE MAROANTSETRA DE LA REGION D'ANALANJIROFO, PROVINCE AUTONOME DE TOAMASINA ;

DISTRICTS DE MANDRITSARA ET DE BEFANDRIANA-NORD DE LA REGION DE SOFIA, PROVINCE AUTONOME DE MAHAJANGA ; ET

DISTRICTS D'ANDAPA ET D'ANTALAHA DE LA REGION DE SAVA, PROVINCE AUTONOME D'ANTSIRANANA

Le Ministre de l'Environnement, des Eaux et Forêts

- Vu la Constitution

- Vu la loi modifiée n° 90-033 du 21 Décembre 1990 portant Charte de l'Environnement,

- Vu l'ordonnance n° 93-022 du 04 Mai 1993 portant réglementation de la pêche et de l'aquaculture,

- Vu la loi n° 97-017 du 8 Août 1997 portant révision de la législation forestière,

- Vu la loi n° 99-022 du 30 août 1999 portant Code Minier,

- Vu la loi n° 2001-005 du 11 Février 2003 portant Code de Gestion des Aires Protégées,

- Vu l'ordonnance N°60-099 modifiée du 21 Septembre 1960 réglementant le domaine public

- Vu la loi n°2001-004 du 25 Octobre 2001 portant réglementation générale des Dina en matière de sécurité publique,

- Vu la loi n° 2004-001 du 17 juin 2004 relative aux Régions,

- Vu le décret n° 99-954 du 15 Décembre 1999 modifié relatif à la mise en compatibilité des Investissements avec l'environnement,

- Vu le décret n° 2000-170 du 20 février 2000 portant application du Code Minier,

- Vu le décret n° 2003-007 du 12 janvier 2003 portant nomination du Premier Ministre, Chef du Gouvernement,

- Vu le décret n°2003-008 du 12 janvier 2003 modifié par les décrets n°2004-001 du 5 janvier 2004, n° 2004-688 du 05 juillet 2004,

n°2004-1076 du 07 décembre 2004, n°2005-144 du 17 mars 2005, n° 2005-700 du 19 octobre 2005 et n° 2005-827 du 28 novembre 2005 portant remaniement de la composition des membres du Gouvernement,

- Vu le Décret n° 2004-178 du 18 mars 2004 fixant les attributions du Ministre de l'Environnement, des Eaux et Forêts ainsi que l'organisation générale de son Département et les décrets n°2004-452 du 6 avril 2004 et 2005-334 du 31 mai 2005 modifiant et complétant le décret n°2003-100 du 11 février 2003 portant organisation générale du Ministère de l'Environnement, des Eaux et Forêts,

- Vu le décret n°2004-847 du 02 septembre 2004 modifié portant nomination des chefs de Région, Vu le décret n°2004-859 du 17 septembre 2004 fixant les règles relatives à l'organisation, au fonctionnement et aux attributions des Régions en application des dispositions transitoires de la loi n°2004-001 du 17 juin 2004 relative aux Régions

- Vu le décret n°2005-848 du 13 décembre 2005 appliquant les articles 2 alinéa 2, 4, 17, 20 et 28 de la loi n°2001/005 portant Code de Gestion des Aires Protégées,

- Vu l'arrêté n° 18177/04 du 27 septembre 2004 portant définition et délimitation des zones forestières sensibles,

- Vu l'Arrêté interministériel nº19 560/2004 du 18 Octobre 2004 portant suspension de l'octroi de permis minier et de permis forestier dans les zones réservées comme Sites de Conservation,

- Vu l'Arrêté nº 21 694/2004 du 11 novembre 2004 relatif à la suspension de toute activité extractive de ressources ligneuses dans les zones réservées comme Sites de Conservation,

- Vu le dossier présenté par le promoteur justifiant la création de l'Aire Protégée dénommée « Makira »

ARRETE :

Article premier : Le site dénommé « Makira », situé dans les communes rurales d'Ambinanitelo, d'Androndrona, d'Ankofa,d'Antakotako, d'Antsirabe-Sahatany, de Manambolo, de Morafeno, de Voloina, d'Ambodimanga-Rantabe district de Maroantsetra dela région d'Analanjirofo, province autonome de Toamasina ; la commune rurale d'Ambilombe, district de Mandritsara et lescommunes rurales d'Ankarongana, d'Antsakabary et de Matsondakana, district de Befandriana-nord de la région de Sofia, province autonome de Mahajanga, et les communes rurales d'Antsahamena, d'Ambodimanga I, d'Andrakata, d'Anoviara et de Tanandava,district d'Andapa et les communes d'Andampy et de Marofinaritra, district d'Antalaha de la région de SAVA, province autonome d'Antsirananaest admis au bénéfice de la **protection temporaire** durant la période précédant le classement en Aire Protégée du site par décret.

La superficie de l'Aire Protégée en création dénommée « Makira » est de 371.217 Ha environ. Les terrains concernés sont de nature domaniale. Une carte de délimitation approximative de l'aire protégée en création comportant des indications géoréferencées est annexée au présent arrêté.

Article 2 : La protection temporaire est prononcée pour une période d'un (1) an renouvelable une fois. Le décret de création de l'Aire Protégée concernée devra intervenir avant la fin de cette période.

Article 3 : La Direction Générale des Eaux et Forêts – Direction de la préservation de la biodiversité - est désignée gestionnaire de l'aire protégée en création. Sa mission sera précisée dans des instructions écrites spécifiques. Elle peut toutefois déléguer la gestion à une ou des personnes publiques ou privées selon un contrat de délégation de gestion qui comportera un cahier des charges déterminant les termes de la délégation, les droits et obligations des parties.

Le principe de gestion de l'aire protégée en création est celui de la co-gestion, type gestion participative, tel que défini par l'article 24 dernier alinéa du décret n°2005-848 du 13 décembre 2005 appliquant les articles 2 alinéa 2, 4, 17, 20 et 28 de la loi n°2001/005 du 11 février 2003 portant code de gestion des Aires Protégées. Un comité d'orientation et d'évaluation, dont les membres seront nommés par décision du Ministre de l'Environnement, des Eaux et Forêts, assure le suivi de l'exécution des actions découlant du présent arrêté. Il est présidé par le Directeur de la Préservation de la Biodiversité et comprend notamment des représentants des services déconcentrés des ministères intéressés, des régions et des communes, ainsi que toute personne ou organisme choisi pour ses compétences particulières.

Article 4 : Les objectifs principaux de gestion poursuivis sur l'aire protégée en création « Makira » sont d'assurer la protection et le maintien à long terme de la biodiversité, la durabilité des fonctions écologiques et l'utilisation durable des produits naturels nécessaires au bien-être des communautés riveraines.

Les objectifs spécifiques de gestion comprennent:

- la protection de l'ensemble des écosystèmes et des populations viables d'espèces endémiques de faune et de flore du site « Makira ».

- le maintien des ponts génétiques pour assurer la connectivité des blocs de forêts du nord de Madagascar

- le maintien des services écologiques (protection des bassins-versants, châteaux d'eau desservant les zones entourant l'aire protégée en création)

Article 5 : L'Aire Protégée en création comprend les unités d'aménagement suivantes : un noyau dur couvrant une superficie d'environ 348.193 Ha et une zone tampon de 23.023 Ha environ.

Le zonage global de l'aire protégée en création est indiqué dans le schéma global d'aménagement annexé au présent arrêté (annexe 1 et 2).

Article 6 : Un « Plan d'Aménagement et de Gestion » sera élaboré par le gestionnaire de manière participative dans le cadre des opérations préalables à la création définitive de l'Aire Protégée par décret. Toute activité incompatible avec les objectifs de gestion sus-mentionnés est interdite à l'intérieur de l'Aire Protégée en création.

Notamment,

- aucun défrichement ni extension des périmètres de culture existants ne sera autorisé jusqu'à l'élaboration de plans d'aménagement et de gestion simplifiés qui définiront les règles d'utilisation et de gestion des différentes unités d'aménagement,

- aucune autorisation, ni délivrance de permis, à des fins d'exploration ou d'exploitation de carrières ou de mines ne sera accordée,

- aucune autorisation, ni délivrance de permis, à des fins d'exploitation forestière ne sera accordée.

Toutefois, sont notamment autorisés, conformément au schéma global d'aménagement :

- les travaux d'aménagement en faveur du tourisme écologique,

- les activités liées aux recherches scientifiques,

- les activités liées à la conservation : suivi écologique, restauration, contrôle et surveillance,

- l'utilisation piétonnière des principaux sentiers de liaison existants,

- l'accès aux sites cultuels par les sentiers y menant et la pratique des activités cultuelles.

Les activités ci-après sont réglementées conformément au schéma global d'aménagement et autorisées par l'administration forestière sous réserve de l'avis favorable du gestionnaire à l'intérieur de la zone tampon de l'aire protégée en création:

- le pâturage ainsi que le pacage de troupeaux de bovidés,

- la coupe de bois sur pied pour les besoins des communautés riveraines,

- le ramassage des bois morts gisant, la récolte du miel et de la cire, des plantes médicinales, des fruits et des plantes comestibles,

- la chasse aux animaux sauvages,

- le prélèvement des produits accessoires des forêts respectant les principes de l'utilisation durable.

Article 7 : Pendant la période de protection temporaire,

- les communes rurales d'Ambinanitelo, d'Androndrona, d'Ankofa, d'Antakotako, d'Antsirabe-Sahatany, de Manambolo, de Morafeno, de Voloina, d'Ambodimanga-Rantabe district de Maroantsetra de la région d'Analanjirofo; la commune rurale d'Ambilombe, district de Mandritsara et les communes rurales d'Ankarongana, d'Antsakabary et de Matsondakana, district de Befandriana-nord de la région de Sofia; et les communes rurales d'Antsahamena, d'Ambodimanga I, d'Andrakata, d'Anoviara et de Tanandava, district d'Andapa et les communes d'Andampy et de Marofinaritra, district d'Antalaha de la région de SAVA

- les Services déconcentrés chargés de l'Environnement, des Eaux et Forêts d'Antsohihy, de Fénérive-Est et d'Antalaha ;

- et les Brigades de Gendarmerie compétentes dans les zones entourant l'aire protégée en création, sont chargés, chacun en ce qui le concerne, de la surveillance et contrôle de proximité du site de l'Aire Protégée en création, en coopération avec le Gestionnaire désigné et conformément aux règles de gestion participative instaurées au titre de la protection temporaire.

Par ailleurs, des Dina pourront être conclus entre les membres des collectivités selon les dispositions légales en vigueur.

Article 8 : Les infractions au présent arrêté sont constatées et réprimées conformément à la législation en vigueur.

Article 9 : Le présent arrêté entre en vigueur dès sa signature, sera enregistré, publié et communiqué partout où besoin sera.

Annexe 1 : Carte de zonage global de l'Aire Protégée en création « Makira »

Annexe 2 : Zonage global de l'Aire Protégée en création « Makira »

Appendix VIII

Delegation of management of Makira Protected Area from the Ministry of Environment and Forests to WCS

REPOBLIKAN'I MADAGASIKARA
Fitiavana - Tanindrazana -Fandrosoana

MINISTERE DE L'ENVIRONNEMENT ET DES FORETS

Arrêté n° 45.330/2011/MEF portant délégation de gestion de la Nouvelle Aire Protégée en création dénommée « MAKIRA »

LE MINISTRE DE L'ENVIRONNEMENT ET DES FORETS,

Vu la Constitution,
Vu la loi n° 90-033 du 21 décembre 1990 portant Charte de l'Environnement, modifiée et complétée par loi n° 97-012 du 06 juin 1997 et loi n° 2004-015 du 19 août 2004,
Vu la loi n° 96-025 du 30 septembre 1996 relative à la gestion locale des ressources naturelles renouvelables,
Vu la loi n° 97-017 du 08 août 1997 portant révision de la législation forestière ;
Vu la loi n° 2001-005 du 11 février 2003 portant Code de Gestion des Aires Protégées,
Vu la loi 2005-019 du 17 octobre 2005 fixant les principes régissant les statuts des terres,
Vu la loi n°2008-013 du 03 juillet 2008 sur le domaine public,
Vu la loi n°2008-014 du 03 juillet 2008 sur le domaine privé de l'Etat, des Collectivités décentralisées et des personnes morales de Droit Public,
Vu le décret n° 2005-013 du 11 janvier 2005 organisant l'application de la loi n° 2001-005 du 11 février 2003 portant Code de gestion des Aires Protégées,
Vu le décret n°2005-848 du 13 décembre 2005 appliquant les articles 2 alinéa 2, 4, 17, 20 et 28 de la loi n°2001-005 du 11 février 2003 portant Code des Aires Protégées,
Vu le décret n°2005-849 du 13 décembre 2005 portant refonte des conditions générales d'application de la loi n° 97-017 du 08 août 1997 portant révision de la législation forestière,
Vu le décret n°2008-1141 du 1er décembre 2008 fixant les modalités d'application de la loi n°2008-013 du 23 juillet 2008 sur le Domaine public,
Vu le décret n°2010-233 20 avril 2010 fixant les modalités d'application de la loi n°2008-014 du 23 juillet 2008 sur le Domaine privé de l'Etat, des Collectivités Décentralisées et des personnes morales de Droit public,
Vu le décret n°2010-647 du 06 juillet 2010 fixant les attributions du Ministre de l'Environnement et des Forêts, ainsi que l'organisation générale de son ministère,
Vu le décret n° 2011-653 du 28 Octobre 2011 portant nomination du Premier Ministre, Chef du Gouvernement de Transition d'Union Nationale,

Vu le décret n° 2011-687 du 21 novembre 2010 portant nomination des membres du Gouvernement de Transition d'Union Nationale,
Vu l'arrêté interministériel n° 52005/2010 du 20 décembre 2010 modifiant l'arrêté interministériel Mine-Forêts n°18633 du 17 octobre 2008 portant mise en protection temporaire globale des sites visés par l'arrêté n°17914 du 18 octobre 2006 et levant la suspension de l'octroi des permis miniers et forestiers pour certains sites,
Sur proposition du Directeur Général des Forêts

ARRETE :

Article premier En application de l'article 4 de l'arrêté interministériel n° 52005/2010 du 20 décembre 2010 sus visé.

Le Ministère de l'Environnement et des Forêts délègue la gestion de la Nouvelle Aire Protégée dénommée « Makira » en vue de mener à terme le processus opérationnel de création définitive.

Par la suite, le Promoteur poursuivra ses activités jusqu'à ce que les structures de gestion définitive acquièrent leur pleine autonomie.

Définitions

Article 2 : Aux termes du présent arrêté, on entend par :

Délégation de gestion : L'acte par lequel, le Ministère de l'Environnement et des Forêts confie la gestion de la Nouvelle Aire Protégée « Makira » à une personne morale de droit privé ou de droit public en vue de la conservation au sens du Code des Aires protégées

Délégant : Le Ministère de l'Environnement et des Forêts

Délégataire : Wildlife Conservation Society, la personne morale à qui le Ministère de l'Environnement et des Forêts délègue la gestion de la Nouvelle Aire Protégée « Makira »

Gestion d'une AP : définie selon les dispositions du Code de gestion des Aires Protégées (COAP) et ses textes d'application en vigueur

Article 3 : Par le présent arrêté, **Wildlife Conservation Society** dont les bureaux se trouvent à Ankorondrano, Bâtiment C2, Explorer business Park, BP 5178 Antananarivo 101 Madagascar, œuvrant dans le domaine de la conservation de la biodiversité selon l'accord de siège valide, n° 592- AESGDAESCD 05.USA du 23 novembre 2010est désigné gestionnaire de la Nouvelle Aire Protégée en voie de création dénommée « Makira ».

Article 4 : L'objet de la présente délégation de gestion concerne la Nouvelle Aire Protégée « Makira » d'une superficie totale de 372 470 Hectares, localisée géographiquement à

Région	District	Commune	Fokontany
ANALANJIROFO	Maroantsetra	Ankofa	Ambalarano
		Ambondrona	Antsirabe Nandihizana
			Ambodimanga Nandihizana
			Ambatrabe
			Nanoharana
		Voloina	Ambodihazomamy
			Ambinanindrano
		Antsirabe Sahantany	Andongona
			Vinanibe
			Maromby
			Antsirabe
			Antaravato
		Ambinanitelo	Andranasana
			Marovovonana
			Ambalamahogo
			Sahantaha
			Ambodihazomamy
			Ambodivoangy
			Andarapaty
		Manambolo	Ambodimanga
			Ambahaohely
			Maintimbato
		Antakotako	Sakatihina
			Somisika
			Ampipoahantsatroka
		Ambodimanga Rantabe	Sahajinja Manonga
			Mafaipoza
		Morafeno	Morafeno
			Antsambalahy
			Beanana
SOFIA	Mandritsara	Ambilombe	Bandabe
			Andranonkazo II
			Antsandrahana
			Antsandrahana

Article 4 : L'objet de la présente délégation de gestion concerne la Nouvelle Aire Protégée « Makira » d'une superficie totale de 372 470 Hectares, localisée géographiquement à

Région	District	Commune	Fokontany
ANALANJIROFO	Maroantsetra	Ankofa	Ambalarano
		Ambondrona	Antsirabe Nandihizana
			Ambodimanga Nandihizana
			Ambatrabe
			Nanoharana
		Voloina	Ambodihazomamy
			Ambinanindrano
		Antsirabe Sahantany	Andongona
			Vinanibe
			Maromby
			Antsirabe
			Antaravato
		Ambinanitelo	Andranasana
			Marovovonana
			Ambalamahogo
			Sahantaha
			Ambodihazomamy
			Ambodivoangy
			Andarapaty
		Manambolo	Ambodimanga
			Ambahaohely
		Antakotako	Maintimbato
			Sakatihina
			Somisika
			Ampipoahantsatroka
		Ambodimanga Rantabe	Sahajinja Manonga
			Mafaipoza
		Morafeno	Morafeno
			Antsambalahy
			Beanana
SOFIA	Mandritsara	Ambilombe	Bandabe
			Andranonkazo II
			Antsandrahana
			Antsandrahana

SOFIA	Befandriana Nord	Matsondakana	Ambavala
			Marojao
			Amparihy Fiadanana (Anahamalemy)
			Andranomena
		Ankarongana	Ankijanilava
			Tsarabanjina
			Andilambe
		Antsakabary	Lavavozona
			Andapanomby
SAVA	Andapa	Tanandava	Antanamangotroka
			Besariaka
		Ambodimanga I	Ampontsilahy
			Andilandrano
			Amponaomby
		Anoviara	Anoviara
			Berokavato
		Antsahamena	Ambodiangezoka
			Mahadera
			Befontsy
		Andrakata	Ambalavelona
			Androka
	Antalaha	Andampy	Tanambao Antsakondrevo
			Andampy
			Antsahabeorana
			Ankijanibe
		Antananambo	NosiBe Virembina
		Marofinaritra	Antsahantitra
			Marofototra
		Antombana	Antombana

La carte géoréférencée de ses limites est portée en annexe.

Article 5 : Dès la signature du présent arrêté, un contrat de délégation de gestion est établi pour préciser les rôles et obligations de l'Administration Forestière et du délegataire à travers son cahier des charges.

Article 6 : Tout manquement aux obligations du délégataire définies dans le cahier des charges annexé au présent arrêté entraîne l'abrogation de plein droit, et ce, après une mise en demeure sans effet de trois (03) mois.

Les modalités de cette abrogation sont définies dans le Contrat de délégation.

Article 7 : La validité de cette délégation de gestion prend fin à la date du 31 décembre 2014. Le Ministère de l'Environnement et des Forêts se réserve le droit de proroger cette date, après évaluation.

Toutefois, **Wildlife Conservation Society** a l'obligation de constituer le dossier de création définitive de l'Aire Protégée Protégée « Makira », en vue de la sortie du décret de création définitive au plus tard le 19 décembre 2012.

Article 8 : Le mode de gestion finale visée par la création définitive est la cogestion.

Article 9 : Toute initiative devant engager l'intégrité du site, ainsi que toute cession de service écologique doivent faire l'objet d'un accord préalable du Ministère de l'Environnement et des Forêts.

Article 10 : Tout engagement à moyen ou long terme découlant des négociations sur les options de financement requiert l'accord du Ministère de l'Environnement et des Forêts.

Article 11 : La Nouvelle Aire Protégée Protégée « Makira » demeure propriété de l'Etat.

Article 12 : Le présent arrêté prend effet à la date de sa signature.

Article 13 : Le présent arrêté sera enregistré et communiqué partout où besoin sera.

Fait à Antananarivo, le 14 DEC [illegible]

Appendix IX

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

REPOBLIKAN'I MADAGASIKARA

Tanindrazana - Fahafahana - Fandrosoana

1.1.1.1.1.2 MINISTERE DES EAUX ET FORETS

DECRET N° 2001-122

Fixant les conditions de mise en œuvre de la gestion Contractualisée des forêts de l'Etat.

LE PREMIER MINISTRE, CHEF DU GOUVERNEMENT,

Vu la Constitution,

Vu la Loi modifiée n° 60-004 du] 5 Février 1960 relative au domaine privé national;

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

Vu la Loi n° 97-017 du 8 Août 1997 portant révision de la législation forestière; .

Vu l'Ordonnance n° 60-128 du 3 Octobre 1960 fixant la procédure applicable à la répression des infractions à la législation forestière, de la chasse, de la pêche et de la protection de la nature;

Vu le Décret n° 97-281 du 7 Avril 1997 fixant les attributions du Ministre des Eaux et Forêts ainsi que l'organisation générale de son Ministère,

Vu le Décret n° 97-1200 du 2 Octobre 1997 portant adoption de la politique forestière;

Vu le Décret n° 98-522 du 23 Juillet 1998 portant nomination du Premier Ministre, Chef du Gouvernement,

Vu le Décret n° 98-530 du 31 Juillet 1998 portant nomination des membres du Gouvernement;

Vu le Décret n° 98-781 du 16 Septembre 1998 fixant les conditions générales d'application de la Loi 97017 sus- visée;

Vu le Décret 98-782 du 16 Septembre 1998 relatif à l'exploitation forestière;

Vu le décret n° 2000-27 du 13 Janvier 2000 relatif aux communautés de base chargées de la gestion locale des ressources naturelles renouvelables ;

Sur proposition du Ministre des Eaux et Forêts,

En conseil de Gouvernement,

DECRETE:

TITRE 1 - DISPOSITIONS GENERALES

Article premier: En application des dispositions de l'article 24 de la loi n° 97-017 du 8 Août 1997 portant révision de la législation forestière, le présent décret a pour objet de fixer les conditions de mise en œuvre de la gestion contractualisée des forêts de l'Etat en vue de la délégation de leur gestion aux communautés de base constituées par les nverams.

Article 2: La gestion contractualisée des forêts (GCF) s'inscrit dans le cadre des objectifs et prescriptions:

- De la gestion locale sécurisée des ressources naturelles renouvelables (GELOSE) ;
- De la politique forestière;
- Du Plan Directeur Forestier National (PDFN) et de ses composantes régionales, en l'occurrence les plans Directeurs Forestiers Régionaux (PDFR) ;
- De la mise en compatibilité des investissements avec l'environnement (MECIE) ;
- Des plans d'aménagement.

Article 3 : Pour l'application du présent décret, on entend par:
- Gestion contractualisée des forêts (GCF): un mode de transfert de gestion des forêts aux communautés de base en vue d'une gestion locale durable et sécurisée des ressources forestières;
- Communauté de base: un groupement constitué, organisé et fonctionnant conformément aux dispositions du Décret n° 2000-27 du 13 Janvier 2000 relatif aux communautés de base chargées de la gestion locale des ressources naturelles renouvelables ;
- Commune de rattachement: la collectivité dans le ressort de laquelle se trouvent les ressources forestières gérées.
- Valorisation économique: l'exploitation à but commercial des ressources forestières s'inscrivant dans le cadre d'une gestion durable des forêts.

Article 4: Le transfert de gestion d'une forêt au moyen d'un contrat de gestion comprend:
- La gestion des droits d'usage exercés individuellement ou collectivement par les membres de la communauté de base soit en vue d'assurer leurs activités traditionnelles par collecte de produits forestiers secondaires soit en vue de satisfaire leurs besoins domestiques tels que prévus par l'article 41 de la loi n° 97 -017 dite loi forestière et les articles 34 et 35 du Décret n° 98-781 du 16 Septembre 1998 fixant les conditions générales d'application de la loi forestière;
- La valorisation économique des ressources forestières conformément aux dispositions du titre III du présent décret. Les bois de première et de deuxième catégorie, prévus par le tableau annexé à l'arrêté du 17 Novembre 1930, font l'objet de clauses techniques particulières dans le cadre de leur valorisation (plan d'aménagement, convention d'exploitation, dina...).
- La protection de la forêt.

Toutefois, le transfert de gestion d'une forêt peut s'effectuer d'une manière progressive en fonction de la capacité de gestion de la communauté de base demanderesse suivant l'avis de la commune de rattachement et de l'Administration forestière compétente.

Article 5 : La GCF peut s'appliquer:
- Aux forêts domaniales;
- Aux forêts classées;
- Aux stations forestières;
- Aux peuplements artificiels;
- Aux zones d'occupation contrôlée, aux zones d'utilisations contrôlées, aux zones périphériques des aires protégées;

Pour des raisons de protection, les zones ou réserves nécessitant une conservation peuvent aussi faire l'objet de transfert de gestion contractualisé.

En sont exclues, sauf en ce qui concerne leur conservation, les aires protégées, notamment les réserves naturelles intégrales, les réserves spéciales, les parcs nationaux.

Article 6: La zone forestière attribuée à une communauté de base est fixée en fonction:
- De l'accessibilité de la forêt considérée;
- De la pression s'exerçant sur les ressources forestières;
- Des besoins de la communauté de base demanderesse;

- De la capacit_ reproductive de la forêt;
- De la motivation et de la volonté de ladite communauté de base. Elle s'inscrit dans les limites du terroir de la communauté de base demanderesse.

Article 7: Un contrat de gestion dans le cadre de la gestion contractualisée d'une forêt est conclu initialement pour une durée de trois (3) ans.

Il sera renouvelé par période de dix (10) ans sous réserve de l'application du titre IV du présent décret, notamment des articles 34 et 35.

Au terme de chaque période, il sera procédé à une évaluation de la gestion de la forêt par la dite communauté de base.

TITRE II - DE LA PROCEDURE DE CONCLUSION

DES CONTRATS DE GESTION

Article 8 : Le contrat ayant pour objet un transfert de gestion de forêts de l'Etat est conclu entre:
- L'Administration forestière,
- La communauté de base demanderesse,

A cet effet, le représentant de l'Administration forestière est désigné par note de service de la Direction Inter-régionale des Eaux et Forêts concernée.

Article 9 : Conformément au modèle indicatif annexe au présent décret, un contrat de gestion détermine:

- La forêt, objet du transfert de gestion;
- L'étendue, les conditions et les termes ~~la consistance~~ du transfert de la gestion;
- Les infractions et les sanctions applicables;

Le règlement des litiges.

Les modalités d'application du présent article sont fixées par arrêté du Ministre chargé des Eaux et Forêts.

Article 10: La conclusion d'un contrat de gestion s'effectue selon la procédure ci-après:
- Demande adressée par des représentants de la communauté de base à la commune de rattachement;
- Transmission de la demande au responsable de l'Administration forestière compétente après avis de la commune avec ampliation au sous-préfet concerné;
- Enquête menée par une commission locale;
- Constitution de l'association gestionnaire et mise en place de]a structure de gestion;
- Elaboration des outils de gestion;
- Signature du contrat.

La commission ci-dessus mentionnée est composée:
- Du maire ou de son représentant,
- D'un membre du conseil de la commune,
- D'un représentant du cantonnement forestier.

1.1.1.1.1.3 TITRE III - DES MODALITES DE GESTION

Article 11: Conformément aux dispositions de l'article 31 alinéa 2 du Décret n° 98-782 du 16 Septembre 1998, la gestion contractualisée d'une forêt par une communauté de base s'effectue en régie.

Toutefois, l'exploitation de la potentialité économique de la forêt dont la gestion est transférée à la communauté de base, peut être sous traitée à des professionnels-forestiers agréés, dans le respect du plan d'aménagement et des règles d'exploitation en vigueur.

Article]2: - Dans les deux cas cités à l'article II ci-dessus, l'exploitation des dites ressources doit s'effectuer conformément:

- à un plan d'aménagement simplifié fixant notamment:
    - Le volume annuel de prélèvement en fonction de la superficie maximale exploitable et du volume maximal des ressources forestières exploitables annuellement;
    - Le zonage d'unités d'aménagement;
    - Le mode de traitement.

- aux prescriptions du décret no99-954 du 15.12.99 relatif à la mise en compatibilité des investissements avec l'environnement.

En outre, elle ne doit pas porter atteinte à la capacité productive ou reproductive de la forêt ni à la biodiversité.

Chapitre 1 - De la l!estion en rél!ie

Article13 : Les modalités de gestion d'une forêt par une communauté de base sont fixées par un cahier des charges selon un modèle approuvé par arrêté du Ministre chargé des forêts.

Article 14 : La Communauté de base gestionnaire peut procéder directement à la commercialisation des ressources forestières exploitées dans le cadre d'une valorisation économique de la forêt.

Les recettes y afférentes sont gérées au niveau de ladite communauté de base suivant les dispositions du Décret n°2000-27 du 13 Janvier 2000, notamment ses articles 20 et 21.

Article 15: Les produits forestiers provenant de l'exercice des droits d'usage ne peuvent pas faire l'objet de transaction commerciale.

Article 16: La valorisation économique des ressources forestières par la communauté de base gestionnaire donne lieu au paiement des redevances forestières prévues par l'article 46 du Décret n° 98-782 du 16 Septembre 1998 et dont les modes de calcul sont fixées par arrêté du Ministre chargé des Forêts.

Les redevances perçues sont versées au profit des fonds forestiers conformément à l'article 49 dudit décret.

Article 17: L'exercice des droits d'usage et la protection de la forêt par la communauté de base gestionnaire ne sont pas subordonnés au paiement de redevances.

Chapitre 2 - De la sous-traitance

Article 18: Une forêt concédée à une communauté de base en vertu d'un contrat de gestion peut, un an après la mise en vigueur dudit contrat, faire l'objet d'une sous-traitance à un ou plusieurs exploitants forestiers agréés.

Leur agrément s'effectue dans les conditions prévues par les articles 3 et 4 du Décret n° 98-782 du 16 Septembre 1998.

Article 19: La sous-traitance évoquée à l'article 18 ci-dessus, a pour objet de céder à un ou plusieurs exploitants forestiers le droit de procéder à une valorisation économique de la forêt considérée. Elle peut porter sur la totalité ou sur une parcelle d'une forêt.

Article 20: Une sous-traitance est attribuée par la communauté de base gestionnaire par voie d'adjudication. Dans la mise en œuvre de la procédure en la matière, elle est assistée par l'Administration forestière compétente.

Article 21: Les droits et obligations de la communauté de base gestionnaire et de l'exploitant forestier agréé sont déterminés par une convention d'exploitation établie conformément au modèle fixé par arrêté du Ministre chargé des Eaux el Forêts.

Les conditions techniques d'exploitation de la forêt concédée sont fixées par un cahier de charges établi selon un modèle approuvé par arrêté du Ministre chargé des Eaux et Forêts.

Article 22 : La durée d'une convention d'exploitation est fixée en fonction:

- de la richesse et de la capacité reproductive de la forêt;
- des moyens techniques dont dispose le concessionnaire;
- de la superficie concédée.

Article 23: Toutefois confo.rmément aux dispositions de l'article 20 du Décret n° 98-782 du 16 Septembre 1998, le régime du permis d'exploitation s'applique à titre transitoire.

Article 24: L'exploitation forestière par un sous-traitant donne lieu au paiement des redevances forestières prévues par l'article 46 du décret n° 98-782 du 16 Septembre 1998.

Article 25: Les taux et les modalités de recouvrement et de répartition des redevances seront fixées par arrêté du Ministère chargé des Eaux et Forêts.

Chapitre 3 - De l'exportation

Article 26: L'exportation des ressources forestières s'effectue conformément aux réglementations en vigueur notamment les articles 41, 42, 43 et 48 du décret 98-782 du 16 septembre 1998.

1.1.1.1.1.4 TITRE IV - DU SUIVI ET CONTROLE

Article 27 : Le suivi technique et le contrôle du respect de l'application de la réglementation concernant la gestion en régie des forêts sont exercés par les agents habilités de l'Administration forestière et les Officiers de la Police Judiciaire conformément aux lois et règlements en vigueur, notamment:

- L'Ordonnance n° 60-128 du 3 Octobre 1960 fixant la procédure applicable à la répression des infractions à la législation forestière, de la chasse, de la pêche et de la protection de la nature;
- Décret na 61-078 du 8 Février 1961 fixant les modalités d'application de l'Ordonnance n° 60.128;
- Le Décret na 98-782 du 16 Septembre 1998 relatif à l'exploitation forestière;

Article 28 : Pour permettre aux Agents de l'Administration forestière d'exercer leurs fonctions de suivi et de contrôle:

- Les communautés de base gestionnaires ou les concessionnaires des forêts doivent d'une part tenir un cahier de chantier et un carnet de laissez-passer et d'autre part, revêtir d'un marquage les ressources forestières exploitées conformément aux dispositions des articles 38 et 39 du décret n°98- 782 .
- Les transporteurs des ressources forestières doivent être munis d'un laissez-passer tel que prévu

par l'article 40 dudit décret.

Article 29: Les agents de l'Administration forestière doivent adresser, à titre de compte rendu, ampliation de leurs procès-verbaux de saisie et de leurs rapports dans le cadre de la gestion contractualisée des forêts:

- Au Représentant de l'Etat concerné;
- A la Direction Inter-Régionale des Eaux et Forêts concernée;
- A la Commune de rattachement.

Article 30: Dans l'exercice de leurs fonctions de contrôle sur les concessionnaires et les tiers, les Contrôleurs communaux, les présidents des comités exécutifs des communautés de base sont habilités à procéder à la saisie des produits délictueux.

Article 31 : Dans le cas où une infraction a été commise par un concessionnaire, le Président de l'organe exécutif de la communauté de base assure les fonctions de gardien séquestre des produits délictueux saisis.

Article 32: Après en avoir été informé par le Président de l'organe exécutif de la communauté de base, le Chef de l'Administration forestière compétente ou l'OftÏcier de la Police judiciaire constate sur place les faits et établit un procès verbal de saisie et de confiscation.

La mise en vente et la répartition des prix de vente des produits confisqués sont effectuées selon la réglementation en vIgueur.

ArtIcle 33: Dans le cas où une infraction a été commise par un membre de la communauté de base gestionnaire, il est fait application du Dina.

Article 34: En cas de faute commise par une communauté de base dans l'exécution du contrat de gestion, le responsable de l'Administration forestière compétente tel que défini à l'article 8 ci-dessus, peut prononcer à l'encontre de la communauté de base les sanctions ci-après selon le cas:

L'avertissement

La suspension du contrat La résiliation du contrat

Les conditions d'application de ces sanctions sont précisées dans le cahier des charges annexé au contrat de gestion.

Article 35: La convention d'exploitation peut être résiliée sans que le concessionnaire puisse prétendre à un dédommagement en cas:

De récidive

De refus d'obtempérer aux injonctions émanant de la communauté de base concédente ou de l'Administration forestière après trois avertissements.

1.1.1.1.1.5 TITRE V - DU REGLE MENT DES LITIGES

Article 36 : En cas de litige entre les membres de la communauté de base ou avec celle-ci, il est fait application des voies de règlement prévues par le dîna en vigueur. L'échec de cette procédure autorisera l'organe exécutif de la communauté de base concernée à saisir le président du conseil de la commune de rattachement dans les trente jours suivants-la constatation du litige.

Le président du conseil de la commune de rattachement procédera avec diligence à la réconciliation à \' amiable des parties.

Article 37: En cas de troubles du fait d'un tiers et préjudiciables à la paisible exécution du contrat de gestion, la communauté de base peut avant toute action en justice, demander au président du conseil de la Commune rurale de rattachement d'user de ses pouvoirs de conciliation.

En cas d'échec d'une telle procédure de conciliation, le litige peut être soumis à la juridiction compétente par la partie la plus diligente.

Article 38: Toutefois, au cas où les parties y consentent, le différend peut être réglé par voie d'arbitrage dans les conditions prévues par la loi n° 96-025 du 30 Septembre 1996 sus- visée en son article 47, sauf pour les infractions pénales.

Un compromis d'arbitrage est signé par les parties en présence du Président du Conseil de la commune de rattachement ou de son représentant.

Article 39 : Si les troubles proviennent du fait de l'Administration, il est fait application des dispositions prises par la loi n° 96-025 du 30 septembre 1996 notamment dans ses articles 45, 46, et 47.

TITRE VI - DISPOSITIONS DIVERSES

Article 40: Conformément aux dispositions des articles 22 et 23 du Décret n° 2000-27 du 13 Janvier 2000, une communauté de base peut être dissoute par:

- La démission de la majorité absolue de ses membres;
- Une décision de l'Assemblée générale.

En cas de dissolution, il est fait application des dispositions de l'article 20 dudit décret en ce qui concerne la dévolution de ses biens.

Article 41 : Des arrêtés fixeront les modalités d'application du présent décret.

Article 42: Toutes dispositions contraires au présent décret sont et demeurent abrogées.

Article 43: Le Vice-Premier Ministre chargé du Budget et du Développement des Provinces autonomes, le Ministre de l'Intérieur et le Ministre des Eaux et Forêts sont chargés, chacun en ce qui le concerne, de l'exécution du présent décret qui sera publié au journal officiel de la République.

Fait Antananarivo, le 14 FEB 2001

Par le Premier Ministre,
Chef du Gouvernement
Le Vice-Premier Ministre chargé du Budget
Et du Développement des Provinces Autonomes

Tantely ANDRIANARIVO
Le Ministre de l'Intérieur

Jean Jacques RASOLONDRAIBE

Pierrot RAJAONARIVELO
Le Ministre des Eaux et Forêts

Rija RAJOHNSON
Pour ampliation conforme
Antananarivo, le 13 JUL 2001
Le SECRÉTAIRE GÉNÉRAL ADJOINT DU GOUVERNEMENT
Honorée Eliane RALALAHARISON

ANNEXE AU DECRET N° 2001-122 DU 14 FEB 2001

Fixant les conditions de mise en œuvre de la gestion

Contractualisée des forêts de l'Etat

MODELE INDICATIF. DE CONTRAT

DE GESTION DES FORETS

CONTRAT DE GESTION RELATIF A LA FORET DE

ENTRE LES SOUSSIGNES:

Le[1]..agissant pour le compte de l'Etat, dénommé, (le……………………),

d'une part,

La communauté de base"……………………………………………"(dénomination et siège),

Commune de……………………………………Fivondronampokontany de …………………………..représentée par son Président, ci-après dénommée, l'association,
d'autre part,

Il est arrêté et convenu ce qui suit:

1.1.1.1.1.6 TITRE 1 - DISPOSITIONS GENERALES

Article premier: Objet du contrat de gestion.

En application du décret n°…………….du………………….fixant les conditions de mise en œuvre de lagestion contractualisée des forêts de l'Etat en vue de la délégation de leur gestion aux communautés de base, le présent contrat a pour objet de déterminer les modalités du transfert de la gestion de la forêt (ou de la parcelle de la forêt) de ……………………………….…… Commune de………………………………………..Fivondronanmpokontany de **............**………..

.................................., au profit de l'Association.

Article 2 : Bénéficiaires

Les habitants du ou des villages de ……………………….………………, membres de l'Association peuvent jouir des ressources forestières dont la gestion est transférée à l'Association.

Article 3 : Délimitation de la forêt

Les limites de la forêt (ou parcelle de la forêt) de ....

Objet du présent contrat, d'une superficie de.................................... hectares, sont constitués:

- Au nord; par ....
- Au sud; par '..

- A l'ouest; par ....

[1] Désigné par la Direction Inter-Régionale des Eaux et Forêts

TITRE II - DU TRANSFERT DE GESTION

Article 4 : Consistance du transfert.

l'Association peut dans ladite forêt (ou parcelle) procéder à:

- l'exercice des droits d'usage tels que prévus par l'article 41 de loi forestière et les articles 34 et 35 du décret n° 98.781 du 16 Septembre 1998 fixant les conditions générales d'application de loi forestières;
- La valorisation économique des ressources forestières;
- Ou à certaines de ses activités (à préciser dans le contrat).

Article 5 : Mode de gestion

L'Association est autorisée à exploiter ladite forêt (parcelle) sous la forme d'une gestion en régie conformément au cahier des charges correspondant.

Elle peut, sur décision de l'assemblée générale, concéder la valorisation économique de ladite forêt (parcelle) à un ou plusieurs exploitants forestiers agréés au moyen d'une convention d'exploitation passée entre l'Association et les concessionnaires après accord préalable du Chef de l'Administration forestière concernée2.

Article 6 : Durée du transfert

La durée initiale du transfert est fixée trois (3) ans; il peut être renouvelé pour une période de dix (10) ans sur avis du Chef de l'Administration forestière de ………[2]

TITRE III - DES DROITS ET OBLIGATIONS DE APRTIES ET DE INTERVENANTS

Chapitre 1 - Des droits et Obligations de l'Association

Section 1 - Droits de l'association

Article 7 : Droits d'usage

Dans l'exercice de leurs droits d'usage, les membres de l'Association peuvent dans ladite forêt (parcelle):

Procéder à la collecte de produits forestiers secondaires; Satisfaire leurs besoins domestiques.

Ses droits peuvent s'exercer individuellement ou collectivement; toutefois, il leur est interdit de vendre à titre professionnelles produits ainsi collectés.

Article 8 : Valorisation économique des ressources forestières

Dans le cadre d'une gestion directe; l'Association est autorisée à effectuer dans la dite forêt (parcelle) à un prélèvement à but commercial des produits forestiers ou de tous autres produits conformément au cahier des charges.

Toutefois, un an après la mise en vigueur du contrat de gestion, la dite forêt (parcelle) peut être confiée à un ou plusieurs exploitants forestiers agréés dans les conditions définies aux articles 17 et suivants du décret n° ....du....................... fixant les conditions de mise en oeuvre de la gestion contractualisée des forêts.

Article 9 : Gestion durable de la forêt

L'Association doit s'organiser et prendre toutes mesures en vue de la gestion durable et sécurisée de la dite forêt (parcelle).

[2] Désigné par la Direction Inter-Régionale concernée

Article 10 : Perception et répartition des ristournes

En cas de sous-traitance de la gestion de la forêt (parcelle), le Président du comité de gestion est habilité à percevoir des ristournes et à les repartir dans les conditions fixées par l'article 27 du décret n°……………….du ....

Article 11 : Contrôle

Le président du Comité de gestion ou son représentant est autorisé à contrôler:

- L'application du Dina;
- L'accès de la dite forêt (parcelle)
- Le cas échéant, \' exécution de la convention d'exploitation par l'exploitant forestier agréé.

Section 2 - Obligation de l'Association

Article 12 : Respect du Dina et du cahier des charges

Les membres de l'Association sont tenus de respecter le Dina et le cahier des charges sous peine du vonodina ou de sanctions prévues par le décret n°…………du………………….en son article 36 et le cahier des charges.

Article 13 : Mise en application du plan d'aménagement

Dans le cadre de la gestion de la dite forêt (parcelle), l'Association doit se conformer aux prescriptions du plan d'aménagement.

Article 14 : Paiement de redevances

La valorisation économique de la dite forêt (parcelle) par l'Association est subordonnée au paiement des redevances forestières conformément aux dispositions réglementaires en la matière.

Article 15 : Interdictions

L'Association doit s'abstenir de délivrer:

Des autorisations de défrichement de la forêt;

Des permis de coupe à des personnes autres que les membres de l'Association; Des permis de chasse à titre commercial.

Chapitre 2 - Droits et Obligations de J'Administration

Article 16 : Droits de l'Administration forestière

Les responsables de l'Administration forestière peuvent effectuer un suivi et un contrôle de l'exécution du présent contrat.

En cas de non-respect du présent contrat, ils peuvent appliquer les mesures définies dans l'article 22 ci-dessous.

Article 17 : Obligations de l'Administration forestière

Les agents de l'Administration forestière sont tenus de procéder à. un encadrement technique en faveur de l'Association dans l'exécution du présent contrat, surtout en cas d'avertissement donné à l'Association.
L'Administration forestière concernée doit adresser un rapport semestriel sur l'exécution dudit contrat:

- Au Représentant de l'Etat de la commune de rattachement;
- A la Direction Inter.Régionale des Eaux et Forêts
- A la commune de rattachement.

Chapitre 3 - Des droits et Obligations de la Commune de rattachement

Section 1 - Droits de la Commune de rattachement

Article 18 : Suivi et contrôle de l'Association

Le Maire de la Commune de .... assisté des contrôleurs Communaux, peut procéder à un suivi et un contrôle:

- De l'application du Dina;
- De l'application de la convention d'exploitation par l'exploitant forestier agrée, le cas échéant.

En cas de constatation d'infraction, il en informe le Chef de l'Administration forestière.

Article 19 : Ristournes

La part revenant à la Commune de……………………………………en tant que commune de rattachement,s'élève à .... % des redevances perçus par le Président du Comité de gestion de l'Association à titre de ristournes.

Section 2 - Obligations de la commune de rattachement

Article 20 : Information et sensibilisation de l'association

Le Maire de la commune de...................................... assisté de ses collaborateurs à l'obligation d'informer et de sensibiliser les membres de l'association sur:

Les objectifs et les avantages de la gestion contractualisée des forêts;

Leurs obligations contractuelles.

Article 21 : Gestion des conflits

En cas de conflits dans la mise en œuvre de la gestion de contractualisée des forêts, le Président du Conseil de la dite Commune est chargé de concilier les parties en litige préalablement à la saisie éventuelle de la juridiction compétente ou au recours à l'arbitrage.

TITRE IV - DES INFRACTIONS ET DES SANCTIONS

Article 22 : Non-respect du contrat de gestion

En cas d'inobservation des dispositions réglementaires et contractuelles par l'Association, il est fait application des sanctions ci-après dans les conditions fixées par le décret n°………du………………et par le contrat de gestion:

L'avertissement;

La suspension du contrat de gestion ou de la convention d'exploitation; La résiliation;

La confiscation et la vente des produits illicites.

Article 23 : Non-respect du Dina

En cas d'inobservation du Dina par des membres de l'Association, ils sont passibles du vonodina.

TITRE V - DISPOSITIONS DIVERSES

Article 24 : Règlement des différends

Le règlement des différents nés dans le cadre de la mise en œuvre de la gestion contractualisée des forêts de l'Etat, s'effectue conformément aux dispositions du décret n° du ....

Article 25 : Mise en vigueur du contrat de gestion

Le présent contrat entre en vigueur à compte de la date de sa notification à l'association.

Article 26 : Révision du contrat de gestion

Le présent contrat peut faire l'objet d'avenant à l'initiative de l'Administration ou de l'Association.

Article 27 : Résiliation du contrat par l'association

L'association peut demander la résiliation du présent contrat au cas où elle aurait décidé de cesser la gestion de la forêt (parcelle)

Elle doit en aviser l'Administration forestière concernée au moins six (6) mois avant la cessation des activités. Fait à ………………………………. en deux originaux, le.......................

Lu et accepté

Le Président du comité de gestion de l'Association

Vu pour être annexé au décret n° **2001 - 122 du 14 FEB 2001**

Le Premier Ministre Chef du Gouvernement

Tantely ANDRIANARIVO

Appendix X

Sample Management Transfer Contract for a Community Managed Site

(GCF site)

FIFANEKEM-PAMINDRAM-PITANTANANA IREO HARENA VOAJANAHARY AZO HAVAOZINA AO AMIN'NY FARITR'ANJIAMAZAVA - TANAMBAO

Ny Sampan-draharahan'ny Tontolo Iainana, Rano sy Ala izay soloan'Andriamatoa Lehiben'ny fari-piadidian'ny Tontolo Iainana, Rano sy Alan'ny Fénérive-Est tena, andaniny

1.1.1.1.1.6.1.1 sy

Ny Vondron'0lona Ifotony "ANJIAMAZAVA SY TANAMBAO MIRAY" (A.T.M) ao amin'ny tanana'Antjiamazava sy Tanambao, fokontany Sahantaha, Kaominina Ambinanitelo, fivondronam-pokotany Maroantsetra, izay soloan'Andriamatoa filohan'ny VOI A.T.M tena, sady eo ambany fiahian'ny Kaominina Ambinanitelo, ankilany

dia mifanaiky amin'izao famindram-pitantanana manaraka izao momba ireo harena voajanahary azo havaozina misy ao amin'ny faritr'Anjiamazava sy Tanambao.

__ANDININY 1__ **: FARITRA AMPIHARANA AN'ITY FIFANEKENA ITY** :

Avaratra : Tanetin'Ambalamahogo

Antsinanana : Rano Antsifamba

Andrefana : Zohitanetin' I Maroaomby

Atsimo : Tanetin'ny Maherivaratra

- Velarany : **2134 ha**

__ANDININY 2__ : **IREO ALA SY HARENA VOAJANAHARY AZO TANTANINA SY HAVAOZINA IHARAN' ITY FIFANEKENA ITY**

a) Izay harena voajanahary rehetra notantanin'ny Sampan-draharahan'ny Tontolo Iainana, Rano sy Ala misy ao amin'ny faritra izay voatondro mazava tsara ary amin'ny antsipiriny ao amin'ny Bokin'Andraikitra (Cahier des Charges).

b) Ny fomba fampiasana ireo tany araka ny nifanarahana tamin'ny Lehiben'ny Tontolo Iainana, Rano sy Ala eo Maroantsetra.

__ANDINANY 3__ : **TANJONA**

Mba hampaharitra ny fampiasana ireo ala sy atiala ary ny harena voajanahary ao aminy ka ho lovan'ny taranaka maro mifandimby ary koa hanatsara ny velontenan'ny mponina ao amin'ny faritra.

__ANDININY 4__ : **ZAVA-KANDRENA**

Fandraisan'ny olona tsirairay andraikitra amin'ny fahaiza-mampiasa ny ala sy ny harena ao aminy izay azo havaozina ka hampaharitra azy ireo.

__ANDININY 5__ : **FAHARETANY**

TELO TAONA (03-ans) no faharetany azo alavaina izany raha hita fa mandeha tsara ny fitantanana.

ANJARA ASANIREO VOAKASIKITY FIFANEKENA ITY

<u>ANDININY 6</u> :

A)-Ny VOI TANAMBAO SY ANJIAMAZAVA MIRAY**:**

- Mamolavola sy mampihatra ny Dina ho enti-manatanteraka ny drafi-panajariana sy fitantanana.
- Mampihatra mivantana ny Dina amin'ny Fitantanana.
- Mamolavola sy manatanteraka ny asa fampandrosoana ny faritra.
- Miara miasa amin'ny Sampan-draharahan'ny Tontolo Iainana, Rano sy Ala sy ny "Projet Makira" amin'ny fiarovana ny Faritra arovana Makira (Aire protégée de Makira).
- Manaraka an-tsakany sy an-davany ny toro-marika amin'ny drafi-panajariana sy fitantanana.
- Manampy ny Lehiben'ny Ala amin'ny fisamborana ireo olo-meloka tsy voasahan'ny Dina ny heloka vitany.
- Manolotra amin'ny Lehiben'ny Tontolo Iainana, Rano sy Ala ao Maroantsetra ireo olo-meloka izay tsy voasahan'ny Dina ny heloka vitany.

B)-Ny Sampan-draharahan'ny Tontolo Iainana, Rano sy ny Ala ao Fénérive-Est **:**

- Manoro hevitra ny VOI A.T.M amin'ny enti-mitantana ny faritra sy ny fanarahana ny drafi-panajariana
- Manara-maso ny fampiharana ny dinam-pitantanana, drafi-panajariana sy Bokin'andraikitra
- Mitana an-tsoratra (proces-verbal) ary mitondra eo anatrehan'ny Fitsarana izay olo-meloka maditra tsy manaraka ny Dina na ireo heloka vita tsy voasahan'ny Dina
- Mandray andraikitra tandrify azy amin'ireo olona tsy vonona hanaraka ny Dina
- Manampy ny VOI A.T.M amin'ny asa fampandrosoana ny faritra miaraka amin'ny Projet MAKIRA.

1.1.1.1.1.7 D)-Ny Kaominina ao Ambinanitelo :

- Manoro hevitra ny VOI A.T.M ny fomba fitantanana ny vola
- Manara-maso ny fampiharana ny Dinan'ny VOI A.T.M
- Manampy ny VOI A.T.M amin'ny fampiharana ny Dinam-pitantanana ho an'ireo olona tsy mety manaraka ny Dina fa indrindra ireo olona tsy mponina ao amin'ny tanan' Anjiamazava sy Tanambao.
- Manampy ny VOI A.T.M amin'ny asa fampandrosoana
- Miahy ara-panjakana ny VOI A.T.M ao Anjiamazava.

IREO ANDRAIKITRA FITANTANANA AZON'NY VONDRON'OLONA ATAO AO ANJIMAZAVA SY TANAMBAO

<u>ANDININY 7</u> :

<u>A)-MOMBA NY ZO NENTIM-PAHARAZANA</u>

- Fanapahana ny hazo ho fampiasana andavanandro ho an'ny mponina ao Anjiamazava sy Tanambao sy ireo tanana manodidina azy toy ny fanamboarana trano hipetrahany, valan'omby, fefim-boly, sns…
- Fiotazana ireo voankazo na vahatr'azo atao fanafody na sakafo.
- Fihazana ireo biby azo hazaina izay ampiasana ny fitaovana nentim-paharazana.
- Fanjonoana amin'ny fintana sy ny harato manara-dalana

B) – ANKOATRAN'NY ZO NENTIM-PAHARAZANA

Araka ny vokatry ny fanadihadiana sy ny fanisana ny kakazo tao amin'ny alan'Anjiamazava dia tsy mahazaka fitrandrahana intsony ny alan'Anjiamazava sy Tanambao. Toy izao ny andraikitry ny VOI A.T.M mikasika ny vokatra ankoatran'ny zo nentim-paharazana :

- Manao tatitra ary mitondra ireo olo-meloka tsy manaraka ny Dina any amin'ny Biraon'ny kaominina Ambinanitelo.
- Manao tatitra ary mitondra eny amin'ny Lehiben'ny Tontolo Iainana, Rano sy Ala eny Maroantsetra izay olo-meloka tsy voasahan'ny Dina intsony ny fanasaziana azy.

1.1.1.1.1.8 D)-NY RAFI-PITANTANANA

Mametraka fomba enti-mitantana ny faritra ary mifidy olona hisahana tanteraka an' izany izay antsoina hoe: **Komity Mpitantana** (Comité de Gestion).

***ANDININY 8* : IREO ANDRAIKITRA TSY AZON'NY VOI A.T.M**

- Manome fahazoan-dalana hitevy ala-velona
- Manome fahazoan-dalana hikapa hazo ankoatry ny zo nentim-paharazana
- Manao fitanana an-tsoratra (proces-verbal) ireo heloka tsy voasahan'ny Dina intsony ny fanasaziana azy izay ampiakarina eny amin'ny Fitsarana.

IREO ANDRAIKITRY NY SAMPAN-DRAHARAHAN'NY TONTOLO IAINANA, RANO SY ALA FENERIVE-EST

***ANDININY 9* :**

- Fampianarana ny VOI A.T.M ny lalàna manan-kerin'ny Tontolo Iainana, Rano sy Ala.
- Manao fitanana an-tsoratra (procès-verbal) ireo heloka tsy voasahan'ny Dina ary mitondra ilay olo-meloka eo anatrehan'ny Fitsarana.
- Manampy ary manara-maso ny fanatanterahana ny voasoratra ao amin'ny Bokin'andraikitra sy ny drafitra fanajariana ny atiala ao amin' ny faritr'Anjiamazava sy Tanambao.
- Miara-manapa-kevitra amin'ny fanohizana na fanajanonana ny fitantanana miaraka amin'ny Ben'ny tanàna ao Ambinanitelo.

IREO ANDRAIKITRY NY KAOMININA AO AMBINANITELO

ANDININY 10 :

- Mananatra farany ireo olona meloka amin'ny fankatoavana ny fampiharana ny Dina alohan'ny hitondrana azy eny amin'ny Lehiben'ny Rano sy Ala eny Maroantsetra.
- Mandamina ireo olana mety hitranga eo amin'ny VOI A.T.M mifanolo-bodirindrina amin'ireo fokontany manodidina.
- Miara-manapa-kevitra amin'ny Lehiben'ny Ala ao Maroantsetra amin'ny fanohizana na fanajanonana ny fitantanana.

FANARAHA-MASO NY FITANTANANA NY DRAFI-PANAJARIANA

***ANDININY 11* :**

- Azon'ny Sampan-draharahan'ny Tontolo Iainana Rano sy Ala Fénérive-Est na ny Solontenany sy Ben'ny Ala Maroantsetra, ny Ben'ny tanana, ny Prezidan'ny Mpanolo-tsaina ny Kaominina ary ny Delegem-panjakan' ny Kaominina ao Ambinanitelo atao ny misava ny Bokim-pitantanana tanan'ny VOI A.T.M ao Anjiamazava sy Tanambao. Raiketin'izay manao fisavana an-tsoratra ao amin'ny kahien'ny VOI A.T.M ny zavatra mety na tsy mety hitany nandritra ny fisavana ary anomezany ny heviny.

***ANDININY 12* :**

- Ny Sampan-draharahan' ny Tontolo Iainana, Rano sy Ala irery ihany no afaka misava ny mety sy ny tsy mety amin'ny fomba fitantanana ireo harena voajanahary azo havaozina eny an-toerana ireo toy ny fanapahan-kazo, ny fampiasana ny faritra araka ny fitsinjarana azy, fanarahana ireo toro-marika teknika amin'ny fambolena eny amin'ny faritra miraka amin'ny "Projet Makira", ny fampiasana ny afo ary ny fihazana.

- Ireo olona ivelen'ny Sampan-draharahan'ny Tontolo Iainana, Rano sy Ala izay mahatsikaritra ny tsy fetezan'ny fitantanana dia mampandre avy hatrany azy ireo am-bava na an-tsoratra mba ahafahan'izy ireo mandray ny andraikitra tandrify azy.

<u>ANDININY 13</u> :

Miara-manao tombana isan'enim-bolana ny fandehanan'ny Fitantanana ny VOI A.T.M ao Anjiamazava sy Tanambao miaraka amin'ny Sampan-draharahan'ny Tontolo Iainana, Rano sy Ala ao Fénérive-Est na ny Ben'ny Ala ao Maroantsetra sy ny Kaominina ao Ambinanitelo.

<u>ANDININY 14</u> : FANAPAHANA NY FITANTANANA

Raha tsapa fa tsy mitarika amin'ny fananana maharitra ireo harena voajanahary azo havaozina ny fitantanana ataon'ny VOI A.T.M ao Anjiamazava sy Tanambao dia omen'ny Sampan-draharahan'ny Tontolo Iainana, Rano sy Ala ao Fénérive-Est sy ny Ben'ny tanàna ao Ambinanitelo fampitandremana izy ireo.

Raha mbola miverina io tsy fahaiza-mitantana io dia omena taratasy fampiatoana amin'ny fotoana voafetra ny VOI A.T.M.

Raha mbola mitohy ny tsy fahaiza-mitantana na mbola tsy feno TELO TAONA (3 ans) aza ny fe-potoana nitantanana dia averina manontolo amin'ny Sampan-draharahan'ny Tontolo Iainana, Rano sy Ala ao Fénérive-Est ny fitantanana ireo harena voajanahary azo havaozina.

Anjiamazava, faha 23 Septambra 2006

Ny Filohan'ny VOI A.T.M	Ny Lehiben'ny Fari-piadidian'ny Tontolo Iainana, Rano sy Ala Fénérive-Est

BOKIN'ANDRAIKITRA MIKASIKA NY FAMINDRAM-PITANTANANA

NY ALA SY NY HARENA VOAJANAHARY METY HAVAOZINA

TOKO I : FAMARITANA ANKAPOBENY

Andininy voalohany :

Ireto avy ireo vondron'olona ifotony manana zo sy andraikitra amin'ny fitantanana:
- Ny mponina ao amin'ny faritr'ANJIAMAZAVA SY TANAMBAO ;
- Ireo mponina avy ao amin'ny Fokontany Sahantaha izay manao velon-tena (manana savoka) ao amin'ny faritr'ANJIAMAZAVA SY TANAMBAO ;

Adidin'ny Komity mpitantana ny mamoaka ny lisitry ny olona feno 18 taona no miakatra manana zo sy andraikitra eo amin'ny fitantanana, fampiasana ary fiarovana ireo loharanon-karena voajanahary mety havaozina ao amin'ny faritra.

1.1.1.1.1.8.1 Andininy faha-2 :

Ireto manaraka ireto ny loharanon-karena voajanahary ao amin'ny alan'Anjiamazava sy Tanambao sy ny manodidina azy, izay azo afindra ny fitantanana azy:
- atiala sy ny sokajim-bokatra misy ao aminy,
- ny savoka misy zava-maniry mody ala na anirian'ny valiha sy ny sisa,
- ny tany azo volena,
- ny rano azo hanondrahana tany hovolena sy azo anjonoana,

Andininy faha-3 : Tanjona kendrena

Fitantanana maharitra ny ala sy ireo harena ao aminy ary koa mba ho fampandrosoana mirindra ny faritr'Anjiamazava sy Tanambao no tanjona farany tianko-tratrarina.

Andininy faha-4 : Faharetany

Manan-kery ao anatin'ny telo taona faharetan'ny fifanekem-pitondram-pitantanana ny ala sy ireo harena ao aminy ity bokin'andraikitra ity.

1.1.1.1.1.8.2 Andininy faha-5 :

Araka ny fanisana sy famaritana natao dia ireto ny faritr'ala matevina (massif forestier) ao an-toerana araky ny sari-tany miaraka amin'ity sy ny tatitra momba ny famaritana ny atiala hotantan'ny VOI A.T.M izay nataon'ny Kaominina Ambinanitelo.

Alan'i Anjiamazava sy Tanambao sy ny manodidina azy toy izao:

Avaratra : Tanetin'Ambalamahogo

Antsinanana : Tanetin'ny Moroamalona

Andrefana : Zohitanetin' I Maroaomby sy Ampitsinjovana

Atsimo : Tanetin'ny Maherivaratra

TOKO II : FEPETRA ILAINA HAMPIRINDRA NY FANDRINDRAM-PITANTANANA

1.1.1.1.1.8.3 Andininy faha-6 :

Anjaran'ny VOI A.T.M ao Anjiamazava sy Tanambao miaraka amin'ny mponina ao amin'ny fokontany ny mametraka rafitra iombonana hitantanana, hampiasana ary hiarovana ny loharanon-karena voajanahary voalaza ao amin'ny andininy fahatelo.

1.1.1.1.1.8.4 Andininy faha-7 :

Tsy maintsy mametraka Dina ny VOI A.T.M ao Anjiamazava sy Tanambao hamehezana ny fitantanana, ny fampiasana ary ny fiarovana ireo loharanon-karena voajanahary mety havaozina misy eo aminy. Ny Dina no mametraka ny zon'ny tsirairay ary ny sazy hampiharina raha misy hadisoana.

Ny Dina dia tsy maintsy hamarinin'ny Ben'ny tanànan'Ambinanitelo ary hankatoavin'ny Lehiben'ny Distrika ao Maroantsetra.

1.1.1.1.1.8.5 Andininy faha-8 :

Afaka manangona ireo vola azo avy amin'ny sandambidin-kazo sy ny hafa miditra ao aminy ny VOI A.T.M hatao tahiry fanajariana ho enti-miatrika:

- ny asa fampiroboroboana sy fanatevenana ny harena voajanahary miankina amin'ny ala sy ho fanatanterahana asa ara-piaraha-monina sy ara-toe-karena ao anatin'ny faritra ;
- ny fandaniana rehetra mikasika ny fitantanana ny harena voajanahary mety havaozina.

Atao mifanaraka amin'ny lalàna ny fomba fitantanana ny vola. Ny Dina no mamolavola sy manangana rafitra sy fitsipim-pitondrana mamariparitra ny asan'ny mpikambana ao amin'ny Komity Mpitantana sy ny fomba fitantanana ny tahiry.

1.1.1.1.1.8.6 Andininy faha-9 :

Tokony hisy mpitahiry vola manatanteraka ny fampidirana sy fandaniana rehetra eken'ny fitsipim-pitondrana. Mifidy olona iray na roa koa ny VOI A.T.M ho mpanamarim-bola.

Ferana tsy hihoatra ny dimy alina ariary (50 000 Ariary) ny vola ekena ho tazonin'ny mpitahiry vola. Anokafana kaonty any amin'ny Banky na OTIV ary arotsaka any ny vola mihoatra rehetra.

1.1.1.1.1.8.7 Andininy faha-10 :

Ny mpitantana dia tsy maintsy manao tatitra isaky ny 06 volana any amin'ny Ben'ny Ala ao Maroantsetra sy ny Sampan-draharahan'ny Tontolo Iainana, Rano sy Ala ao Fénérive-Est mikasika ny fanatanterahana ny Drafitr'asa, ny Bokin'andraikitra ary ny Dina.

1.1.1.1.1.8.8 Andininy faha-11 :

Ny mpitantana dia tsy maintsy mitazona boky firaketana ny fampiasana ny ala sy ny vokatra avy aminy.

<u>TOKO III : ANDRAIKITRA ISAN-KARAZANY</u>

MIKASIKA NY TEVIALA SY FAMBOLENA

1.1.1.1.1.8.9 Andininy faha-12 :

Noho ny fahasimban'ny alan'Anjiamazava sy Tanambao dia tsy azo atao intsony ny manao teviala. Atsahatra koa ny fanaovana sy fanohizana ny fanapahana sy fitevena ny savoka amin'ny loharano sy ny zohin-tanety.

1.1.1.1.1.8.10 Andininy faha-13 :

Ho fitsimbinana ny mpamboly dia hanao famaritana ny toeram-pambolena ivelan'ny ala matevina ny Ben'ny ala miaraka amin'ny fokonolona eto Anjiamazava sy Tanambao. Tsy ilaina ny mamaritra toerana vaovao fa ireo savoka sy ireo lohasaha efa misy no atao faritra ho toeram-pambolena.

1.1.1.1.1.8.11 Andininy faha-14 :

Ho fiarovana ny nofon'ny tany tsy ho lasan'ny riaka dia tsy azo atao ny mamboly amin'ny toerana misompirana be loatra. Ankoatr'izay dia tsara ny manaraka toro-marika ara-teknika omen'ny teknisiana momba ny fiarovana ny nofo-tany (DRS: défense et restauration du sol) sy ny voly maharitra (permaculture).

1.1.1.1.1.8.12 Andininy faha-15 :

Mba tsy hanitarana ny velaran-tany dia ilaina ny mijery vaha-olana hafa:

- fanatsarana ny voly vary an-koraka amin'ny fanaovana zezika "compost"
- fampitomboana ny vokatra amin'ny voly vary maro anaka (SRI, SRA)
- fanaovana voly rakotra ho an'ny vary an-tanety
- fambolena hazo fihinam-boa
- fambolena anana sy legioma
- sy ireo tetikasa voafaritra ao amin'ny drafitr'asa fampandrosoana

1.1.1.1.1.8.13 Andininy faha-16 :

Araka ny hevitry ny fokonolona hiaro ny faritra manamorona ny Ala fady dia tsy hanaovana fitrandrahana intsony ny zohin'ny Maroaomby.

1.1.1.1.1.8.14 Andininy faha-17 :

Tsy azo atao intsony ny manome alalana hitrandraka atiala raha tsy efa voamarina ara-tekinika fa manomboka mihoatra ny filan'ny mponina eo an-toerana ny vokatra.

MIKASIKA NY ZO NENTI-PAHARAZANA AMIN'NY VOKATRA AVY AMIN'NY ALA

1.1.1.1.1.8.15 Andininy faha-18 :

Ny mpikambana ao amin'ny VOI A.T.M dia manana zo amin'ny fampiasana ny vokatry ny ala sy ny vokatry ny savoka ao anatin'ny zo nentim-paharazana. Izany fampiasana izany dia tsy maintsy manaraka ny fepetra raiketin'ny drafi-panajariana sy fitsipika itantanana azy.

1.1.1.1.1.8.16 Andininy faha-19 :

Ny olona izay efa manana zo nentim-paharazana (mponina ao Anjiamazava sy Tanambao sy ny manodidina) dia mandoa saram-pangalana ny vokatra amin'ny Komity mpitantanana araka ny Dina efa napetraky ny VOI A.T.M.

1.1.1.1.1.8.17 Andininy faha-20 :

Amin'ireo faritr'ala sisa tavela ka tsy arovana araka ny lalàna no angalana hazo vaventy ilaina ho an'ny mponina eto amin'ny VOI A.T.M ato amin'ny faritr'Anjiamazava sy Tanambao.

Mba hitandrovana ny lamina ara-piaraha-monina efa misy dia hajaina ny faritr'alan'ny isam-pianakaviana.

1.1.1.1.1.8.18 Andininy faha-21 :

Ho fiarovana ny lohan'ny rano midina amin'ny horaka sy ao amin'ny tanana rehetra dia atao faritra arovana ireo atiala 100 metatra manodidina ny loharano sy 25 metatra manodidina ny saha madinika ka tsy azo angalana ireo vokatra ilaina andavanandro ireo faritra arovana voafaritra ao amin'ny drafi-panajariana.

Ankoatra ireo atiala arovana izay mety ho voafaritra amin'ny drafi-panajariana dia ireto fepetra ireto koa tsy maintsy arahina amin'ireo toerana fambolena:

- Avela haniry ny savoka 100 metatra manodidina ny loharano sy ny zohin– tanety na anaovana toerana fambolen-kazo. Ny fandoroana savoka dia tsy azo atao intsony amin'ireo faritra ireo.

- Toy izany koa ny faritra 25 metatra manodidinana ny saha madinika dia avela haniry ny savoka na anaovana toerana fambolen-kazo fa tsy azo atao intsony ny fandoroana savoka.

1.1.1.1.1.8.19 Andininy faha-22 :

Ireto karazan-kazo ireto dia tsy azo ampiasaina anaovana fafana noho izao antony manaraka izao:

- Hazo tafiditra amin'ny sokajy faharoa : Andramena, hazovola, hazo mafana, Maintimpototra
- Hazo efa akaiky ho lany taranaka: Antaivaratra, Arina, Fotsidity, Hasintoho, Hazoandatra, Mampay, Minofotrakoho, Ombavy, Tafononana, Tarantana, Totokintsina, Voantsilana.

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1.1.1.1.1.8.20 Andininy faha-23 :

Malalaka ny fitantanan'ny fokonolona sy fangalana ireo vokatra madinidinika rehetra ao anaty ala toy ny oviala, zavamaniry hatao fanafody, rary, tantely afa-tsy ireo izay hila fa ho lany tamingana. Tsy azo ekena ny fandavoana hazo lehibe raha haka tantely.

FILANA IVELAN'NY ZO NENTIM-PAHARAZANA

1.1.1.1.1.8.21 Andininy faha-24 :

Ny hazo mihoatra ny zo ananan'ny tsirairay feran'ny lalàna dia tsy maintsy hakana fankatoavana avy amin'ny Ben'ny Ala.

MIKASIKA NY ZO NENTIM-PAHARAZANA AMIN'NY HAZA

a)Sokajim-biby mpanimba voly

1.1.1.1.1.8.22 Andininy faha-25 :

Azo hazaina sy amidy mandavan-taona ireo karazam-biby mpanimba voly toy ny lambo, fody, sns…

b)Sokajim-biby atao hoe haza

1.1.1.1.1.8.23 Andininy faha-26 :

Ho fiarovana ireo biby amam-borona fihaza toy ny trandraka, sns.... tsy ho lany taranaka dia feran'ny lalàna miatomboka amin'ny volana mey ka hatramin'ny alahady voalohan'ny volana oktobra no fihazana azy. Tsy azo amidy ivelan'ny tanàna ny vokatra raha tsy mahazo fahazoan-dalàna (permis de chasse).

c) Sokajim-biby arovan¶ny lalàna

1.1.1.1.1.8.24 Andininy faha-27 :

Tsy misy afa-tsy eto Madagasikara ary koa efa mihalany taranaka ka voararan'ny lalàna ny fihazana azy :
- ireo karazan-gidro : fotsife – akomba – tsiditsidy-hayhay – babakoto – ets ,
- Ny karazam-borona toy ny lampira (akoholahiala)…

MIKASIKA NY ZO NENTIM-PAHARAZANA AMIN¶NY JONO

1.1.1.1.1.8.25 Andininy faha-28 :

Malalaka ny fanjonoana laoka sy orana hatao sakafo

1.1.1.1.1.8.26 Andininy faha-29 :

Mba hamelana ireo hazan-drano hamela taranaka dia raràna ny fanaratoana azy ireo manomboka amin'ny voalohan'ny volana desambra ka hatramin'ny voalohan'ny volana febroary raha toa ka atao asa fitadiavam-bola izany. Tsy azo atao ny mampiasa harato ambanin'ny 30 mm.

1.1.1.1.1.8.27 Andininy faha-30 :

Raràna ny famonoana ny trondro (laoka) isan-karazany amin'ny zava-maniry na karazam-panafody hafa no hakana azy ireo hatao sakafo na varotra.

TOKO IV : SAZY AZO AMPIHARIN'NY DINA SY ANDRAIKITRY NY BEN'NY ALA

1.1.1.1.1.8.28 Andininy faha-31 :

Natao hifampifehazan'ny tsirairay ao amin'ny faritry Anjiamazava sy Tanambao ny Dina ka anjaran'ny VOI A.T.M ny mampihatra avy hatrany ny sazy amin'ny mpanao hadisoana. Amin'ny fandraisany an-tanana ny fitantanana ny harena voajanahary sy ny fahazoany ireo fahefana nafindra aminy dia tsy tokony hisalasala ny fokonolona, indrindra fa ireo Komity Mpitantana misolo tena azy, hampihatra ny sazy tinapany ao amin'ny Dina. Ny fandraisana andraikitry ny fokonolona dia porofon'ny finiavany hanaraka an-tsakany sy andavany ny fifanekem-pitatanana.

1.1.1.1.1.8.29 Andininy faha-32 :

Andraikitry ny fokonolona ny tsy maintsy mikaroka ny mpanao hadisoana rehetra mikasika ny fitantanana ny harena voajanahary. Raha tsy hita ny mpanao hadisoana, ny fokonolona manontolo no tompon'andraikitra amin'ny harena voajanahary voakasika ka tsy maintsy miantsoroka ny sazy sy fanarenana mifanaraka amin'ny fahasimbana.

1.1.1.1.1.8.30 Andininy faha-33 :

Tompon'andraikitra tanteraka eo anatrehan'ny fanjakana ny mpitantana amin'ny hadisoana rehetra mitranga amin'ny faritra misy azy na ataon'ny mpikambana izany na fahadisoana ataon'olon-tsy fantatra ary ny fahadisoana amin'ny fitantanana.

1.1.1.1.1.8.31 Andininy faha-34 :

Raha ny olona ivelan'ny VOI A.T.M no manao hadisoana dia ampiharin'ny VOI ihany ny Dina raha mety izy. Raha tsy vita ao an-toerana ny fandaminana ny raharaha dia ho entina eo anatrehan'ny Kaominina izy mba ho faizina. Raha toa ka mbola tsy manaiky hanefa ny saziny eo anivon'ny Kaominina izy dia ampakarina amin'ny tompon'andraikitra any Maroantsetra ny raharaha (Ben'ny ala, Zandary)

1.1.1.1.1.8.32 Andininy faha-35 :

Arakaraky ny havesatry ny hadisoana no irotsahan'ny Ben'ny ala hanenjika ny hadisoana aram-panjakana na amin'ny fampakarana ny raharaha any amin'ny fitsarana ankoatry ny sazy ampiharin'ny VOI A.T.M araky ny voafetran'ny Dina.

TOKO V : FISAFOANA SY SAZY AMPIHARINA AMIN'NY MPITANTANA

1.1.1.1.1.8.33 Andininy faha-36 :

Ny famindrana ampahany na tanteraka amin'ny VOI A.T.M ny fahefana hitantana ny loharanon-karena voajanahary ao aminy tsy manakana ny Ben'ny ala hanao fisafoana araka ny zo ananany araka ny lalàna.

1.1.1.1.1.8.34 Andininy faha-37 ;

Mandritry ny fisafoana azon'ny Ben'ny ala atao ny manadihady eo an-toerana ny fandehan'ny fitantanana ny loharanon-karena voajanahary mety havaozina amin'ny ankapobeny. Anjaran'ny Komity Mpitantana ny manome fanazavana momba ny zava-miseho mikasika ny hadisoana niteraka fahavoazana amin'ny loharanon-karena, hahafahan'ny Ben'ny ala mpisafo mandanjalanja ny fanapaha-kevitra tokony horaisiny.

1.1.1.1.1.8.35 Andininy faha-38 :

Toy izao manaraka izao ny hadisoana mety hitranga sy ny sazy ampiharina mikasika ny fitantanana:

Fanomezana fampitandremana amin'ireto hadisoana ireto :

- tsy fampiharana ny Dina amin'ny olona nanao hadisoana ;
- tsy fanaovana ary tsy fanatanterahana ny drafitr'asa isan-taona ;
- fanapahana hazo tsy nahazoana alalana

Fampiatoana ny fifanekena:

- rehefa nahazo fampitandremana in-telo
- teviala tsy nahazoana alalana
- doro-ala

Fanafoanana ny fifanekena

- teviala tsy nampiharana ny dina
- fahazoana fampiatoana in-droa.

Anaovan'ny Ben'ny ala fitanana an-tsoratra doholo ny fanadihadiana rehetra ataony sy ny sazy ampihariny ka homeny fitanana an-tsoratra ny VOI A.T.M, ny Ben'ny tanànan' Ambinanitelo ary ny Sous-Prefet-n'Maroantsetra.

TOKO VI : FEPETRA SAMY HAFA

1.1.1.1.1.8.36 Andininy faha-39 :

Ho fanatanterahana ny fiarovana sy fanatevenana ny ala sy fanajariana samy hafa, dia tokony hanao tetik'asa momba izany isan-taona ny VOI A.T.M ka anasàna ny Sampan-draharahan'ny Tontolo Iainana, Rano sy Ala sy ny Tetik"asa MAKIRA ho mpanohana azy ara-teknika eo am-pamolavolana ny asa ho tanterahina.

1.1.1.1.1.8.37 Andininy faha- 40 :

Ilaina ny fanaovana fivoriam-ben'ny VOI A.T.M indray mandeha isaky ny 04 volana hanaovan'ny Komity Mpitantana tatitra ny fandehan'ny fitantanana ny harena voajanahary iandraiketany sy ahafahan'ny fokonolona mandrefy ny dingana vitany sy ny fahavitrihan'ny fitantanana nankinina aminy.

1.1.1.1.1.8.38 Andininy faha- 41 :

Manan-kery sy ampiharina avy hatrany ity Bokin'andraikitra ity rehefa vita sonian'ireo izay voakasiky ny fifanekena.

Anjiamazava, faha 23 Septambra 2006

Voavaky ary ekena

Ny Filohaǹ ny VOI

TANAMBAO SY ANJIAMAZAVA MIRAY

Ny Lehibeǹny Fari-piadidiaǹny

Tontolo Iainana Rano sy Ala

Fénérive-Est

Hita sy voamarina

Ny Ben'ny tanàna

Ambinanitelo

Ny Lehiben'ny Sampan-draharahan'ny

Tontolo Iainana, ny Rano sy Ala

Maroantsetra

Hita

Ny Lehiben'ny Distrika

Appendix XI

Sample Supporting Letter from Local Authority

REPOBLIKAN'I MADAGASIKARA
Tanindrazana – Fahafahana – Fandrosoana
================
FARITANY MIZAKA TENA ANTSIRANANA

FARITRA SAVA

DISTRIKA ANDAPA

Andapa, le .02 Septembre 2006

A

Destinataires in fine

Référence : 011/DIS/AND/06
Objet : Lettre de Soutien et d'approbation pour
la création de l'Aire Protégée Makira.

Dans le cadre de la mise en œuvre de la politique générale de l'Etat, visant l'augmentation des superficies des aires protégées de Madagascar à six millions d'hectare d'ici 2007, le District d'Andapa n'a cessé de soutenir tout organisme ou toute structure, étatique ou privé, qui intervient pour la réalisation de cet objectif.

Le District d'Andapa a toujours appuyer le Projet Makira pendant tout le processus de mise en place de l'Aire Protégée Makira. Pour atteindre l'objectif de mettre en place un million d'hectare de nouvelle Aire Protégée, le District a soutenu l'effort de l'équipe de délimitation dans la réalisation d'une partie de la délimitation des zones concernées. Ces efforts ont abouti au classement temporaire de l'Aire Protégée Makira.

Etant donné que la population est suffisamment informée sur la création de cette Aire Protégée, et surtout conscient qu'une partie de l'objectif seulement a été atteint, le District d'Andapa réitère son soutien aux efforts entrepris par le Projet Makira et approuve les résultats de différents ateliers qui ont débouché à l'actuelle proposition de limite. Par ailleurs, il recommande la suite des dialogues et des discussions entre toutes les catégories de parties prenantes aussi bien dans la phase de création que dans la gestion de l'Aire protégée dans le futur.

Le Chef de District d'Andapa

TOKELY Justin
Administrateur Civil

Appendix XII

Sample Agreement on Controlled Occupation Zone (ZOC)

FIFANARAHANA AMIN'NY FIPETRAHANA AMIN'NY FARITRA IVELOMANA ARAHA-MASO AO AMIN'NY FARITR'ALA SOAMIANGONA

Ny Tetik'Asa Makira, manana ny foibeny ao Maroantsetra BP 106, eo ambany fiadidian' ny Ministeran' ny Tontolo Iainana, Rano sy Ala, izay soloin'ny Taleny tena, antsoina hoe Mpitantana ny valan-javaboahary , eo andaniny ,

1.1.1.1.1.8.38.1 sy

sy ny VOI FMIS ato amin' ny tanàna Soamiangona, Fokontany Amponaomby, Kaominina Ambodimanga I, Distrika Andapa, Faritra SAVA, misy mponina miisa 578 (Marsa 2007), ary soloin' ny Komity Mpitantana ny VOI FMIS (Faritra Maitso Ivelomana Soamiangona) tena, antsoina hoe Mpanorim-ponenana , eo ankilany,

fa tao aorian'ny fizahana natao teny an-toerana ny Faritra Ivelomana araha-maso sy ny fifanarahana momba ny fampiasàna ny tany dia miara-manambara sy manaiky fa :

TOKO I : FAMARITANA ANKAPOBENY

Andininy 1 : NY FARITRA IVELOMANA ARAHA-MASO

Atao hoe faritra ivelomana araha-maso ny faritra izay tafiditra ao anaty Valan-javaboahary Makira nefa misy fari-ponenana sy velon-tenan'ny mponina izay efa nonina teo talohan'ny taona 1950.

Andininy 2 : NY TANJONA KENDRENA AMIN'NY FAMETRAHANA NY FARITRA IVELOMANA ARAHA-MASO

Ny tanjona dia ny fampandraisana andraikitra ireo mponina izay monina ao anaty faritra ivelomana araha-maso amin'ny fiarovana maharitra ny Valan-javaboahary Makira manodidina azy.

TOKO II : NY FARITRA IVELOMANA ARAHA-MASO AO SOAMIANGONA

Andininy 3 : Ny tanàna Soamiangona sy ny Lasy Antsinjoreba dia mikambana ao amin'ny VOI FMIS ary tafiditra ao anatin' ny faritry ny Valan-javaboahary Makira. Mba ho fikajiana ny tontolo iainana dia iarahan' ny roa tonta mandinika ny asa rehetra ho tanterahina ao anatin' ny faritra ivelomana araha-maso.

Andininy 4 : Ny tanàna Soamiangona dia tafiditra ao anatin'ireo faritra antsoina hoe: faritra ivelomana araha-maso (Zone d'Occupation Contrôlée) izay efa voafaritra ara- panjakana.

Andininy 5 : Ny toeram-piveloman'ny mponina dia voafaritra hitambatra ho iray manodidina ny tananan'i Soamiangona. Noho izany, ireo lasy sy tanimboly mitokana lavitra ny toeram-ponenana dia tsy maintsy afindra hamonjy ireo toeram-pivelomana voafaritra mitambatra.

Andininy 6 : Na inona na inona fisehoan-javatra mety hitranga amin'ny ho avy dia tsy azo ovaina intsony ny faritra araha-maso natao iveloman'ny mponina efa voafaritra ara-panjakana. Raha misy fandaozan'ireo mponina ny faritra ka tsy ampiasainy intsony ny tany dia ho foanana ity fifanarahana ity ary ho raisina ao anatin'ny faritry ny Valan-javaboahary Makira avy hatrany ny toerana.

Andininy 7 : Voarara tanteraka ny fifindra-monina vaovao ao anatin'ny faritra araha-maso. Ny fanaraham-bady dia azo atao raha ohatra ka olona efa mipetraka ato anatin'ny faritra ivelomana araha-maso no vadiny. Raha misy ny fisarahan'ny mpivady dia ny vokatra ihany no hifampizarana fa tsy ny tany. Ny komity mpitantana ny VOI sy ny mponina ao anatin'ny faritra no miandraikitra izany fanaraha-maso izany ary mampilaza avy hatrany ny manam- pahefana (Sampan-draharaha ny tontolo iainana, Rano sy Ala, Fananan-tany, Fokontany, Kaominina, Mpitantana ny Valan-javaboahary Makira), raha misy ny fandikàna ny lalàna.

Andininy 8 : Raha misy ny fandikàna ny lalàna momba ny fihazàna (ohatra: fangalàna varika) , fanjonoana (fampiasana fañamo, fanilovana), ny teviala sy doro ala, ny fitrandrahana ny ala, ny fitrandrahana harena an-kibon'ny tany (volamena, vatosoa, ets…), dia ampiharina ny dinan'ny VOI FMIS ary helohina araky ny lalàna manan-kery mifanandrify amin'izany ireo voampanga. Mety hiafara amin' ny fandroahana tanteraka ireo mponina amin'ny faritra izany arakaraky ny fahadisoana natao.

Andininy 9 : Ho fitsinjovana ny fampiasàna mahomby ireo tany ao anatin'ny toeram- pivelomana dia ho ampidirina ao anatin'ny fandaharan'asan'ny Tetik'asa Makira sy ny mpiara-miasa aminy ny fanampiana ara-teknikam-pambolena ireo mponina ao anatin'ny faritra araha-maso.

Andininy 10 : Manan-jo hampiasa ny faritra ny mponina araka ny drafi-panajariana sy drafi-pitantana izay voafaritra.

Andininy 11 : Tsy azo afindra amin'olon-kafa ny zo fahafaha-mampiasa ny faritra. Ny zanakin'ny Mpikambana izay efa ao amin'ny faritra ihany no manan-jo handimby ny zony amin'ny fampiasana ny faritra ivelomany.

Andininy 12 : Manerana ny toerana araha-maso, dia voarara ny manatanteraka na mitarika ny fahasimban'ny tontolo manodidina.

Andininy 13 : Ireo mponina ao anaty faritra dia manangana " Dina " mifanaraka amin'ny andalana voasoratra ato anatin' ity fifanarahana ity.

Natao teto Soamiangona anio ....

Ny Filohan'ny Komity Mpintantana	Ny Tale Nasionaly
VOI FMIS	Tetik'Asa Makira

BOKIN'ANDRAIKITRA

MIKASIKA NY FARITRA IVELOMANA ARAHA-MASO AO SOAMIANGONA

1.1.1.1.1.8.38.2 TOKO I : FAMARITANA ANKAPOBENY

Andininy 1 : NY FARITRA IVELOMANA ARAHA-MASO

Atao hoe faritra ivelomana araha-maso ny faritra izay tafiditra ao anaty Valan-javaboahary Makira nefa misy fari-ponenana sy velon-tenan'ny mponina izay efa nonina teo talohan'ny taona 1950.

Andininy 2 : NY TANJONA KENDRENA AMIN'NY FAMETRAHANA NY FARITRA IVELOMANA ARAHA-MASO

Ny tanjona dia ny fampandraisana andraikitra ireo mponina izay monina ao anaty faritra ivelomana araha-maso amin'ny fiarovana maharitra ny Valan-javaboahary Makira manodidina azy.

Andininy 3: Ireo olona efa nipetraka sy nampiasa ny faritra ihany no manana zo hipetraka ao amin'ny faritra ivelomana araha-maso Soamiangona.

Andraikitry ny VOI FMIS ny manara-maso ny faritra ivelomana araha-maso Soamiangona. Ny Komity mpitantana ny VOI no mamoaka ny lisitry ny olona feno 18 taona no miakatra manana zo sy andraikitra eo amin'ny fanaraha-maso ny faritra ary ny fampiasàna maharitra ary fiarovana ireo harena voajanahary mety havaozina ao amin'ny faritra ivelomana araha-maso.

Andininy 4: Ny Komity mpitantana ny VOI no tompon'andraikitra voalohany amin'ny fanaraha-maso ny fanajàna ny Dina sy ny fampiharana ny sazy ao amin'ny Faritra Ivelomana araha-maso.

Andininy 5: Araka ny fizahana sy ny famaritana natao dia ireto ny fieferan'ny faritra ivelomana araha-maso ho ampiasain'ny VOI izay napetraka niaraka tamin'ny mponina sy ny Kaominina Ambodimanga I izay mifanaraka amin'ny sarin-tany izay miaraka amin'ity boky ity.

Avaratra : Anjanaharibe Sud

Andrefana : Rano Manandriana

Atsimo : Tampon'i Beanatsalady

Antsinanana : Faritry ny ala Amponaomby

1.1.1.1.1.8.38.3 TOKO II : FEPETRA ILAINA HAMPIRINDRA NY FANDRINDRAM-PAMPIASANA NY FARITRA IVELOMANA ARAHA-MASO

Andininy 6 *:* Tsy maintsy mametraka Dina ny VOI FMIS hamehezana ny fampiasàna ireo loharanon-karena voajanahary misy eo aminy. Ny Dina no mametraka ny zon'ny tsirairay ary ny sazy hampiharina raha misy hadisoana.

Ny Dina dia tsy maintsy hamarinin'ny Ben'ny Tanànan'Ambodimanga I, hankatoavin'ny Lehiben'ny Distrika Andapa, Ny Sampandraharahan'ny Tontolo Iainana, Ny Rano sy Ala ary ny Fitsàrana.

Andininy 7 : Ny Komity Mpitantana dia tsy maintsy manao tatitra isaky ny enim-bolana (06 volana) any amin'ny Sampandraharahan'ny Tontolo Iainana, ny Rano sy Ala sy any amin'ny Komity Mpitantana ny Valan-javaboahary Makira momba izay fiovàna rehetra nisy sy ny fepetra noraisina tamin'izany.

Andininy 8 : Noho ny maha-toeram-pivelomana araha-maso ireo toerana voalaza etsy ambony ireo dia voarara ny manao teviala. Tokony hanaraka ny fepetra fiarovana amin'ny afo miridana sy poakafo rehefa mampiasa afo eny an-tanimboly

Ho fitsimbinana ny mpamboly dia hanao famaritana ny toeram-pambolena ivelan'ny ala matevina ny Ben'ny Ala miaraka amin'ny Fokonolona eto Soamiangona. Tsy ilaina ny mamaritra toerana vaovao fa ireo savoka sy ireo lohasaha efa misy no atao faritra ho toeram-pambolena

Andininy 9 : Voarara tanteraka ny fitrandrahana ny atiala ao anaty Faritra Ivelomana Araha-maso. Raha misy ny fandikàna lalàna dia ny Dina sy ny lalàna manan-kery no mamaritra ny fepetra tokony ho raisin'ny tompon'andraikitra isan-tokony.

Andininy 10 : Voarara tanteraka ny fitrandrahana ny harena an-kibon'ny tany ao anaty Faritra Ivelomana Araha-maso. Raha misy ny fandikàna lalàna dia ny Dina sy ny lalàna manan-kery no mamaritra ny fepetra tokony ho raisin'ny tompon'andraikitra isan-tokony.

Andininy 11 : Ny faritra misy savoka dia mbola azo hambolena saingy tsy azo doroina intsony. Mba hitsinjovana ny mponina anefa dia ho ampidirina ao anaty fandaharan'asan'ny Tetik'Asa Makira sy ireo mpiara-miasa aminy ny fanampiana ny fanatsaràna ny teknikam-pambolena.

Andininy 12 : Malalaka ny fangalàna ireo vokatra madinidinika rehetra ao anaty ala toy ny oviala, tantely, zava-maniry atao fanafody, zava-maniry atao rary, afa-tsy ireo izay hita fa ho lany tamingana. Tsy azo ekena ny fandavoana hazo lehibe raha haka tantely.

Andininy 13 : Azo hazaina mandritry ny fotoam-pihazàna ireo karazam-biby izay tsy arovan'ny lalàna toy ny lambo, fody, sns..., fa ao anatin'ny Faritra Ivelomana Araha-maso ihany.

Ho fiarovana ireo biby amam-borona fihaza tsy ho lany taranaka dia feran'ny lalàna miatomboka amin'ny voalohan'ny volana Mey ka hatramin'ny faran'ny volana Septambra no fihazàna azy. Tsy azo amidy ivelan'ny Faritra Ivelomana Araha-maso ny vokatra.

Andininy 14 : Malalaka ny fanjonoana laoka sy orana hatao sakafo ary tsy azo amidy ivelan'ny Faritra Ivelomana Araha-maso.

Mba hamelàna ireo hazan-drano hanana taranaka dia raràna ny fanaratoana azy ireo manomboka ny voalohan'ny volana desambra ka hatramin'ny voalohan'ny volana febroary.

Andininy 15 : Raràna ny famonoana ny trondro (laoka) isan-karazany amin'ny zava-maniry na karazam-panafody hafa (fanamo, fanilovana).

1.1.1.1.1.8.38.4 TOKO III: ANDRAIKITRY NY TSIRAIRAY

Andininy 18 : Natao hifampifehezan'ny tsirairay ao amin'ny Faritra Ivelomana Araha-maso ny Dina ka anjaran'ny Komity Mpitantana ny VOI ny mampihatra avy hatrany ny sazy amin'ny mpanao hadisoana.

Amin'ny fandraisana an-tànana ny fanaraha-maso dia tsy tokony hisalasala ny Fokonolona, indrindra fa ireo Komity Mpitantana misolo tena azy, hampihatra ny sazy tinapany ao amin'ny Dina.

Andininy 17 : Andraikitry ny Komity mpitantana ny VOI sy ny Fokonolona ny tsy maintsy mikaroka ireo mpanao hadisoana rehetra. Raha tsy hita ny mpanao hadisoana dia ny fokonolona manontolo no tompon'andraikitra amin'ny harena voajanahary voakasika ka tsy maintsy miantsoroka ny sazy sy fanarenana mifanaraka amin'ny fahasimbàna.

Andininy 18 : Tompon'andraikitra tanteraka eo anatrehan'ny fanjakàna ny Komity mpitantana ny VOI amin'ny hadisoana rehetra amin'ny faritra misy azy na ataon'ny mponina ao anaty faritra izany na fahadisoana nataon'olon-tsy fantatra.

Andininy 19 : Raha ny olona ivelan'ny Faritra Ivelomana araha-maso no manao hadisoana dia ampiharin'ny Komity mpitantana ny VOI ihany ny Dina. Raha tsy vita ao an-toerana ny fandaminana ny raharaha dia ho entina eo anatrehan'ny Kaominina izy mba ho faizina. Raha toa ka mbola tsy manaiky hanefa ny saziny eo anivon'ny Kaominina izy dia ampakarina amin'ny tompon'andraikitra any Andapa ny raharaha (Ben'ny Ala, Zandary).

Andininy 20 : Arakaraky ny havesatry ny hadisoana no irotsahan'ny Ben'ny Ala hanenjika aram-panjakana na amin'ny fampakarana ny raharaha any amin'ny fitsaràna ankoatry ny sazy ampiharin'ny VOI arak'izay voafetran'ny Dina.

Andininy 21 :

A)-Ny VOI **:**

- Mamolavola sy mampihatra mivantana ny Dina
- Miara miasa amin'ny Sampan-draharahan'ny Tontolo Iainana, ny Rano sy Ala sy ny Tetik'Asa Makira amin'ny fiarovana ny Ala Valan-javaboaharin'i Makira
- Manampy sy manolotra ny Lehiben'ny Tontolo Iainana, ny Rano sy Ala amin'ny fisamborana ireo olo-meloka tsy voasahan'ny Dina ny heloka vitany.
- Manao tatitra isaky ny enim-bolana amin'ny Ben'ny Ala sy amin'ny Tetik'Asa Makira

B)-Ny Sampan-draharahan'ny Tontolo Iainana, ny Rano sy Ala ao Antalaha **:**

- Manoro hevitra ny VOI FMIS amin'ny fomba fanaraha-maso ny Faritra Ivelomana Araha-maso
- Manara-maso ny fampiharana ny dina
- Mitana an-tsoratra (procès-verbal) ary mitondra eo anatrehan'ny Fitsarana izay olo-meloka maditra tsy manaraka ny Dina na ireo heloka vita tsy voasahan'ny Dina
- Mandray andraikitra tandrify azy amin'ireo olona tsy vonona hanaraka ny Dina
- Manampy ny VOI FMIS amin'ny asa fampandrosoana ny faritra miaraka amin'ny Tetik'Asa Makira.

1.1.1.1.1.9 D)-Ny Kaominina ao Ambodimanga I :

- Manoro hevitra ny VOI FMIS amin'ny fomba fanaraha-maso ny Faritra Ivelomana Araha-maso
- Manara-maso ny fampiharana ny Dinan'ny VOI FMIS
- Manampy ny VOI FMIS amin'ny fampiharana ny Dina fa indrindra amin'ireo olona tsy mponina ao Soamiangona.
- Miahy ara-panjakana ny VOI FMIS

E) – Ny Tetik'Asa Makira

- Manoro hevitra ny VOI FMIS amin'ny enti-manara-maso ny Faritra Ivelomana Araha-maso
- Manara-maso ny fampiharana ny Dina
- Manome fanohanana fampiasàna ara-teknikam-pambolena

- Manao tomban'ezaka ny fanaraha-maso ny faritra Ivelomana Araha-maso iarahana amin'ny Sampan-draharahan'ny Tontolo Iainana, Rano sy Ala.

Natao teto Soamiangona, ...

Ny Filohan'ny VOI

Ny Lehiben'ny Fari-piadidian'ny Tontolo Iainana, Rano sy Ala

Ny Filohan'ny Fokontany Amponaomby

Ny Tale Nasionaly Tetik'asa Makira

Ny Ben'ny Tanàna Ambodimanga Ie

Appendix XIII

Attestastion de Repérage

CIRCONSCRIPTION DES PLANS
TOPOGRAPHIQUES FONCIERS
D'ANTALAHA

ATTESTATION

LE CHEF DE LA CIRCONSCRIPTION DES PLANS
TOPOGRAPHIQUES FONCIERS
D'ANTALAHA

à Monsieur LE DIRECTEUR NATIONAL
PROJET MAKIRA
ANTANANRIVO

N° 844 /076 CirPTF A/ha

Objet : Attestation de repérage de zone

Monsieur,

Le Chef de la Circonscription des Plans Topographiques Fonciers, soussigné, atteste par la présente que la zone prévue pour le projet « MAKIRA » n'empiète ni sur des propriétés titrées, ni sur des demandes en immatriculation foncière.

En foi de quoi la est délivrée pour servir et valoir ce que de droit.

Fait à Antalaha, le 28 Novembre 2007

LE CHEF DE LA CIRCONSCRIPTION
DES PLANS TOPOGRAPHIQUES FONCIERS

[illegible]mandimby A. Jean Luc

Appendix 13

Appendix XIV

Makira Project Ten Year Financial Plan

WCS Makira Protected Area Project - 30 Year Financial Plan

			2011	2012	2013	2014	2015	2016
Annual Budget for Management of PA	Scenario adjustment							
General Costs of Managing the PA		0%	($457'414)	($583'593)	($498'963)	($532'152)	($604'892)	($633'415)
+ Cost of Transfer of Management Activities		0%	($80'700)	$0	$0	$0	$0	$0
+ Cost of Community Development Activities		0%	($132'442)	$0	$0	$0	$0	$0
+ Cost of Conservation and Research Activities		0%	($63'381)	($77'739)	($84'855)	($70'600)	($68'389)	($122'608)
+ Cost of IEC Activities		0%	($49'198)	($50'674)	($52'194)	($53'760)	($55'373)	($57'034)
= Annual Budget for Management of PA	(Details)		**($783'135)**	**($712'005)**	**($636'013)**	**($656'513)**	**($728'654)**	**($813'057)**
Annual Financing Surplus (Deficit)								
Annual Budget for Management of PA			($783'135)	($712'005)	($636'013)	($656'513)	($728'654)	($813'057)
+ Non-carbon funding	(Details)		$838'532	$1'093'775	$749'909	$663'044	$15'379	$0
= Annual Financing Surplus (Deficit) before carbon proceeds			**$55'397**	**$381'769**	**$113'896**	**$6'531**	**($713'276)**	**($813'057)**
+ Annual Funds for Management of PA from carbon	(Details)		($43'632)	$221'486	$1'064'320	$1'279'525	$2'219'021	$1'021'472
= Annual Financing Surplus (Deficit)			**$11'765**	**$603'255**	**$1'178'216**	**$1'286'056**	**$1'505'745**	**$208'415**
Ongoing Financing Surplus (Deficit)			$11'765	$615'020	$1'793'236	$3'079'292	$4'585'037	$4'793'452
Breakeven pricing								
Tonnes of carbon assumed to be sold	(Go to projectio		0	500'000	1'734'259	1'659'554	3'370'056	1'061'748
Breakeven price for each year - excluding non-carbon funding			N.A.	$7.12	$1.83	$1.98	$1.08	$3.83
Breakeven price for each year - including non-carbon funding			N.A.	($3.82)	($0.33)	($0.02)	$1.06	$3.83

Total project breakeven average gross price - excluding non-carbon funding	**$4.13**
Total Project Breakeven average gross price - including non-carbon funding	**$3.52**

Costs Associated with Community Management Activities to be paid by 50% Community Benefits Allocation		2011	2012	2013	2014	2015	2016
General Costs of Managing the PA	0%	$0	($11'056)	($11'388)	($11'729)	($12'081)	($12'444)
+ Cost of Transfer of Management Activities	0%	$0	($83'121)	($85'615)	($88'183)	$0	$0
+ Cost of Community Development Activities	0%	$0	($133'415)	($134'418)	($135'450)	($136'514)	($137'609)
+ Cost of Conservation and Research Activities	0%	$0	($52'762)	($63'246)	($52'516)	($37'772)	($38'905)
+ Cost of IEC Activities	0%	$0	$0	$0	$0	$0	$0

2017	2018	2019	2020	2021	2022	2023	2024	2025	2026
($614'864)	($605'638)	($623'807)	($642'521)	($661'797)	($681'651)	($702'100)	($723'163)	($744'858)	($767'204)
$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
($86'883)	($74'731)	($102'308)	($85'806)	($88'380)	($91'031)	($93'762)	($96'575)	($99'472)	($102'457)
($58'745)	($60'507)	($62'323)	($64'192)	($66'118)	($68'102)	($70'145)	($72'249)	($74'416)	($76'649)
($760'492)	**($740'876)**	**($788'438)**	**($792'519)**	**($816'295)**	**($840'784)**	**($866'007)**	**($891'987)**	**($918'747)**	**($946'310)**
($760'492)	($740'876)	($788'438)	($792'519)	($816'295)	($840'784)	($866'007)	($891'987)	($918'747)	($946'310)
$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
($760'492)	**($740'876)**	**($788'438)**	**($792'519)**	**($816'295)**	**($840'784)**	**($866'007)**	**($891'987)**	**($918'747)**	**($946'310)**
$990'920	$1'020'648	$1'051'267	$1'082'805	$1'115'289	$1'148'748	$1'183'210	$1'218'707	$1'255'268	$1'292'926
$230'428	**$279'772**	**$262'829**	**$290'286**	**$298'994**	**$307'964**	**$317'203**	**$326'719**	**$336'521**	**$346'616**
$5'023'881	$5'303'652	$5'566'482	$5'856'767	$6'155'762	$6'463'726	$6'780'929	$7'107'649	$7'444'169	$7'790'786
1'000'000	1'000'000	1'000'000	1'000'000	1'000'000	1'000'000	1'000'000	1'000'000	1'000'000	1'000'000
$3.80	$3.70	$3.94	$3.96	$4.08	$4.20	$4.33	$4.46	$4.59	$4.73
$3.80	$3.70	$3.94	$3.96	$4.08	$4.20	$4.33	$4.46	$4.59	$4.73
($12'817)	($13'201)	($13'598)	($14'005)	($14'426)	($14'858)	($15'304)	($15'763)	($16'236)	($16'723)
$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
($138'737)	($139'900)	($141'097)	($142'329)	($143'599)	($144'907)	($146'255)	($147'642)	($149'071)	($150'544)
($40'072)	($41'275)	($42'513)	($43'788)	($45'102)	($46'455)	($47'849)	($49'284)	($50'763)	($52'285)
$0	$0	$0	$0	$0	$0	$0	$0	$0	$0

2027	2028	2029	2030	2031	2032	2033	2034	2035
($790'220)	($813'927)	($838'345)	($863'495)	($889'400)	($916'082)	($943'564)	($971'871)	($1'001'027)
$0	$0	$0	$0	$0	$0	$0	$0	$0
$0	$0	$0	$0	$0	$0	$0	$0	$0
($105'530)	($108'696)	($111'957)	($115'316)	($118'775)	($122'339)	($126'009)	($129'789)	($133'683)
($78'948)	($81'317)	($83'756)	($86'269)	($88'857)	($91'523)	($94'268)	($97'097)	($100'009)
($974'699)	**($1'003'940)**	**($1'034'058)**	**($1'065'080)**	**($1'097'032)**	**($1'129'943)**	**($1'163'841)**	**($1'198'757)**	**($1'234'719)**

($974'699)	($1'003'940)	($1'034'058)	($1'065'080)	($1'097'032)	($1'129'943)	($1'163'841)	($1'198'757)	($1'234'719)
$0	$0	$0	$0	$0	$0	$0	$0	$0
($974'699)	**($1'003'940)**	**($1'034'058)**	**($1'065'080)**	**($1'097'032)**	**($1'129'943)**	**($1'163'841)**	**($1'198'757)**	**($1'234'719)**
$1'331'714	$1'371'665	$1'412'815	$1'455'200	$1'498'856	$1'543'821	$1'590'136	$1'637'840	$1'686'975
$357'015	**$367'725**	**$378'757**	**$390'120**	**$401'824**	**$413'878**	**$426'295**	**$439'083**	**$452'256**
$8'147'801	$8'515'526	$8'894'284	$9'284'404	$9'686'227	$10'100'105	$10'526'400	$10'965'483	$11'417'739

1'000'000	1'000'000	1'000'000	1'000'000	1'000'000	1'000'000	1'000'000	1'000'000	1'000'000
$4.87	$5.02	$5.17	$5.33	$5.49	$5.65	$5.82	$5.99	$6.17
$4.87	$5.02	$5.17	$5.33	$5.49	$5.65	$5.82	$5.99	$6.17

($17'225)	($17'742)	($18'274)	($18'822)	($19'387)	($19'968)	($20'567)	($21'184)	($21'820)
$0	$0	$0	$0	$0	$0	$0	$0	$0
($152'060)	($153'622)	($155'230)	($156'887)	($158'594)	($160'352)	($162'162)	($164'027)	($165'948)
($53'854)	($55'470)	($57'134)	($58'848)	($60'613)	($62'431)	($64'304)	($66'234)	($68'221)
$0	$0	$0	$0	$0	$0	$0	$0	$0

Appendix XV

Carbon Communication Plan

STRATEGIE ET PLAN DE COMMUNICATION CARBONE DE L'AIRE PROTEGEE MAKIRA

CONTEXTE

Le Projet Makira a été initié comme un projet pilote pour tester le financement des actions de conservation à travers la vente de Carbone, en espérant que les crédits acquis par la séquestration du carbone pourraient soutenir la création et la gestion d'une nouvelle Aire Protégée, la gestion durable des ressources naturelles et le développement socio-économique de la région autour de Makira.

Lancé officiellement en octobre 2003, les activités du projet Makira ont surtout été concentrées autour du processus de création de la nouvelle AP Makira avec diverses activités d'accompagnement. Ces activités comprennent (i) la mise en place d'une ceinture verte composée de sites à gestion communautaires autour de l'AP pour assurer une forte implication et responsabilisation des communautés dans les efforts de conservation, (ii) la mise en œuvre de toute une gamme d'activités d'appui au développement de ces communautés qui sont considérées comme les Populations affectées par le projet afin de minimiser l'impact négatif de la création de l'AP sur leur condition de vie ; (iii) mais aussi la mise en œuvre d'un programme d'Information, d'Education et de Communication.

Parallèlement à toutes ces activités, il y avait également eu le développement du mécanisme de financement carbone pour les forêts de Makira. Des séries d'études et de recherches ont permis de confirmer la grande potentialité des forêts de Makira à générer des crédits carbone à travers le mécanisme REDD ; et d'avancer dans les séries d'activités préparatoires menant à la future promotion et commercialisation de ces crédits carbone.

Les activités d'Information, d'Education et de Communication qui ont été menées jusque là portaient surtout sur tout ce qui concerne l'AP, la gestion des ressources naturelles et les appuis au développement. Le Projet Makira a choisi de garder au minimum les communications carbone au niveau des communautés locales et régionales de peur de créer de faux espoirs ou de lassitude en attendant de voir les retombées arriver jusqu'à leur niveau. Le projet a décidé de n'aborder ce sujet au niveau des communautés locales que lorsque le projet est assez avancé dans le processus. En revanche, beaucoup efforts ont été prodigués au niveau national et international pour communiquer l'aspect carbone de Makira – en tant que projet pilote - afin de partager les expériences du projet et d'informer le développement de la stratégie nationale REDD.

Avec l'avancement actuel (février 2012) du développement du projet carbone Makira (validation du PDD en cours) et l'imminence d'une éventuelle vente de crédits Carbone Makira, il est jugé opportun de commencer les campagnes de communication carbone au niveau des communautés et au niveau des autorités locales et régionales.

Ces efforts de communications carbones sont intégrés dans le cadre général du programme d'IEC de WCS Madagascar et de MaMaBaie. Ce document offre un cadre général ainsi qu'un plan d'action pour mener la communication sur l'aspect carbone du projet Makira.

OBJECTIFS

Le but de ce Programme de communication carbone de Makira est de faciliter et d'appuyer la réalisation des objectifs de gestion de cette AP. Pour ce faire, les objectifs spécifiques suivants sont proposés :

- Elucider les méfiances de la population à l'égard du programme de conservation en général et du Concept carbone en particulier afin d'en assurer l'appropriation ;
- Assurer que la population connaisse leurs droits et aie accès aux informations nécessaires pour pouvoir participer pleinement au programme;
- Changer les perceptions, attitudes et comportements des différentes parties prenantes pour que chacune d'entre elle puisse contribuer de façon responsable à la gestion des ressources naturelles en général ;
- Sensibiliser et encourager les populations à s'engager dans les activités ayant moins d'impacts sur l'environnement et ayant plus de résultats sur la réduction d'émissions de GES en particulier.

Le programme de communication Carbone devrait être un programme permanent au sein de l'aire protégée Makira. Toutefois, ce plan initial de communication couvrira la période de Janvier au Décembre 2012.

AUDIENCES CIBLES

Ce programme de communication carbone cible surtout les différents groupes communautaires vivant autour de l'Aire protégée et qui sont majoritairement impliqués dans la déforestation et la dégradation de la forêt. Toutefois, les autorités locales et régionales seront également considérées comme une cible aussi importante à cause de leur rôle et influence sur la population.

Les enfants et la jeunesse constituent les futurs utilisateurs des ressources et gestionnaires de l'aire protégée et ils sont considérés pour assurer la durabilité à long terme du projet ¶

- ✓ Les adultes acteurs et auteurs directs de pressions ;
- ✓ Les mères de famille et jeunes filles vu leurs rôles éducateurs ;
- ✓ Les autorités traditionnelles, religieuses, administratives locales qui ont un pouvoir d'influence ;
- ✓ Les enfants et écoliers vecteurs des messages de nouvelles pratiques ;
- ✓ L'ensemble de la communauté concernée.

CONSIDERATIONS STRATEGIQUES

Un certain nombre de faits et de compréhension au niveau des communautés sont très importants à considérer lors des campagnes de communication :

- La forêt est considérée comme une source de vie inépuisable que certains exploitent abusivement. Pour gagner la vie, certains produits forestiers sont exploités intensivement sans souci de la durabilité de l'exploitation ;
- Dans les forêts de l'état et en particulier au niveau des Aires Protégées, les propriétés reviennent à l'état.
- Alors que la plupart des membres de la communauté vivant dans la Région Makira sont déjà bien sensibilisés sur l'importance et les bénéfices des actions de conservation en général et de l'AP Makira en particulier, certains individus ont manifesté leur méfiance face aux activités du Projet ;

DEMARCHE

Dans le cadre du Programme IEC de WCS Maroantsetra (voir annexe), un effort important sera prodigué pour assurer que l'« aspect Carbone » soit intégré dans toutes les activités de communication et d'éducation en cours au sein de Makira. Toutefois, WCS mènera des actions ciblées sur Carbone pour optimiser le résultat :
Différents outils de communications adaptés aux besoins de chaque cible seront soigneusement développés par l'équipe IEC de WCS puis une série de formation des animateurs et des jeunes membres de réseaux de jeunes suivront.
Trois équipes vont travailler en parallèle suivant les trois axes principaux de l'AP Makira : Axe Maroantsetra, Andapa et Mandritsara ; couvrant chacune deux secteurs.

Toutes les trois équipes vont adopter les mêmes approches méthodologiques pour mener les campagnes.

Au niveau de chaque secteur, l'équipe de communication va mener des :

- Réunions d'information et d'échange villageoises, auxquelles sera invité l'ensemble des communautés
- Réunions de mise en place des points focaux permanents au sein de la population pour collecter et dispatcher les informations
- réunions d'information et de consultation au niveau communal, qui verront la participation des autorités communales ainsi que les responsables des plateformes de CoBas
- atelier de discussion et de consultation au niveau régional, avec la participation des autorités régionales et districts ainsi que les partenaires locaux et régionaux

Au niveau enfants et jeunes l'équipe de IEC renforcera l'education et va

- Intégrer l'aspect « Carbone de Makira » dans les séances hebdomadaires d'éducation environnementale au niveau de 6 écoles primaires et 6 lycées,
- Mener en collaboration avec les réseaux des jeunes pour l'environnement des activités d'animation spécifiques sur le carbone pour le public.

Pour couvrir toutes les cibles, et assurer la complémentarité avec le programme sus cité, l'équipe va produire

- des émissions radiophoniques sur le radio local
- des numéros ou articles spéciaux dans le Magazine Dalaly

PLAN D'ACTION

OBJECTIFS	ACTIONS	ACTIVITES	AUDIENCES	MESSAGES	METHODE	RESPONSABLE	TIME LINE	NOTE
Elucider la mefiance à l'égard du programme de conservation en général et du Concept carbone en particulier afin d'en assurer l'appropriation	Campagne de sensibilisation sur Carbone à différents niveaux et utilisant différents moyens de communication	Organisation des Réunions d'informations villageoises	COBAs et autorités villageoises	Echange sur la perception du Changement climatique par la population-Notion de Carbone,- lien entre Carbone changement climatique et conservation de l'AP Makira-Lien entre Carbone, forêt, déforestation et subsistance-introduction sur la rente de carbone le model Makira (critères...)	Réunion d'Echange - projection de film et discussion			Pilote mars 01-05 : Axe Ambinanitelo, mars 06-12 Axe sud Ivoloina
			Plateforme et autorités communales	Même message + rôle des plateformes et autorités communales dans la sensibilisation de la communauté de base, appui au COBA à l'élaboration du projet, par rapport au choix des projets à financer par le rente carbone, défense de l'intérêt du secteur	Echange - projection de film et discussion			
		Organisation d atelier	Fédération COBA + autorités Régionales: districts et région, STD and partenaires	Même message + rôle des fédérations et autorités régionale dans la sensibilisation de la communauté de base, et dans la gestion de rente			Juillet –décembre 2012	

				Modèle de partage équitable des bénéfices carbone			a partir du mois de juin 2012
Assurer que la population connaisse leurs droits et aie accès aux informations nécessaires pour pouvoir participer au programme et offrir leurs commentaires.	Communication permanente entre animateurs et points focaux Carbone au sein de la population	Mettre en place des affiches sur les points essentiels à savoir Echanger des informations avec les autres Communautes	COBAs et autorités villageoises	Droits de participer au projet Droits de savoir les détails sur le Carbone Droits de communiquer aux points focaux les aspects qui nécessitent des clarifications	Affichage		Janiver2012-decembre 2012
	Vulgarisation par le media	Production d'émission radiophonique sur Carbone au niveau des stations locales	Public	Lien entre rente carbone et déforestation et services éco systémiques et l'AP de Makira	session d'un mois sur la radio local	+ JRC	Avril 2012
		Production d'articles sur le carbone dans le Magazine Dalaly	COBAs et autorités villageoises	le model Carbone de Makira gestion équitable de revenue Droits et responsabilités de chaque entité incluse dans le projet Carbone			juin 2012
Changer les perceptions, attitudes et comportements des jeunes et enfants pour qu'ils puissent contribuer de façon responsable à la gestion des ressources naturelles	Intégration du « carbone » au niveau des programmes d'éducation environnementale au niveau scolaire	Intégration des aspects Carbone au niveau de « Saturday School » et Connecting classroom	Enfants et jeunes	Notion de changement climatique et lien avec séquestration de carbone et le projet Carbone de Makira	trois sessions d'éducation des jeunes	Tana + MaMaBaie	Mars 2012

		Animation au niveau des écoles travaillant avec WCS au niveau rural	Enfants et les jeunes		activités pratiques		
	Extension des efforts des réseaux des jeunes à plaider contre le Changement global du Climat vers les aspects « Carbone »	Organisation d'événements d'information par les clubs des jeunes sur le thème Carbone	public	Le Carbone de Makira comment ca marche- Makira poumon de Madagascar :	Organisation de journée spéciale au niveau rural	IEC team Tana+ MaMaBaie + réseaux des jeunes	May-12
Sensibiliser les populations à s'engager dans les activités ayant moins d'impacts sur l'environnement et ayant plus de résultats sur la réduction d'émissions de GES en particulier	Coordination avec les ressources existantes	Organisation d'exposition sur l'aspect carbone durant les journées mondiales et festivals	public		exposition de photo et de faits		

Chronogramme

Activités		avril				mai				juin
I. Elucider les méfiances de la population à l'égard du programme de conservation en général et du Concept carbone en particulier afin d'en assurer l'appropriation										
I.1. Test de l'approche au niveau du secteur Ambinanitelo	-									
Réunion villageoise à Marovovonana, Ambalamahogo, Andaparaty et Ambodivoangy										
Réunion villageoise à Sahantaha et Anjiamazava										
Atelier communal Ambinanitelo (secteur n°1)										
1 atelier régional Analanjirofo										
II Assurer que la population connaisse leur droits et aie accès aux informations necessaires pour pouvoir participer au programme										
II.1. Développement outils de communication										
Conception et production des fact sheet, affiche										
II.2. Campagnes de communication										
30 Réunions villageoises										
18 ateliers communaux										
2 ateliers régionaux (Lieux de réunion: Sambava et Antsohihy)										
Production d'émission radiophonique sur Carbone au niveau des stations locales										
Production d'articles sur le carbone dans le Magazine Dalaly										
III Changer les perceptions, attitudes et comportement des jeunes et des enfants pour qu'ils contrbuer de façon resposables à la gestion des ressources naturelles										
III.1. 3 sessions d'éducation des jeunes dans « Saturday School » et Connecting classroom										

III.2. Animation au niveau des écoles travaillant avec WCS au niveau rural										
III.3. Organisation d'événements d'information par les clubs des jeunes sur le thème Carbone										
IV Sensibiliser les populations à s'engager dans les activités ayant moins d'impacts sur l'environnement et ayant plus de résultats sur la réduction d'émissions de GES en particulier										
IV 1 Organisation des expositions "carbone" durant les journées mondiales et festivals										

Appendix XVI

Sample Field Inventory Sheets

16.1: Data sheet sample 26_1 (total carbon stock 446.87 t CO_2-e/ha): Above ground live tree biomass

Dist % 1 = 0 m
Alt: 288 m ± 7
Slope = 40% vers 290° W

Lohan'i Sanantamina ha

Andandravina

FEUILLE DE DONNEES N° 06

Plot ID : 9-8-226 Localisation : Andilambena Point GPS : N : 15°34'34.9 E : 049°33'27.5

Type de forêt : SAVOKA

Date : 15/11/09 Données prises par : FELIX Photo N° : N39 ; E 40, W 41, S 42

Nb équipes : 07 Chef d'équipe : Felix

Heure de départ : 11:20 Heure de clôture : 13:35 Durée totale : 2:15

Notes : c'est une Savoka de 4 ans après le Tavy / aucune valeur particulière, il sera ~~agroforestier~~ jinja.

MESURES D'ARBRES VIVANTS ET D'ARBRES MORTS SUR PIED DE LA CLASSE I

Dimensions du plot (m) : Petit : 5 m Moyen : 15 m Large : 20 m

Classes diamétrales (Cm) : Petit : > 5cm Moyen : > 10cm Large : > 20cm

Nombre de régénérations et de jeunes bois (Moins de 5cm de dbh et plus de 1.3m de hauteur) dans un rayon de 1 m : = 29

R = 5m

ID	Espèces	DBH (Cm)	Hauteur Palmiers (m)
Fompono		6.4	
Fompono		8.5	
Andrarezondahy		8.1	
Fonofono		7.9	
Fognofogno		5.9	
Fognofogno		7.5	
Ravinala		(48) 5.3	6.2

R = 15

ID	Espèces	DBH (Cm)	Hauteur Palmiers (m)
	Trotrokala	16	

R = 20

ID	Espèces	DBH (Cm)	Hauteur Palmiers (m)
Trotrokala		25.9	
Trotrokala		24.2	
Ravinala		(65)	5.5
Ravinala		(102)	7.00
Ravinala		70	8.3
Ravinala.		55	6.2

1, 2

(..) Trahan

7.

16.2: Data sheet sample 26_2 (total carbon stock 446.87 t CO_2-e/ha): Above ground non-tree, lying and standing dead wood biomass

Plot ID : 9-8-22C

ARBRES MORTS SUR PIED DE CLASSE 2

Classe de Densité S=Solide I=Intermédiaire P=Pourrie	Diamètre Basal (0.3m)	DBH (1.3m)	Diamètre au sommet (m)*	Distance Œil Règle (m)	Diamètre du sommet par la règle (m)	Distance de l'œil à l'arbre (m)	Hauteur (m)*	Angle Clinomètre (%)	Distance de l'œil à l'arbre (m)	Hauteur de l'œil (m)
✓										

CLIPLOTS

Dimensions du plot : 50cm x 50cm

Id Echantillon	Poids Total (g)	Sous Echantillon (g)
1	240 g	120 g
2	100 g.	
3	255 g	
4	220 g.	

LITER PLOTS

Dimensions du plot : 50cm x 50cm

Id Echantillon	Poids Total (g)	Sous Echantillon (g)
1	330 g	260 g.
2	370 g.	
3	1080 g	
4	465 g	

MESURE DU BOIS MORT COUCHE (diamètre >5 cm)

Ligne de transect = 100 m

T: 100 m.

Diam (Cm)	Classe de Densité S=Solide I=Intermédiaire P=Pourrie	Diamètre Creux (Cm)
T I 7.2	I	
11.6	S	
14,00	S	
14.1	P	
9	P	7.8
6.8	P	
31	S	
36.3	S	
32	I	
15,5	P	
30.7	I	
17.5	P	
14,8	I	
26.4	S	

16. P
18.1 P
15.4 P
18.6 I

II
10,5 I
13,9 I

13.3 I
21.2 P
9 S
15.8 P
17.8 I
7.5 P
20 P
13. PS
13 P
36.7 S
24.2 P
16.1 S
26.2 S
6,6 P
7.7 I

16.3: Data sheet sample 30_1 (total carbon stock 37.29 t CO_2-e/ha): Above ground live tree biomass

Dist % 25 = 1m
Alt : 495m ± 8m
Slope : +50% Vers 270°

FEUILLE DE DONNEES N° 10

Plot ID : 9-8-230 Localisation : Verezambola Point GPS : Plot 9-8-230 N : 15°30'36.2" E : 049°32'37.4"
Type de forêt : Forêt dégradée
Date : 19/11/09 Données prises par : Félix Photo N° : N: 229 E 230 S 231 W 231
Nb équipes : 07 Chef d'équipe : Félix
Heure de départ : 9:10 Heure de clôture : 12:09 Durée totale : 2:59
Notes : Forêt dégradée.

MESURES D'ARBRES VIVANTS ET D'ARBRES MORTS SUR PIED DE LA CLASSE 1

Dimensions du plot (m) : Petit : 5 m Moyen : 15 m Large : 20 m
Classes diamétrales (Cm) : Petit : > 5cm Moyen : > 10cm Large : > 20 cm
Nombre de régénérations et de jeunes bois (Moins de 5cm de dbh et plus de 1.3m de hauteur) dans un rayon de 2 m : = 45

ID	Espèces	DBH (Cm)	~~Hauteur~~ Palmiers (m)
R=5m	Maintimpototra	~~[illegible]~~	17.4
	Hazomemy	5.2	
	Voantsilana	11.8	
	Tsimahamasatsokina	6.4	
	Tamenaka	29.	
	Trotrokala	6.3	
	Tanatanampotsy	5.8	
	Ovotrasina	14.8	
	Hazomamy	8.00	
	Tsilopaimbarika	37.6	
	Nanto	10.6	
	Mandravokina	26.4	
	Maintimpototra	5.9	
	~~Ankazogaranoala~~	~~7.3~~	
	Mahintymiotra	10.4	
	Ankazgaranoala	7.3	
R=15	Somotsorana	27.3	
	Tsimahamasatsokina	11.2	

ID	Espèces	DBH (Cm)	Hauteur Palmiers (m)
R=	9.2		
	Hazo ambo	9.2	
R=15m	Tamenaka	83.5	
	Maintimpototra	10.2	
	Mandravokina	20,00	
	Mandravokina	14.6	
	Varantsoala	23.4	
	Tanatanampotsy	57.1	
	Ovotrasina	10.3	
	Varantsoala	23.5	
	Varantsoala	23.1	
	Mandravokina	10.6	
	Varantsoala	11.3	
	Mandravokina	25.8	
	Tsilopaimbarika	75.8	
	Mandravokina	27.8	
	Vantsilana	21.5	
*	Ravinala	31.7	23.4 Tronc 20,2
	Tanatanampotsy	29.6	
	Hazombato	37.8	
	Vongo	80.8	
	Totokintsina	18	
	Totokintsina	18.3	

ID	Espèces	DBH (Cm)	Hauteur Palmiers (m)
	Menavony.	36.4	
	Tsilopaimbarika	46.8	
	Tanatanampotsy	22.9	
	Vantsilana	29	
	Mandravokina	32.8	
R=20m	Fanokindambo	24.5	
	Ompa	23.3	
	Mandravokina	48.2	
	Mandravokina	22.8	
	Hazomainty	20.9	
	Tanatanampotsy.	23.4	
	Mandravokina	54.5	
	Tsilopaimbarika	31.8	
	Tanantanamena	20.1	
	Tsilopaimbarika	24.3	
	Tavolomalaly	32,00	
	Tsilopaimbarika	44.2	
	Tamenaka	20.4	
	Nanto	59.8	
	Vongo	22.4	
	Totokintsina	30.2	
	Mandravokina	20.5	
	Totokintsina	34	
	Hazomainty	61.4	
	Mandravokina	39.8	

16.4: Data sheet sample 30_2 (total carbon stock 37.29 t CO_2-e/ha): Above ground non-tree, lying and standing dead wood biomass

Plot ID : 9-8-230

ARBRES MORTS SUR PIED DE CLASSE 2

R= 15m (classe 1)

Classe de Densité S=Solide I=Intermédiaire P=Pourrie	Diamètre Basal (0.3m)	DBH (1.3m)	Diamètre au sommet (m)*	Distance Œil Règle (m)	Diamètre du sommet par la règle (m)	Distance de l'œil à l'arbre (m)	Hauteur (m)*	Angle Clinomètre (%)	Distance de l'œil à l'arbre (m)	Hauteur de l'œil (m)
	~~14.5~~	~~13.2~~	~~7.9~~				~~1.30~~			
Hazimina S	21,00	17.2			4 mm	6	12.52	0% 150%	6	1.63
Nanto S	70.2	65		67	22 mm	5,4	18,93	-6%, +15%	5,4	1.63
Ompagavo S	28.3	26.6		6.7	6 mm	7,1			7,1	1.63
Ompagavo I	54.3	38.8		6.7	38 mm	4.1	5,23	-47% +90%	4,1	1.63

CLIPLOTS

Dimensions du plot :

Id Echantillon	Poids Total (g)	Sous Echantillon (g)
1	130 g	170 g
2	120 g	
3	110	
4	180	

LITER PLOTS

Dimensions du plot :

Id Echantillon	Poids Total (g)	Sous Echantillon (g)
1	370 g	175 g
2	190 g	
3	345 g	
4	315 g	

MESURE DU BOIS MORT COUCHE (diamètre >5 cm)

Ligne de transect = 100 m

Diam (Cm)	Classe de Densité S=Solide I=Intermédiaire P=Pourrie	Diamètre Creux (Cm)
I 51.6	S	32.5
10.2	I	
46.2	S	
II 10.7	S	
21.05	S	
22.04	I	
13.09	S	
8.2	P	
8.5	S	
19.00	I	
15.4	S	

Appendix XVII

Makira Project Timeline

ANNEE	CREATION AP MAKIRA	Référence	Détails
2001			
2002	Elaboration du document de projet Makira comme un projet pilote pour tester le financement carbone		
	Accord de financement CI/GCF et CI /CEPF		
	Présentation du Projet Makira aux autorités locales et partenaires potentiels au niveau local à Maroantsetra	Réunion officielle, ouverte par les autorités	**Participants :** MEF, DGEF Tana, DIREF Tamatave, CANFORET Maroantsetra - WCS Tana & Maroantsetra - Sous-préfecture Maroantsetra, Commune urbaine Maroantsetra, les autres communes de la région de Makira - Les Présidents de Fokontany dans la région de Makira - Equipe Antongil Conservation - ANGAP Masoala - SAF FJKM Maroantsetra - WWF/CAF Ankarahaka
	Lancement des travaux d'inventaires biologiques	Rpport de missions	8 taxons concernés depuis 2003 à savoir, les plantes, les lémuriens, les carnivores, les petits Mammmifères, les Chiroptères, les Oiseaux, les Reptiles, les Amphibiens et lépidoptères. Plus de 20 sites ont été inspectés jusqu'à présent. Les résultats obtenus ont montré la présence de plus de 460 espèces de plantes, 17 espèces de Lémuriens, 6 espèces de carnivores, 18 espèces de micromamifères, 7 espèces de chiroptères,101 espèces d'oiseaux ,61 espèces de reptiles,116 amphibiens,145 espèces de lépidoptères.
	Début de la campagne de sensibilisation et d'information à tous les niveaux sur la création de l'AP Makira	Suivant les structures existantes	03 regions, les 06 districts, les 22 communes et les sites Fokontany/villages La campagne IEC a continué tout le long du projet jusqu'à maintenant. Cibles: Communautés, Autorités locales, Services concernées, …
2003	**Atelier de planification stratégique:** Validation de la 1ère version du cadre logique des activités - Validation de l'organigramme du Projet		**Participants :** DGEF, DADF, DIREF Toamasina, SESPAF/DGEF, SCB/DGEF, CEF Maroantsetra, CI, WCS
	Visite sur terrain de l'équipe technique du projet pour voir les réalités de terrains et pour discuter avec les autorités locales	Descente dans la forêt et échanges	Etaient présent équipe MEF MEF, DGEF, WCS , CI
	Lancement des enquêtes socio-économiques sur terrain	Rapport socio -économiques	Etude faite du mois d'avril au Septembre 2011 par un équipe de Consultant (Ignace Ramanadriana)
	Présentation du Projet aux trois PDS Antsiranana, Mahajanga, Toamasina		Visite de courtoisie et échange avec les PDS
	Atelier d'information et de présentation de l'équipe et du projet à Maroantsetra	Réunion officielle, ouverte par les autorités	**Participants :** CANFORET Maroantsetra - WCS Tana & Maroantsetra - Sous-préfecture Maroantsetra, Communes dans le district de Maroantsetra - Les services deconcentrés et ONG
	Première réunion du CA: validation de la deuxième version du cadre logique		
	Atelier de lancement Officiel du projet à l'echelle nationale, tenu à Antananarivo		
2004	Etude socio-économiques dans les zones concernées par l'AP Makira	Rapport socio -économiques	Fait dans 104 villages de 24 communes sis dans 07 district de 03 région. Taux d'acroissement = 3%. Population jeune car 56,1% mois de 18 ans. Taille de ménage = 5,6. Taux de scolarisation 39,8%.
2005	Institution de l'équipe de délimitation par arrêté régional	Arrêté régional	01 arrêté régionale elaboré par les régions. Equipe incluant les service de domaine, district, agriculture
	Verification physique de la limite de l'AP Makira	Limite Makira - Point GPS	Coordonnées Laborde et Description des points et des limites des differents zonages de l'AP: 1550 points decrites sur la limite du ND, 130 points sur les limites des zones tampon 700 points au niveau des limites de zone de peotection et 200 points au viveau des pistes
	Affichages des limites au niveaux des communes et collectes des doléances	Cahier de doléances	16 reclamations enregistrés dans la Region SAVA, 10 dans la Region Sofia et 75 dans la Region d'Analanjirofo
	Promulgation de l'arrêté N° 20.022 /2005 portant protection temporaire de l'aire protégée en création denommée Makira	Arrêté temporaire	
2006	Négociation avec le service de mine et les opérateurs miniers		
	Réalisation de l'Etude d'impact Environnemental		Le document de PGES elaboré et un permis environnemental délivré par l'ONE
	Identification de la situation foncière des communautés aux alentours de l'AP, en collaboration avec le service des domaines	Certificat de situation juriqiques	01 certificat juridique délivré par chaque service topographique régionale
	Descente sur le terrain pour la délimitation des ZOC - ZUC	Limite ZOC ZUC	Coordonnées Laborde et Description des points et des limites des zones tampons au niveau des 130 points
	Zonage à l'intérieur de l'AP et Elaboration des outils de gestion pour l'élaboration du PAG	Contrat d'utilisation et Cahier de charge	1 cahier de charge et 1 contrat d'utilisation par zone tampon signé chacun par le president de VOI et le representant du gestionnaire de l'AP

ANNEE	CREATION AP MAKIRA	Référence	Détails
2007	Négociations et validation des grandes pistes, ZUC, ZOC et collectes des autres éléments du PAG	PV de négociation	05 ZOC délimités. Surface 11875 Ha. Population = 1643. Ménage 306. Village/hameau = 12 - Un PV de negociation par piste, par ZOC et ZUC signé chacun par les presidents de COGES et des autotité
2008	Validation de la limite Makira au niveau régional: Réunion multipartite	PV de validation	3 rapport signé chacun par le chef de region concerné, par un representant de DRDR, par un representant de service de domaine et topographique, un representant de service forestier, un representant de ministère de l'energie et un representant du gestionnaire de l'AP
	Rapport final détudes d'impact environnemental - PGES	PGESS	Un cahier de charge environnemental signé et un rapport soumis par an à l'ONE. PGESS élaboré
2009	Mise en œuvre de suivi écologique participatif	Contrat de collaboration	Un contrat par site de transfert de gestion avec les comité de suivi (29 comités mis en place et fonctionnels
	Publication du PAG de Makira	PAG	Atelier de validation le 01 septembre 2009
2010	Elaboration des éléménts du création définitif de l'AP (décret, carte de l'AP)		
2011	Revision du PAG	PAGS définitif	01 PAG mise à jour
	Constitution du dossier de création définitive de l'AP Makira		
	Validation du dossier de création définitive de 'AP Makira par la Commission SAPM		
2012	Validation du dossier de création définitive par le conseil du gouvernement = 19 Juin 2012		

ANNEE	STRUCTURE DE GESTION et Ceinture verte	Référence	Détails
2001			
2002			
2003	Signature de l'Accord Cadre MINENVEF –WCS		
	Signature de la Convention d'Exécution DGEF - WCS		
	Recrutement des staffs du Projet	TDR	Directeur - Chef de volet CR - Chef de volet Com - Chef de volet TDG - Chef de volet Appui au dév.
	Mise en place du Conseil d'administration du Projet		
2004	Début du processus de mise en place des sites de transfert de gestion dans la ceinture verte de l'AP Makira	Document de transfert	Total: 10 dont 08 à Maroantsetra et 02 Andapa. Surface forêt = 18790 Ha . Population = 11545. Ménage = 1602. Village/Hameau = 31
2005			
2006	Continuation de la mise en place des sites TDG	Document de transfert	03 TDG dans secteur III. Surface forêt = 10790 Ha. Population = 600. Ménage = 100. Village/hameau= 08
2007	Continuation de la mise en place des sites TDG et Evaluation des anciens sites	Document de transfert	03 TDG dont 01 sesteur V et 02 secteur I. Surface = 3656 Ha. Population = 2170. Menage = 517. Village/Hameau= 08
2008	Continuation de la mise en place des sites TDG et Evaluation des anciens sites	Document de transfert (limite)	03 TDG dans secteur III . Surface = 1440 Ha. Population = 3217 ha. Ménage = 642. Village= 03
	Evaluation d'anciens sites	PV d'évaluation	08 sites évalués dans le secteur I. Surface forêts = 12552. Population =11504. Ménage = 1620. Hameau= 16
2009	Continuation de la mise en place des sites TDG	Document de transfert	10 TDG dont 05 dans secteur IV et 05 dans seteur V. Surface = 14340 Ha. Population = 7684. Ménage = 1587. Village/Hameau = 22
	Mise en place des Plateformes des COBA	PV de constitution	01 Plateforme dans le secteur I
2010	Continuation de la mise en place des sites TDG et Evaluation des anciens sites	Document de transfert	11 TDG dont 03 dans le secteur II, 04 dans le secteur III et 04 dans le secteur VI. Surface forêts = 25313. Population = 5084. Ménage = 1136. Village hameau = 34.
	Mise en place des Plateformes des COBA		03 Plateforme dont 01 dans le secteur IV, 01 dans le secteur V et 01 dans le secteur III
2011	Continuation de la mise en place des sites TDG	Document de transfert	04 TDG dans le secteur VI. Surface forêts = 6229. Population = 2873. Ménage = 574. Village/ hameau = 06
	Evaluation d'anciens sites	PV d'évaluation	03 sites évalués dans le secteur III. Surface forêt = 10790 Ha. Population = 600. Ménage = 100. Village/hameau= 08
	Mise en place des Plateformes des COBA	PV de constitution	01 Plateforme dans le secteur VI
2012	Continuation de la mise en place des sites TDG	Document de transfert	En cours
	Evaluation d'anciens sites	PV d'évaluation	03 sites évalués dans le secteur VI. Surface forêts= 8713 Ha. Population = 3088. Ménages= 12
	Mise en place des Plateformes des COBA		01 Plateforme dans le secteur II
	Mise en place de la Fédération des COBA	PV de constitution	01 Féderation des COBA
	Identification des répresentants des COBA à la COE	PV de constitution	03 représentants soit 01 par région (SAVA, Sofia, Analanjirofo)

ANNEE	FINANCEMENT DURABLE	Référence	Détails
2001	Symposium international sur le financement durable des AP et autres programmes environnementaux: Instruments pour le financement de la conservation		Mécanisme de financement du carbon identifié comme sources de financement potentiel
2002			
2003			
2004	Etude de faisabilié REDD par Winrock International		
2005			
2006	Vente de 40.000 tCO2e (par CI-CELB)		
2007			
2008	Formation sur la méthodologie d'évaluation la capacité de stockage de Carbonne	Rapport de mission - Référence de document	Durée: 5 jours (24-28 Septembre 2008) ***Localisation:*** Marovovonana, CR Ambinanitelo. -Participants : 15 (dont 3 WCS ; 2 QMM et 10 CI). ***Formateurs :*** Sarah Walker et Nancy Harris - 18 agents locaux ont été aussi formés lors de la collecte des données
	Collecte des données préliminaires sur la capacité de stockage de Carbonne dans les forêts de Makira	Fiche de collecte	Collecte avec méthodologie à utilser
	Signature accord GOM – MCC/WCS pour la commercialisation de CO2 de Makira		
	Bourse de CI-CELB pour l'achat de 100.000 tCO2e à 7US$/t		

ANNEE	FINANCEMENT DURABLE	Référence	Détails
2009	Suivi de l'évolution des capacités de stockage de carbone des forêts de Makira et aux alentours	Coordonnée géographiques d'implatation de suivi	132 Points GPS
	Évaluation de capacité de stockage de carbone des forêts fortement perturbées de Makira	Rappport de mission	***Methodologies:*** Pour la Forêt Intacte de Moyenne et Basse altitude, la mensuration était faite : ***- Dans le rayon de 0 à 2m :*** comptage des arbres non-arborés à une hauteur supérieure à 1,30 m et de DBH inferieur à 5 cm), ***- Dans le rayon de 0 à 4m :*** mensuration des arbres de DBH > 5 cm, ***-Entre le rayon de 4 à 14m :*** mensuration des arbresde DBH > 15 cm, ***-Entre le rayon de 14 à 20m :*** mensuration des arbres de DBH > 30 cm .
			Pour les strates Savoka la mensuration a ete faite : ***- Dans le rayon de 0 à 2m :*** comptage des arbres non-arborés à une hauteur supérieure à 1,30 m et au DBH inferieur à 5 cm, ***- Dans le rayon de à à 5m :*** mensuration des arbres au DBH > 5 cm, ***- Entre le rayon de 5 à 15m :*** mensuration des arbres au DBH > 10 cm, ***- Entre le rayon de 15 à 20m :*** mensuration des arbres au DBH > 20 cm),
			Realisations. 5 strates ont été identifiées : Forêt Intacte de Moyenne Altitude (FIM); Forêt Intacte de Basse Altitude (FIB); Forêt Dégradée de Moyenne Altitude (FDM); Forêt Dégradée de Basse Altitude (FDB); Savoka (SVK)
			L'évaluation de la capacité de stockage de carbone au sein du PN Makira a été finalisée au mois de Juin 2010. 132 placettes des deux strates forêts à haute et à basse pression ont été tour à tour inventoriées. 30 placettes de strate Savoka de type agroforesterie a également été inventoriée. Ces travaux ont définitivement clôturés les inventaires sur le carbone terrestre de l'AP Makira.
	Suivi de l'évolution des capacités de stockage de carbone dans le Savoka des forêts de Makira	Coordonnée géographiques d'implatation de suivi	30 Points GPS
2010	Atelier de consultation publique sur la REDD au niveau de la région Analajirofo et SAVA dans le cadre de l'élaboration du RPP	Rapport ONE	COBA de Makira représentés pendant les réunion et des services concernés (domaines, agriculture, topo)
2011	Elaboration PDD		
2012	Certification des carbones forestiers de Makira	Rapport de mission et leurs commentaires	Descente sur terrain à Makira de l'équipe de Smart wood avec l'équipe de WCS

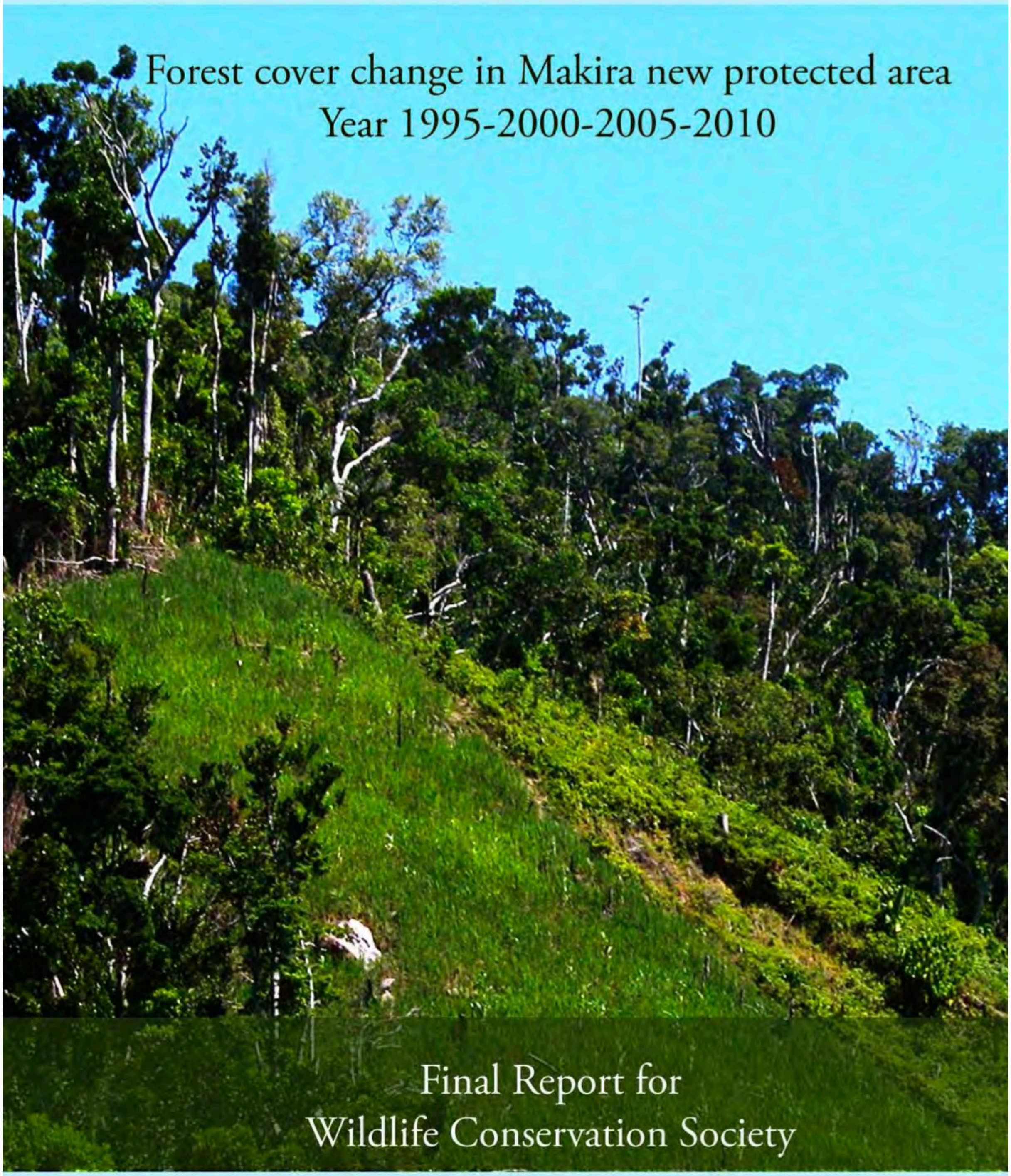
Appendix XVIII

Makira Deforestation Analysis Report

Note: The areas mentioned in the deforestation analysis report corresponded to the different reference areas from version 2 of the Makira PD. During the revision, RRD, RRL and LB have been adapted as mentioned in various sections of version 3 of the PD and areas in the deforestation analysis report did therefore not correspond anymore. The only area that did not change is the PA and areas mentioned in table 2 of the report do in fact correspond with the areas mentioned in tab "HistDef" of the "Makira v4 - Deforestation Projections" Spreadsheet.

The final result of the deforestation analysis were shapefiles for the entire area covered by the two considered Landsat scenes for the four dates. Although the report contains some maps, all maps in the PD were in fact developed by the WCS GIS team and do therefore not necessarily correspond with the maps in the report below.

Forest cover change in Makira new protected area
Year 1995-2000-2005-2010



Final Report for
Wildlife Conservation Society

Ileiry Geospatial Services
July 2012

CONTEXTE

Depuis près de 10 ans, WCS est engagé dans la réduction des Emissions de la déforestation et de la Dégradation des forêts (REDD) dans la zone de Makira dans le Nord-Est de Madagascar. Ces activités se sont concentrées principalement sur la création de la nouvelle aire protégée de Makira créée officiellement en 2005, ainsi que sur l'appui au transfert de la gestion des forêts dans la zone de protection de l'Aire Protégée Makira (APM) aux communautés locales selon les procédures GCF. Déjà en en 2003, lors de la délimitation de la future AP, WCS a signé avec le Ministère de l'environnement et des forêts (MEF) un contrat de délégation de gestion qui est actuellement en train d'être étendu pour une période de 30 ans.

L'objectif global du projet REDD Makira est d'atteindre un financement durable de l'aire protégée à travers la vente de crédits carbone générés par la réduction des émissions de Gaz à Effet de Serre (GES) liées à la déforestation. Ces revenus du carbone forestier devraient en outre motiver les populations locales à réduire leurs activités destructrices (tavy) à long terme et contribuer au développement rural. Cependant, la vente de crédits carbone nécessite aujourd'hui un processus de certification indépendante rassurant les acheteurs potentiels que les crédits ont effectivement été générés et que les effets négatifs sur l'environnement et le milieu humain ont été pris en considération.

A l'heure actuelle, WCS se trouve dans le processus de certification selon deux systèmes :

- La certification VCS (Voluntary Carbon Standard) certifie l'effectivité des réductions d'émissions de GES annoncées, leur additionnalité et leur durabilité ;
- La certification CCB (Climate, Community and Biodiversity Standard) certifie la prise en compte appropriée des aspects climat, social et biodiversité dans le développement et la mise en œuvre du projet.

Au niveau de la certification VCS, plusieurs méthodologies ont déjà été approuvées par VCS qui s'appliquent à plusieurs types de projet REDD (AFOLU, IFM, etc.) dans différentes situations de départ. Un des éléments centraux de ces méthodologies est le développement d'un scénario de référence des émissions de la déforestation qui seraient apparues sans l'intervention du projet. Ce scénario s'appuie d'un côté sur une modélisation de la déforestation en partant de la déforestation historique, et de l'autre sur des données sur les stocks de carbone obtenu par des inventaires forestiers.

INTRODUCTION

The Makira protected area is situated in the north eastern Madagascar. It is formed of a vast forested land and is one of the biggest pristine forests still existing in Madagascar. This habitat is however threatened by gradual loss of forest cover over time. The main threat has been the small scale subsistence agriculture engaged by the local population. However, recently, one of the biggest concerns is also illegal extraction of rose wood.

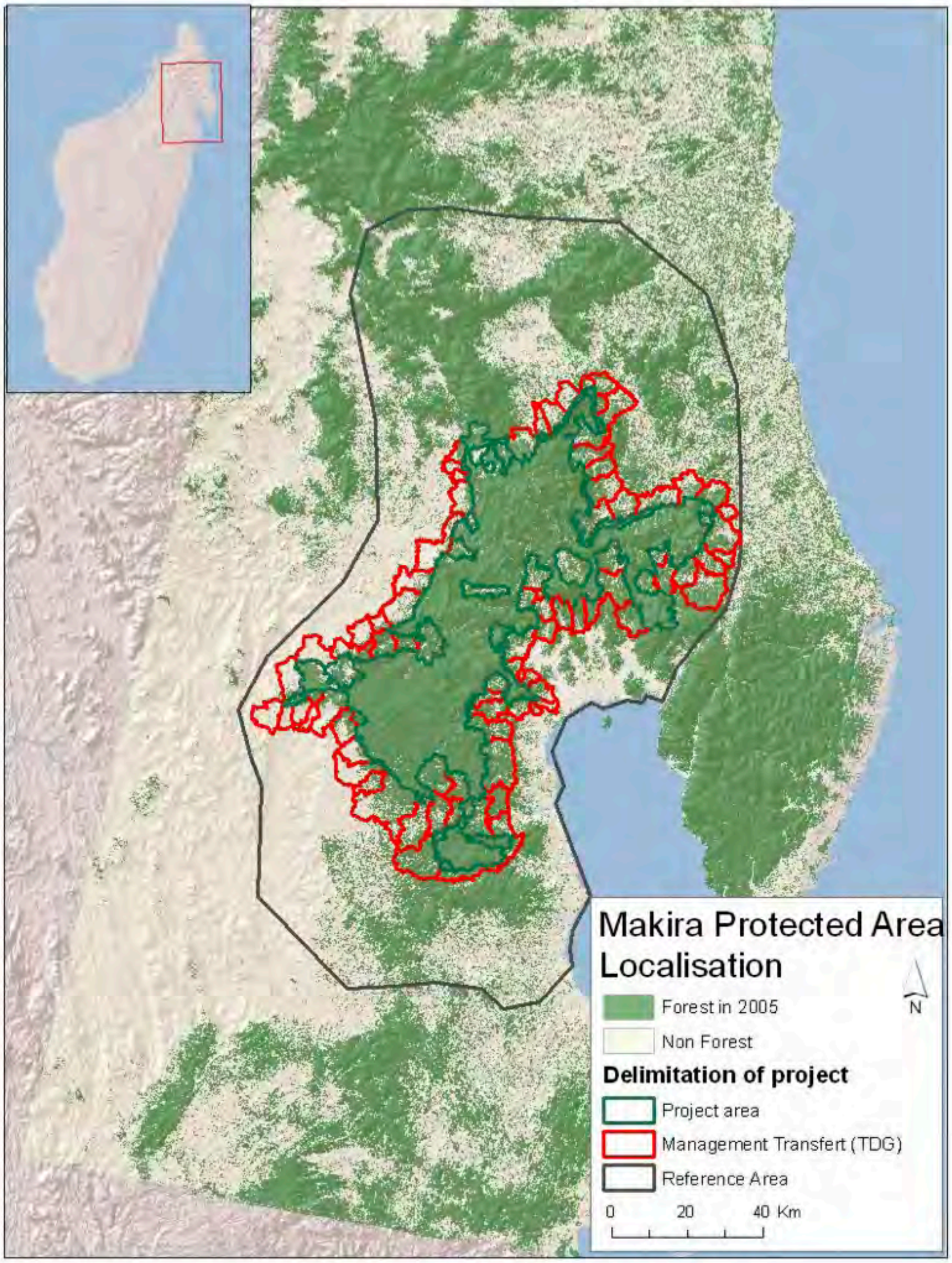


Figure 1 Localisation map of Makira

FOREST AND DEFORESTATION DEFINITION

Different definition of forest in the past has created confusions in comparing the amount of forest cover present in Makira. According to UNEP(1998), there are many definition in use for what is defined as forest and non forest. table xx summarizes the definition of forest used to date in Madagascar :

Table 1 few definition of forest cover

Source	Definition used	Note
UNEP/FAO	Land with tree crown cover (or equivalent stocking level) of more than 10 percent and area of more than 0.5 hectares (ha). The trees should be able to reach a minimum height of 5 meters (m) at maturity *in situ*	This definition would include a lot of wooded savanna and savoka if applied in Madagascar
Conservation International	Closed canopy forest (80% cover), 7 meters high and 2 ha minimum area	This is mainly based on an ecological definition of forest
DNA (designated National Authority), CDM definition	Stands of trees with 30% cover, 5m high and at least 1 ha in area	The one used in this analysis
IEFN	06 hectares minimum mapping unit	

As the main purpose of this analysis is the establishment of emission baseline for the Makira project, we have chosen the national definition of forest for the Clean development Mechanism (CDM), that is :

"Stands of trees having at least 30% crown cover, of 5 meters high and at least one hectare in area".

In this definition, lightly degraded areas as well as pristine forest are included. Are also included area of medium degradation and few plantations and agricultural area (plantation of cloves for instance). We have then excluded in this analysis any vegetation that is less than 5 meters high or having less than 30% cover. Additionally, any entity less than one hectare has been filtered out from the map. A priori, heights of trees are not visible in imagery, but we are relying in good knowledge of vegetation types, vegetation succession and field experience to decide what vegetation to include as forest. Also, high resolution images in google earth give a clear view of the vegetation existing in the area.

Deforestation however is defined as a transition of the vegetation cover, going below the threshold of forest definition, that is forest that has gone below 30% in cover or less than 5meters overall height or become less than 1 hectare patch.

FOREST COVER AND CHANGE OVER TIME

Both Landsat-5 and Landsat-7 measure reflected light in six spectral bands in the visible, near and middle-infrared. Among these bands, closed-canopy, mature forest appears different than almost all other cover types. This analysis aims to track change in forest cover change from 1995 - 2000 - 2005 and 2010. There are several methods used for change detection but they can be classified in two groups:

- combine images and classify to detect cover change: this is the ideal method, and has been used successfully by Conservation International (CI) for their national forest cover change analysis. This is however time consuming and practically impossible if you have more than two dates in analysis as this would create infinite number of layer or bands within the single image to classify.

- classify images, superimpose to derive change: this is the method adopted in this analysis. It consists of classifying images separately then combines them in the end to form an image of change.

The accuracy of both methods is similar and depends a lot on the georegistration of each individual image. That is why, the co-registration of images are of prime importance for an analysis of forest cover change, since a displacement of pixel may be interpreted as change in the cover type.

Summarized below are the specific steps in the methodology:

Image selection and acquisition

The revisit period for Landsat satellites is 18 days; but image availability is very limited due to quais-permanent cloud cover over Makira protected areas and the whole eastern Madagascar. When choosing images, we have set these criteria in order of priority:

- Acquisition date (we wanted a regular interval of analysis 1995, 2000, 2005, 2010)
- Cloud cover, the less the clouds the better
- Season (dry season preferred to humid season)

Landsat images are available through a few distributors. We have searched each one for image availability:

- USGS through earth explorer (http://earthexplorer.usgs.gov) or Glovis (http://glovis.usgs.org). Landsat images are free from these sites
- Global Land Cover Facility (GLCF http://glcf.umiacs.umd.edu) at the University of Maryland (UMD), free images from the archive
- University of Michigan (http://www.landsat.org), images at the cost of USD 50 a scene
- South African National Space Agency (www.sensa.org) from the receiving station in South Africa. Sensa holds the most comprehensive archive of all Landsat data and other satellite imagery. Landsat prices are USD 250 for a level 1 (north oriented) corrected images and another USD 50 for orthorectified imagery
- Added to these are our personal collection of image

Co-registration and pairing

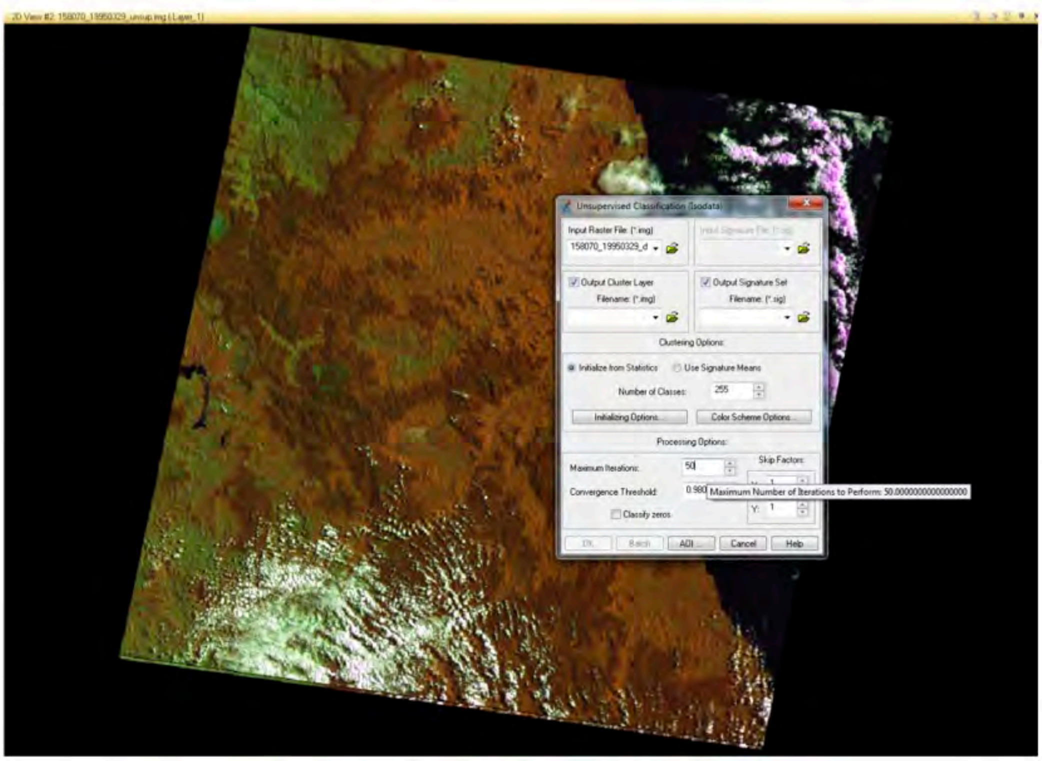
Although images are already georeferenced, there is always misalignment between different images, ranging from 10 to 100m, depending on the image sources (Landsat 5TM or Landsat 7 ETM). It is then of prime importance that images be coregistered to a maximum of 1 pixel displacement. Base images used to georeference images are the landsat 7 ETM geocover images from 2000. These are ground and orbit referenced, so as accurate at it can get. All the other images are registered to these images.

Clouds removal

Clouds are the mother of classification error, due to their nature, sometimes semi transparent, sometimes opaque, with an array of colors. Also, cloud shadows change completely the value of the pixel where it is occurring. Unfortunately, clouds are permanent in the eastern humid forest of Madagascar, and Makira is particularly in the wettest area of the country. It is a pure luck if we can get single cloudless image. Apart from Clouds, there is also the problem of data gaps for Landsat 7 ETM+ imagery which worsen the problem. To successfully remove image, we have gathered many images and superimpose them eliminating clouds and replacing them with value from other dates. Here is a summary of the process to remove the clouds:

- Unsupervised classification of images

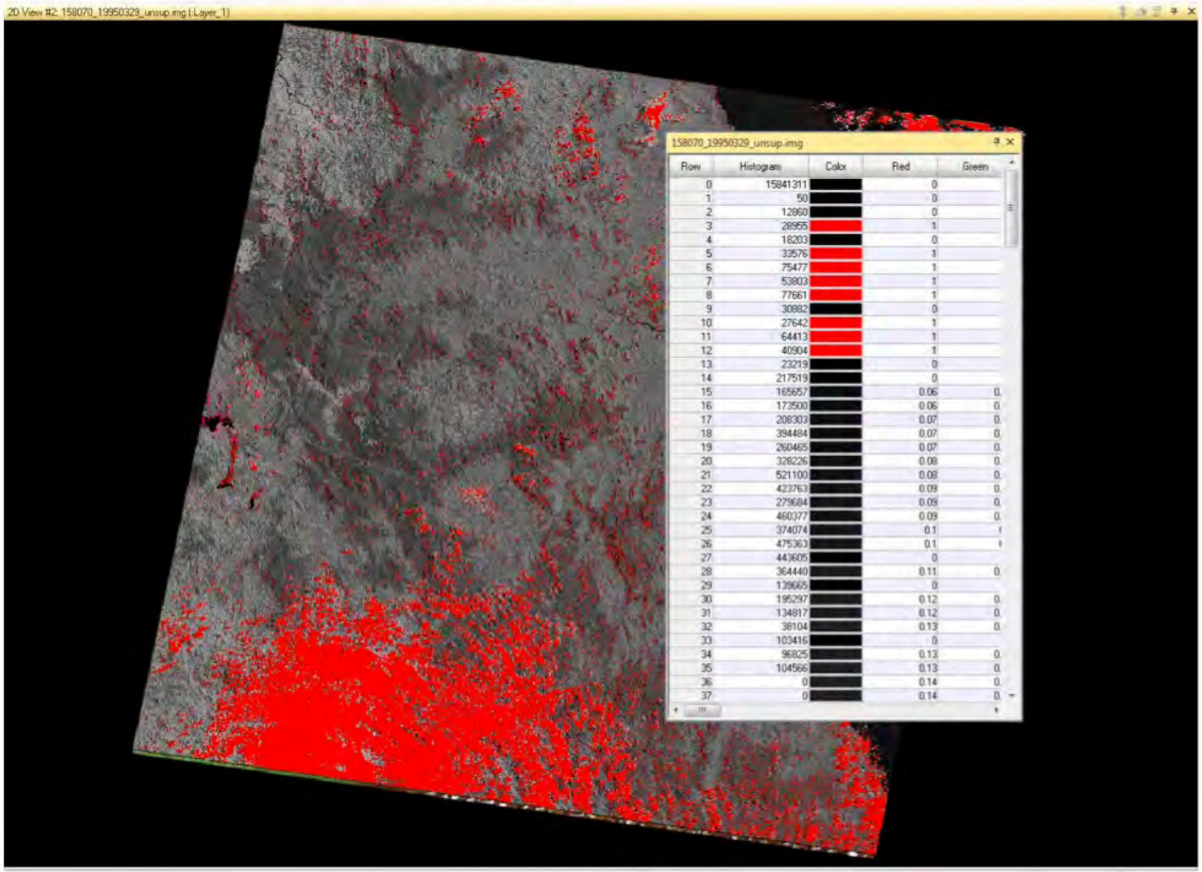
First step is to go make an unsupervised classification of the cloudy image. In Erdas, this step is accessible through raster>unsupervised>unsupervised classification. The setting for the classification are as follow :



Number of classes: 255. This is the ideal as Landsat images are delivered in 8 bits pixel depth, so each band has a value ranging from 0 to 255 (256 possible values). Also, if you choose more than 255 classes, the output should be a 16 bit images. That is why the number 255 is the optimal number of class here.

To prevent the software to go into an eternal loop, two more parameters need to be supplied here : the iteration number (50 is the choice) and the wanted precision (98 is the number). The process will stop if one of these two criteria is fulfilled.

- Selecting clouds from the classified imagery



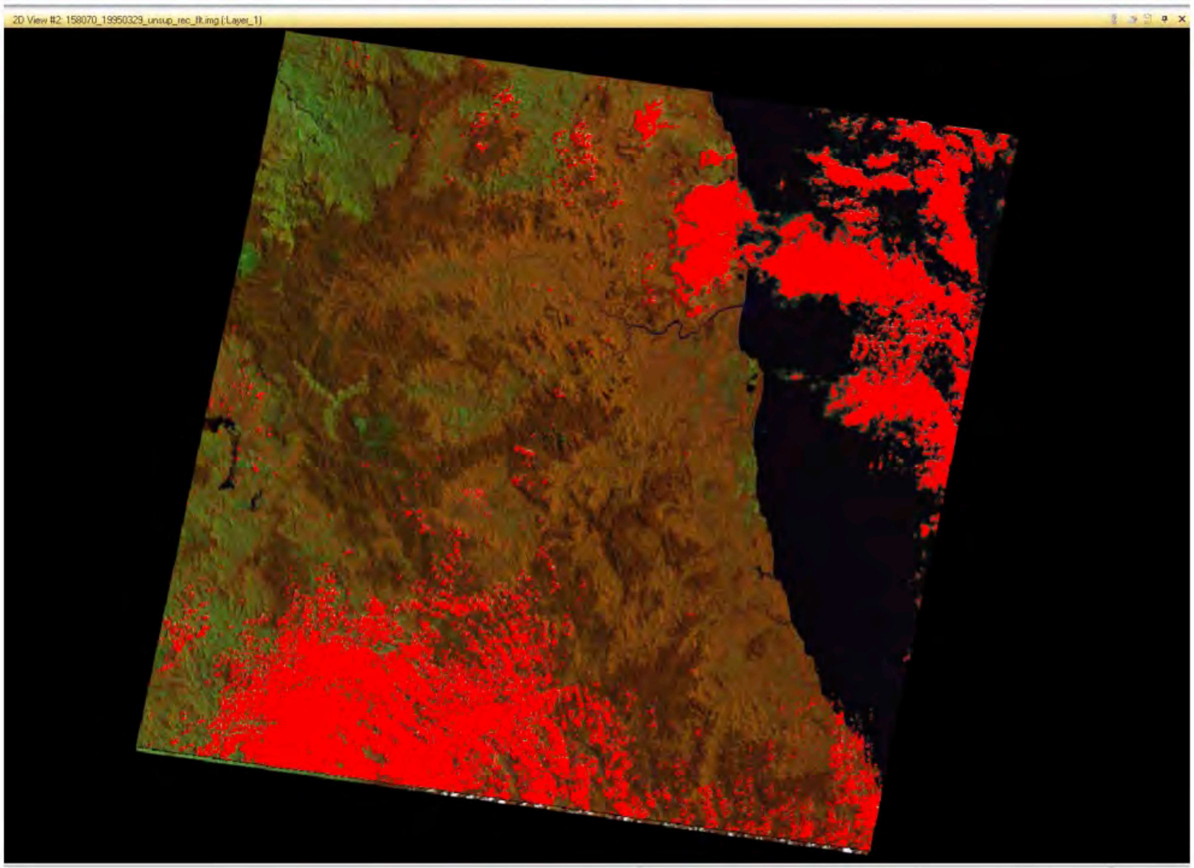
The classified image is open in a viewer and the attribute table changed. Each class that represents clouds is colorized. At the end of this step, some classes that contain non cloud are also colorized due to the clouds signature mixing with other classes like water, dark forest, bare soils ...

- Manually remove misclassification from the classified image

The colorized image is then edited manually. All non-clouds that has been colorized (mixed with clouds for their signature) are handpicked and edited out. This step is very flexible and this makes the difference with the automated cloud removal tool available (like ledaps tool from NASA). The user here has total control of what to include and what not to include as cloud. Sometimes, hazes are difficult to pick in automated tool but in this process, the user just creates a polygon and define these as clouds. On the other hand, if the user judges that the haze is not interfering with the classification as it is too light, it can be leaved there and classified normally as hazed forest (or any other class) afterwards.

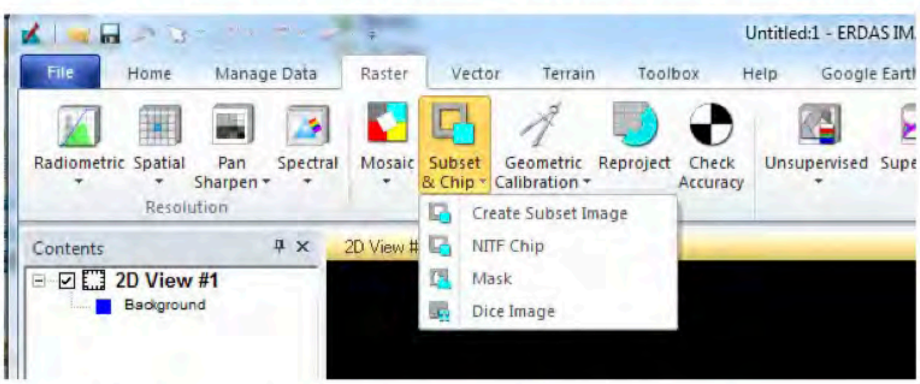
- Recode the value to 0 and 1, 1 being clouds and 0 as non –cloud

This step is necessary to bring down the number of classes, and to conform to the mask creation afterwards, as the masking image should be a binary in value.

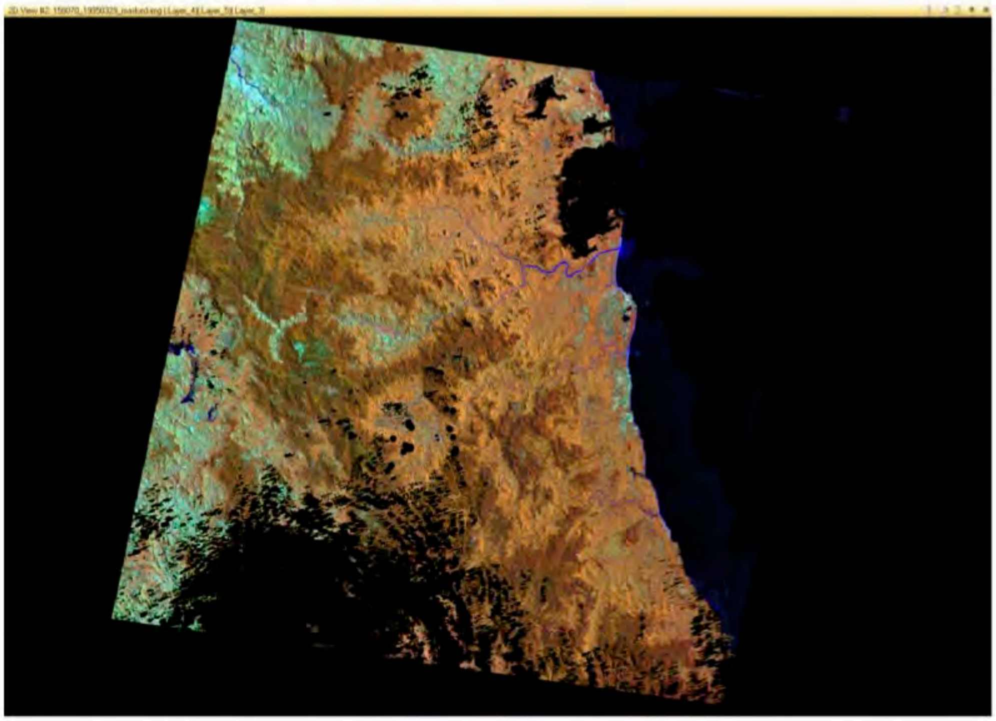


- use the binary map as mask; create the image without clouds for one date

The final step on removing clouds from images is to mask out the clouded area from the image.



The resulting image would look like the one below. This is now a cloud/haze/shadow free image and the next step of classifying the image (supervised classification this time) should have no problem.



- classify cloud free images using supervised classification (this step explained on its own section). It is important to not merge the cloud free image with other processed here as image with different dates have different illumination and different spectral response from the same subject.

- repeat the process for more images

- superimpose all masked images, this will automatically use non clouds value for the hole. All the cloud-free image from the (approximately) same period are now successfully classified. Each individual image should be taken and the **mosaic** module from ERDAS imagine can be used to combine them.

Display set-up

There are a lot of band combinations available for image analysis. In our case, the most important is the Green band and the red bands as vegetation absorbs red and reflects green lights. The most used band combinations for vegetation analysis are 4/3/2 or 4/5/3. Both Combination shows vegetated area in red and bare area in grey. The more the vegetation, the red the response. In this analysis, 4/5/3 combination is the main one used, as this shows more contrast on the forest.

With this combination, old growth forest is shown as dark brown, while savoka and annual vegetation would show as glossy pinkish color.

In ERDAS IMAGINE 2011, it is possible to open and synchronize google earth™ with the view, allowing a simultaneous view of the Landsat images with the high resolution images

Training sites selection

An initial inspection of all areas on the image has been performed. Based on differences in the spectral signature, existing ancillary data (mainly old vegetation maps), imagery in Google, and local knowledge of the processor, it is rather easy to create homogeneous sites used to train the software for the classification. Training sites are created for any possible vegetation and land cover types for the area being analyzed.

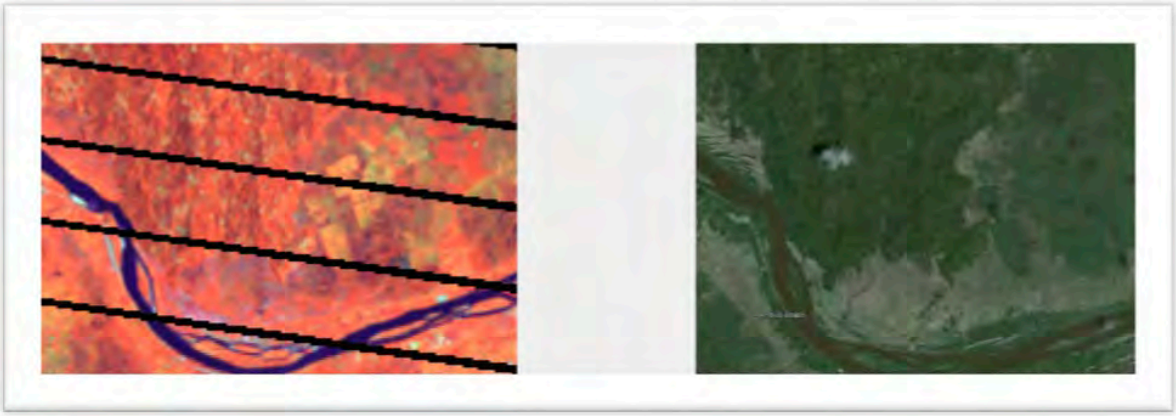


Figure 2

Ricefield and Savoka,View of the Landsat images on Erdas (RGB 4/5/3) and the corresponding high resolution images in Google earth

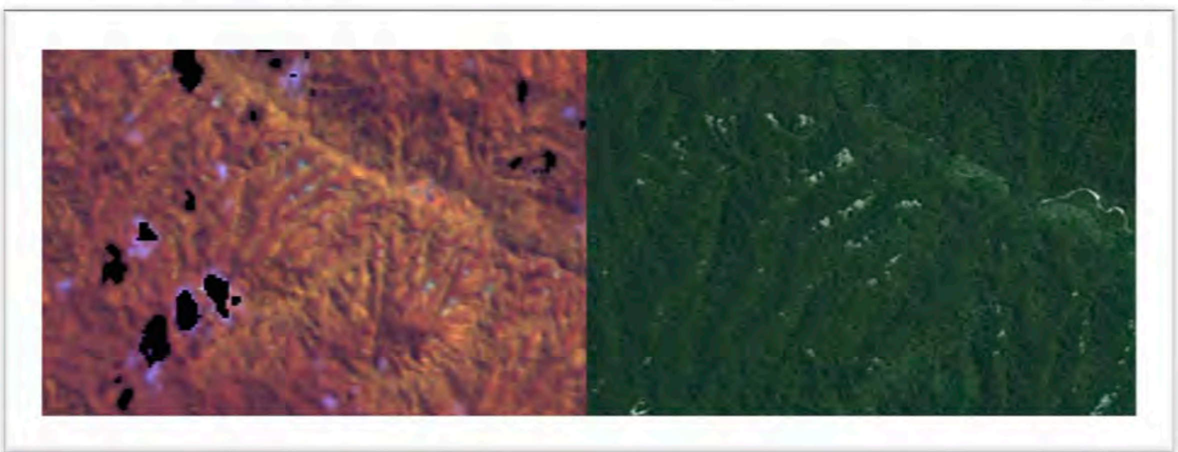


Figure 3

Forest and a small clearance, view from ERDAS (RGB 4/5/3) and Google Earth

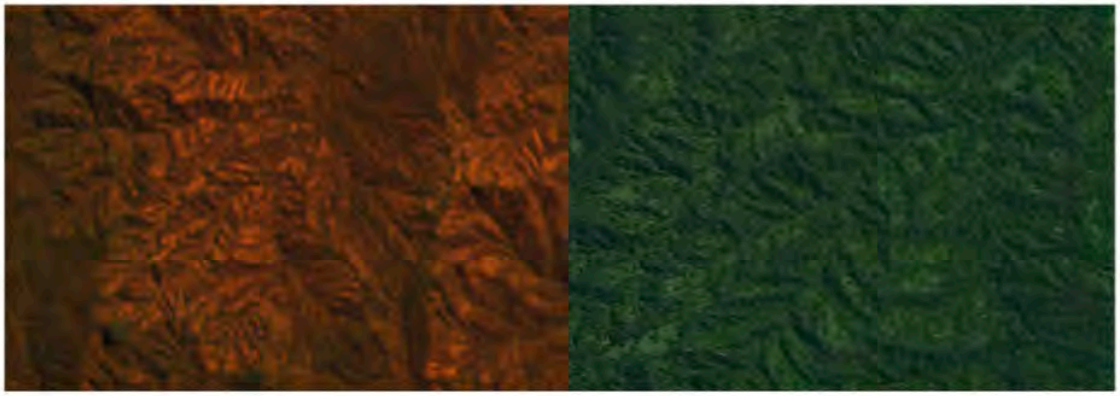


Figure 4

Severely degraded and fragmented landscape, Landsat view from ERDAS (RGB 4/5/3) against high resolution Google earth

Classification

Once training sites are selected, we performed a supervised classification using ERDAS IMAGINE 2011. Polygons are created at homogeneous area (training sites) and signatures are imported to the signature editor module. As many training sites are created as there are visible/evident land cover differences. For the time being, it is important to separate each spectrally different land cover type to avoid misclassification. We then have for one class many subclasses. For example, in a forest classes, we might have: Forest dark in western hillside, Forest light brown in eastern hillside, Forest brown degraded, Forest with glossy canopy, etc...

Several algorithms exist on how to classify images based on set of signature files, for instance:

- **Maximum Likelihood** The maximum likelihood decision rule is based on the probability that a pixel belongs to a particular class. The basic equation assumes that these probabilities are equal for all classes, and that the input bands have normal distributions.
- **Mahalanobis Distance** The Mahalanobis distance decision rule uses the covariance matrix in the equation. Variance and covariance are figured in so that clusters that are highly varied will lead to similarly varied classes, and vice versa.
- **Minimum Distance** The minimum distance decision rule (also called spectral distance) calculates the spectral distance between the measurement vector for the candidate pixel and the mean vector for each signature.

Based on experience, maximum likelihood is the most used and produces good result

After the classification is finished, we check the classified images by superimposing it to the Landsat unclassified images and comparing to it by flickering the screen (alternating view of original landsat and classified images) or setting transparency to one layer allowing us to see the classified images and the original at the same time. If there are errors, we restart the classification by adding new classes or replacing existing classes of signatures.

Statistics and a few analysis

Forest cover in the study areas are summarized in the table below. A sensible increase in forest loss is evident on from 2005-2010 timeframe. This may be explained by the proliferation of illegal rosewood extraction and the quasi-absence of the regulation due to political crisis.

Table 2 Forest cover and cloud cover

Year	Transfert management	Project area	RRD	RRL
Total area (ha)	340 144	372 495	1 210 091	978 365
forest 1995 (ha)	220 679	361 607	654 822	712 192
clouds 1995 (ha)	7	-	-	7
forest 2000 (ha)	217 201	360 677	644 527	705 890
clouds 2000 (ha)	72	18	193	110
forest 2005 (ha)	214 577	360 060	626 394	701 545
clouds 2005 (ha)	72	18	193	110
forest 2010 (ha)	210 107	358 045	608 669	693 155
clouds 2010 (ha)	153	61	2 163	273

For the computing of the rate of deforestation, only pixels that were not cloudy in the two date pair were considered, this to avoid miscalculation of rate due to clouds masking some forest area, making it appear as cover change while it might not be. Forest used as base for the calculation and the deforestation rate for each project subdivision is presented in the table below.

Table 3 Forest used as a base for the rate calculation and deforestation rate

Year	Transfer Management	Project area	RRD	RRL
Forest base 1995 (ha)	220 614	361 607	654 629	712 089
loss 1995-2000 (ha)	3 413	930	10 101	6 199
rate 1995-2000 (% per year)	0.31	0.05	0.31	0.17
Forest base 2000 (ha)	217 201	360 677	644 527	705 890
loss 2000-2005 (ha)	2 624	617	18 133	4 345
rate 2000-2005(% per year)	0.24	0.03	0.56	0.12
Forest base 2005 (ha)	214 431	360 060	624 231	701 279
loss 2005-2010 (ha)	4 324	1 951	15 562	8 125
rate 2005-2010 (% per year)	0.40	0.11	0.50	0.23

Validation

Accuracy assessments determine the quality of the information derived from remotely sensed data (Congalton and Green, 1999). Assessments can be either qualitative or quantitative. In qualitative assessments, we determine if a map "looks right" by comparing what we see in the imagery with what we see on the ground. This is not usually done in a rigorous way, but rather in a "quick and dirty" way. General accuracy is the goal in this case, and error and its sources are not as important. This is usually a first cut assessment. However quantitative assessments attempt to identify and measure remote sensing-based map error. In such assessments, we compare map data with reference or groundtruth data (where groundtruth data is assumed to be 100% correct).

To assess the accuracy of the produced map, a set of 250 points was distributed randomly across the reference area; using Hawths' tool for ArcGIS. Each points is then exported to the Google earth .kml format and checked what kind of cover it is falling in. those points are then compared with the result of the classification.

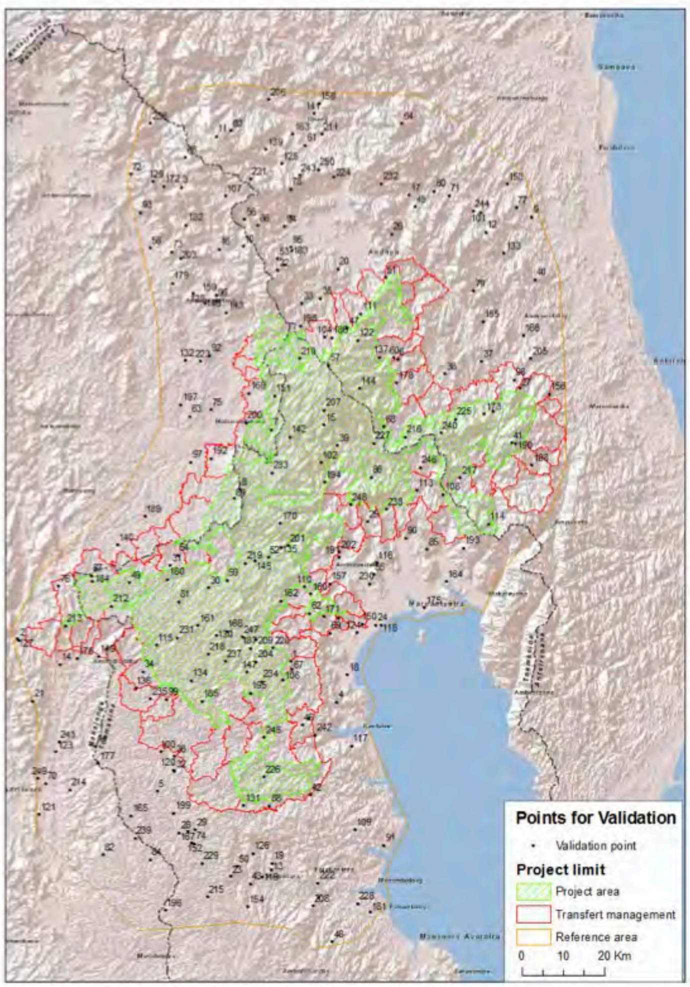


Figure 5 view of reference points in ArcMap

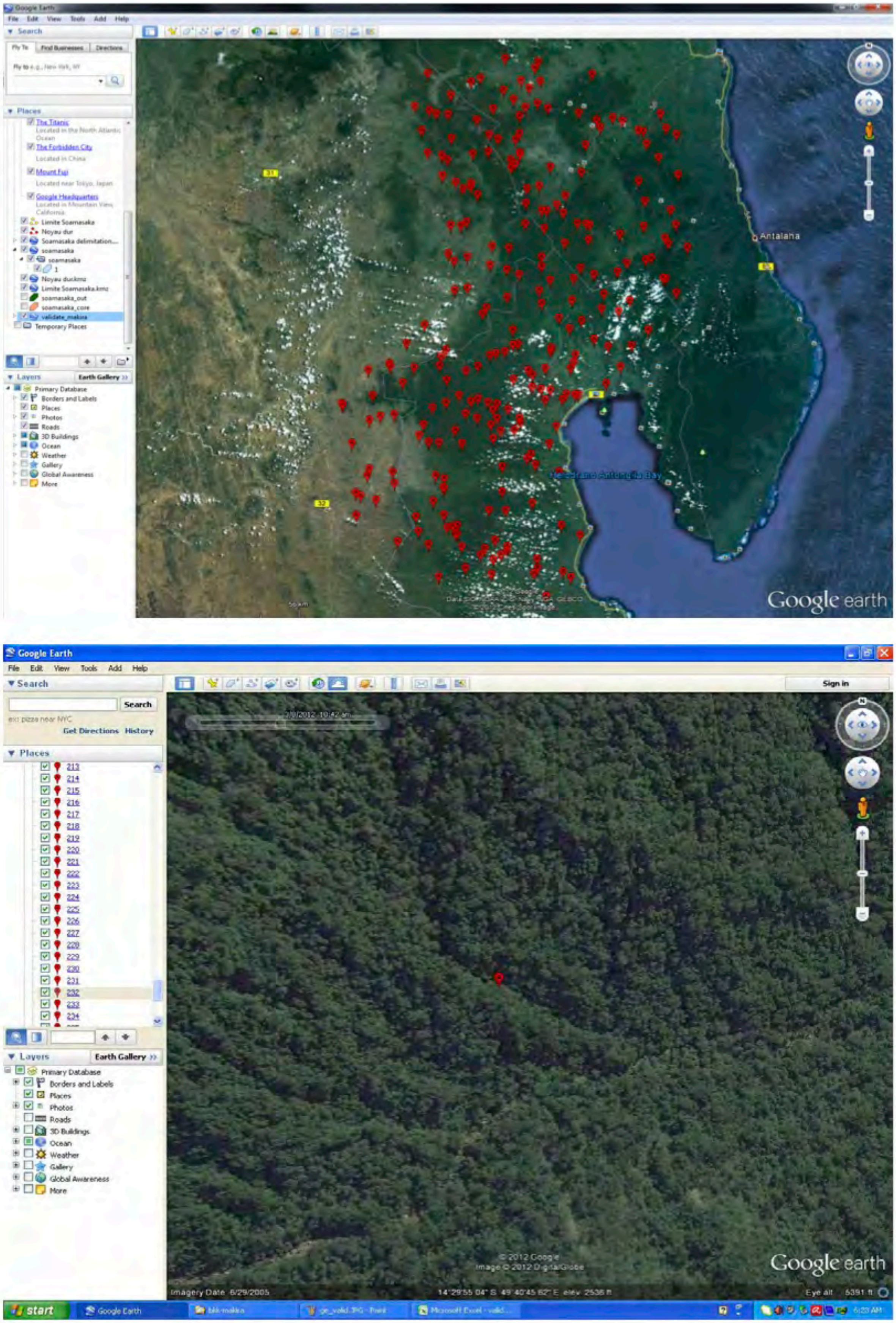


Figure 6 Validation points in Google Earth

Two types of precision/Error are computed:

- The user accuracy (Pu) showing percent of classified pixel that is correct in the field/reference. It is seen from the user's perspective : "If I select any forest pixel on the classified map, what is the probability that I'll be standing in a forest stand when I visit that pixel location in the field?". It can be computed with the formula:

$$P_u = \frac{number\ of\ pixels\ classified\ correctly}{number\ of\ reference\ pixels} \times 100$$

- The production accuracy (Pp) which is the percent of pixels from the field that are correctly represented on the map. It is seen from the producer's perspective: "If I know that a particular area is forest what is the probability that the digital map will correctly identify that pixel as forest?". it can be computed using the formula :

$$P_p = \frac{number\ of\ pixels\ classified\ correctly}{Total\ number\ of\ pixels\ classified} \times 100$$

From the 250 randomly crated, after all the checking on Google earth has finished, we removed all the points that had clouds either in Google or the classified maps, since clouds represent a moving entity and sure error on the matrix. We removed 10 such a points, leaving us with 240 reference points to validate the map.

The confusion matrix below summarizes all of the accuracy parameters for each class in the last cover maps (2010). The table shows that the overall accuracy of the map is 92.92% meaning that the map in general is accurate at around 93%

Table 4 Confusion matrix

		reference (google)			
		forest	non forest	total	**Users accuracy**
maps	Forest	**126**	13	139	**90.65**
	non forest	4	**97**	101	**96.04**
	total	130	110	**240**	
	producers accuracy	**96.92**	**88.18**		**92.92 (Overall accuracy)**

ANNEXES:

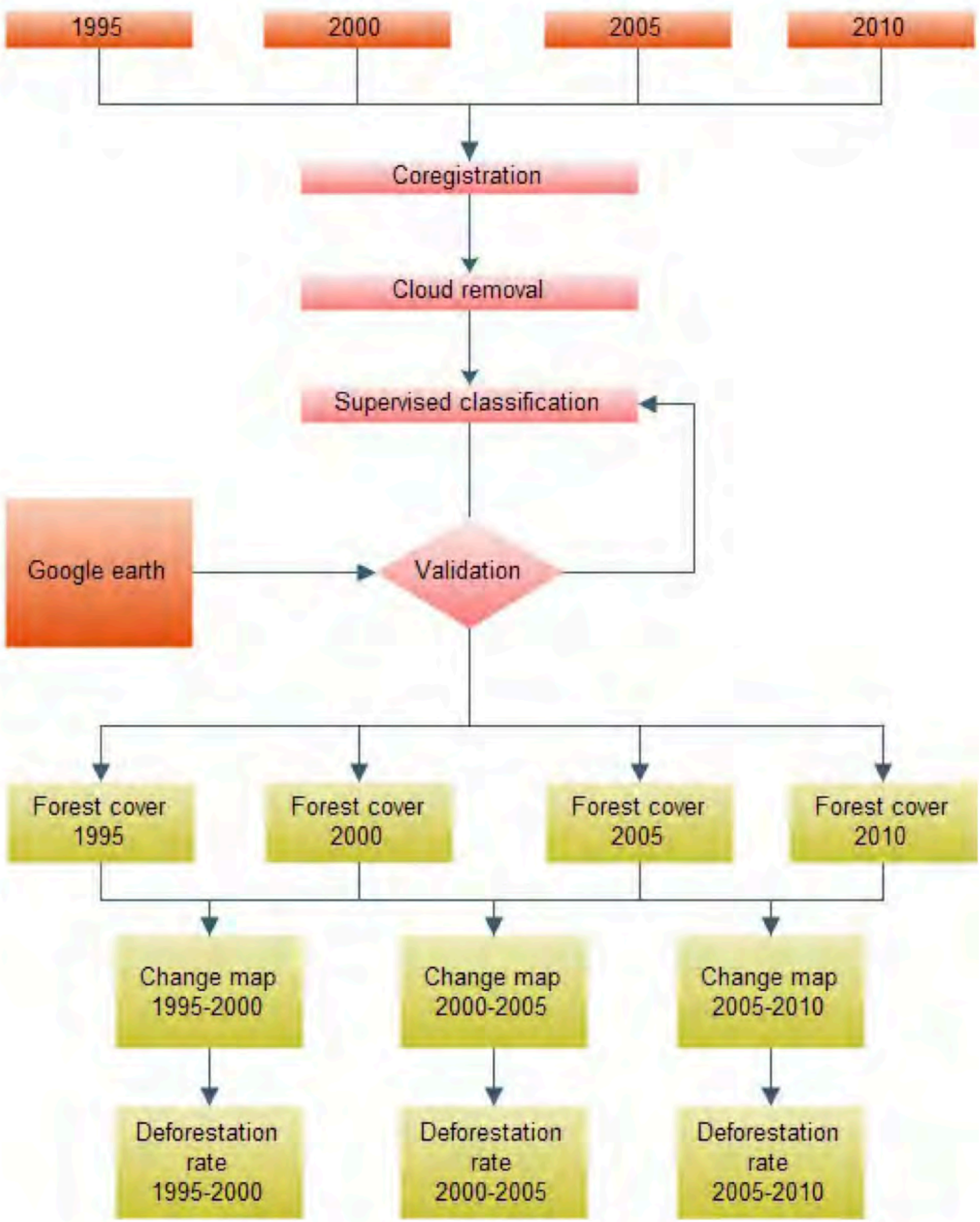
List of images used

Scene path	Scene row	Date	type	Percent clouds	Observation
158	070	**29 mar 1995**	Landsat 5 TM		
		21 nov 1994	Landsat 5 TM		
		22 aug 1996	Landsat 5 TM		Image used I n the CI land cover change analysis
158	071	**08 jan 1995**	Landsat 5 TM		
		24 jan 1995	Landsat 5 TM		
		21 nov. 1994	Landsat 5 TM		
		22 aug 1996	Landsat 5 TM		Image used in the CI land cover change
158	070	04 oct 2000	Landsat 5 TM		
		28 oct 2000	Landsat 7 ETM+		CI Used
		05 may 2000	Landsat 7 ETM+		
158	071	**22 mar 2001**	Landsat 5 TM		
		15 oct 2001	Landsat 7 ETM+		CI Used
158	070	16 may 2004	Landsat 7 ETM+		
		01 jun 2004	Landsat 7 ETM+		
		17 apr 2005	Landsat 7 ETM+		
158	071	16 may 2004	Landsat 7 ETM+		
		12 feb 2005	Landsat 7 ETM+		
		08 mar 2005	Landsat 5 TM		CI used

Scene path	Scene row	Date	type	Percent clouds	Observation
158	070	**09 may 2010**	Landsat 5 TM		
		01 may 2010	Landsat 7 ETM+		
		06 sep 2010	Landsat 7 ETM+		
158	071	**06 sep 2010**	Landsat 7 ETM+		
		01 may 2010	Landsat 7 ETM+		
		17 oct 2010	Landsat 5 TM		

Note: bold images are the one used as principal images, the other images have been used to fill gaps and fill clouds from the main image.

Analysis flowchart



Appendix XIIX

List of Management Transfers

Code	Data	Statut	Mois Ritualisation	Année Ritualisation	**Sup terroir (ha)**	**Foret 2005 (ha)**	**% foret**
10	Amponaomby	Operationnel	Novembre	2004	5'190.05	4'073.60	78.49
15	Marovovonana	Operationnel	Décembre	2004	5'095.09	3'668.69	72.00
16	Andaparaty	Operationnel	Décembre	2004	2'546.26	1'456.93	57.22
17	Ambodivoangy	Operationnel	Décembre	2004	2'842.82	2'152.22	75.71
19	Ambalamahogo	Operationnel	Décembre	2004	1'654.20	1'258.83	76.10
23	Andranovolo	Operationnel	Décembre	2004	6'626.36	6'254.08	94.38
25	Sahajinja Manonga	Operationnel	Décembre	2004	3'600.62	3'201.40	88.91
28	Ambinanindrano	Operationnel	Décembre	2004	5'109.19	4'354.47	85.23
30	Anjiahely	Operationnel	Décembre	2004	2'587.89	2'389.72	92.34
32	Besariaka	Operationnel	Novembre	2004	4'273.03	3'794.34	88.80
14	Anjiamazava	Operationnel	Septembre	2006	2'313.06	1'546.44	66.86
18	Ambalavanona	Operationnel	Octobre	2006	3'705.23	3'459.13	93.36
21	Ambohimarina	Operationnel	Octobre	2006	2'384.94	2'266.26	95.02
26	Vohimaro (Maevarivo)	Operationnel	Octobre	2006	5'852.81	5'574.80	95.25
9	Antanamangotroka	Operationnel	Janvier	2007	3'057.28	779.44	25.49
29	Soanafindra	Operationnel	Juillet	2008	550.81	328.31	59.61
33	Antseranana	Operationnel	Juillet	2008	4'426.89	3'456.29	78.07
5	Ambavala	Operationnel	Octobre	2009	1'805.31	1'008.81	55.88
6	Marojao	Operationnel	Octobre	2009	1'482.08	273.57	18.46
7	Anahamalemy	Operationnel	Octobre	2009	1'094.56	371.20	33.91
8	Andranomena	Operationnel	Octobre	2009	7'288.51	1'135.44	15.58
22	Andranonkazo	Operationnel	Octobre	2009	2'057.92	149.21	7.25
24	Ankijanilava	Operationnel	Octobre	2009	4'576.75	96.66	2.11
31	Andilambe	Operationnel	Septembre	2009	5'268.82	952.93	18.09
34	Soavera	Operationnel	Octobre	2009	4'316.37	1'253.30	29.04
1	Androaka	Operationnel	Mars	2010	3'074.24	2'138.74	69.57
2	Lohan'Androaka	Operationnel	Mars	2010	1'075.89	886.41	82.39
3	Tanambao Betsivakina	Operationnel	Mars	2010	2'258.89	765.38	33.88
4	Andatsakala	Operationnel	Mars	2010	3'542.39	1'420.71	40.11
11	Antsahamilemaka	Operationnel	Novembre	2010	6'123.49	1'374.25	22.44
12	Marofototra	Operationnel	Novembre	2010	6'802.15	4'316.62	63.46
13	Beravintsara	Operationnel	Novembre	2010	3'581.93	2'905.50	81.12
20	Ambalavoahangy	Operationnel	Novembre	2010	3'864.78	910.94	23.57
27	Tanambao Ambahy	Operationnel	Novembre	2010	4'453.50	2'638.43	59.24
35	Antananivo	Operationnel	Septembre	2010	6'313.02	1'967.84	31.17
36	Ambalasoa	Operationnel	Septembre	2010	2'021.91	704.95	34.87
37	Ambalarivo	Operationnel	Septembre	2010	3'703.59	658.25	17.77
38	Ankorakabe	Operationnel	Septembre	2010	5'066.11	1'001.34	19.77
39	Anivorano	Operationnel	Mars	2010	1'446.71	1'304.55	90.17
40	Besira	Operationnel	Novembre	2010	1'620.46	890.06	54.93
41	Amparihimena	Operationnel	Novembre	2010	3'530.74	2'329.86	65.99
42	Antsahantitra	Operationnel	Novembre	2010	8'707.82	7'276.14	83.56
Total					**156'894.47**	**88'746.03**	**56.60**

Appendix XIX

Workers Safety Implementation Plan

Implementation plan

These measures will be implemented as indicated in the following operational plan

POTENTIAL RISKS / PROBLEMS										Timing											
										2012						2013					
Objectif 1. Minimize risks of fall or fracture during a trip		Unit	need / year	Available	Description	Qty	Unit price	Total	Budget	J	A	S	O	N	D	J	F	M	A	M	J
	Activity: Agents will be equipped with **boots** to protect their feet during the trip.	paires	15		boots for 15 field agents	15	213	3 195	Banque Mondiale, WCS												
Objective 2. Ease agent difficulties in case of																					
	Activity 1: Provide the staff with **first aid kit** for emergency care to victim before carrying him to the hospital.	kit	6		One kit per sector. There will be 3 teams of 5 people.	6	102	612	WCS												
	Activity 2: **Train** staff annually on first aid technique	sessions	2		Initial trainaing and retraining. Input from concultants	2	500	1 000	WCS												
	Activity 3: Agents move at least in pairs and will be accompanied by at least one member of the local population to escort and help carry their luggage during their field mission				This is always the case during missions in unknown field. Local guide are indemnified by day.			-													
								-													
Objective 3. Improve communication system								-													
	Activity : Install a communication station by sector; each will be equipped with a **BLU and satellite phone**							-													
	BLU	unité	5	1	To be installed in the offices of four sectors where there are no mobile phone network. Maroantsetra, Andapa and Mandritsara operate with mobile phones. One BLU is available in Maroantsetra to ensure communication with those sites.	4	2 900	11 600	WCS/TBF												
	Satellite phone	Unité	4	2	Two satellite phones are availaible but the contract with the operators to be renewed	3	1 875	5 625	WCS/TBF												
								-													
Objective 4. Reduce agent difficulties / problems in case								-													
	Activity 1: Train all staff on the technical navigation with a compass and a GPS.				Will be done by senior staff when the equipment are available			-													
	Activity 2: Equip all staff on navigation							-													
	GPS	unité	66		For the team and the community members in charge of terrestrial patrols.	66	500	33 000	Banque Mondiale												
	compass	unité	15		For the three teams composed by 5 people each	15	189	2 835	Banque Mondiale												
	lamp	unité	15		For the three teams composed by 5 people each	15	60	900	Banque Mondiale												
	Activity 3: A local **guide** should come with staff working in the forest				All agents during mission in unknown field are accompanied with a local guide that are daily paid.			-													
								-													
Objective 5. Cyclones, river flood.								-													
	Activity 1: All employees should stay in a							-													
	Activity 2: Equip a canoe and safety package (**life jackets**) on big rivers all across the runway							-													
	canoe	unité	1	1	Metallic Pirogue in good condition available			-													
	life jacket	unité	14	14	Already acquired in 2012			-													
	rope	mètres	10	10	Available			-													
								-													
Objective 6. Bite of venomous animals								-													
	Activity 1: Complete the first aid kit of **medicines** to ease pain from venomous substances				Produits à mettre dans le kit de first aid			-													
	Activity 2: Strengthen the annual training of first aid on healing technique against the bite of venomous animals				To be combined with the first aid kit training (Obj 2. Activity 2)			-													
								-													
Objective 7. Measures taken toward the lack of drinking								-													
	Activity 1: Equip all staff with a **water filter**	unité	6		One water filter for each sector	6	500	3 000	WCS												
	Activity 2: Provide staff with **water purifiers**	unité	15			15	46	690	WCS												
	Activity 3: Agents should get **vaccinated** against Tuberculosis	vaccins	25		Normally vaccination was done during childhood but plan vaccination for 25 people.	25		-	WCS												
	Activity 4: Complete first aid kit of **medicines**							-													
	medicines for emergency treatment of	Box of 100	15		Only available on prescription	15	19	285	WCS												
	medicines for emergency treatment of [illegible]	unité	15		Serum for cleaning injury lesion	15	8	120	WCS												
								-													
Objective 8. Prevention against risk related with the								-													
	Activity : Staff does not travel/go alone but always accompanied by another person				The principle is adopted. All agents will be accompnied with a guide.			-													

Appendix XX

Makira Carbon Company Agreement

AGREEMENT

This AGREEMENT (this "Agreement"), is made and entered into as of this ____ day of March 2012 by and between the REPUBLIC OF MADAGASCAR (hereinafter, the "State"), acting through its MINISTRY OF ENVIRONMENT AND FORESTS (such ministry or any successor ministry for the environment authorized by the State in the future, hereinafter is referred to as the "Ministry"), and MAKIRA CARBON COMPANY LLC, a Delaware limited liability company (the "Company") (the State and the Company hereinafter sometimes are referred to individually as a "Party" and together as the "Parties");

WITNESSETH:

WHEREAS, the State holds title to approximately 380,000 hectares of land (the "Land") in the Makira region in northeastern Madagascar which is covered by a tropical rain forest commonly called the Makira Forest (the "Makira Forest");

WHEREAS, President Marc Ravalomanana announced a plan in September 2003, known as the "Durban Vision," at the International Union for the Conservation of Nature 5th World Parks Congress in Durban, South Africa, to increase Madagascar's protected habitats from 1.7 to 6 million hectares by 2008, and the protection of the Makira Forest is a key component of the Durban Vision and of implementing the third phase of the State's National Environmental Action Plan (known as "EP3"), which is supported by bilateral donors, international organizations (including the International Development Agency of the World Bank and the United Nations Development Programme) and non-governmental organizations, including the Wildlife Conservation Society, a New York not-for-profit corporation ("WCS");

WHEREAS, the goals and objectives of EP3 have now been enshrined as "Commitment 7: Cherish the Environment" of the Madagascar Action Plan ("MAP"), which spans the years 2007 through 2012 and which outlines priority projects and activities including those to promote forest conservation and reduce forest degradation;

WHEREAS, Madagascar ratified the Kyoto Protocol in September 2003. To insure the effective implementation of this treaty, the country has a permanent structure within the Ministry of Environment and Forests: the Designated National Authority, which is in charge of issues relating to the regulated and voluntary carbon markets, the Clean Development Mechanisms (CDM), and REDD +; The Designated National Authority represents the Ministry in the drafting, negotiation, and approval of carbon purchase contracts, monitoring the implementation of projects as well as in the assessment and promotion of carbon markets in Madagascar;

WHEREAS, the Ministry and WCS have collaborated since 2003 on a project to manage the Land and the Makira Forest for the long term to conserve the biodiversity and assure the sustainable use of natural resources of the Land and the Makira Forest (the "Makira Forest Project"), pursuant to which the Land and the Makira Forest were designated permanent Protected Area status under Malagasy law on 30 December 2011 (the "Makira Natural Park");

WHEREAS, WCS has been designated as the manager of the Makira Natural Park pursuant to Management Delegation Agreement (the "Management Delegation Agreement") dated [DATE] between the Ministry and WCS;

WHEREAS, in light of the MAP objectives, the Ministry and WCS are now conducting and intend to continue to conduct Makira Forest Project activities pursuant to the Management Delegation Agreement to conserve the Makira Natural Park and the biodiversity and ecosystem service functions therein, including activities to avoid deforestation and restore degraded lands in the Makira Forest that, inter alia, will avoid the release of carbon dioxide ("CO_2") into the atmosphere by retaining in the Makira Forest carbon currently stored in the Makira Forest – commonly measured by reference to equivalent amounts of CO_2 (referred to as "carbon dioxide equivalents" or "CO_2 equivalents") the release of which is avoided – and in turn support the creation of CO_2 emission offsets linked to the conservation of the Makira Forest (hereinafter the "Makira Emission Offsets") and thereby reduce CO_2 emissions that would otherwise occur without such forest conservation activities;

WHEREAS, the Ministry intends that Makira Emission Offsets will be denominated in units each of which will represent one metric ton of CO_2 equivalent, and the Ministry anticipates that, over the entire period from 2005 to 2035, the conservation of the Makira Forest will avoid the emission of up to approximately 35 million metric tons of CO_2 equivalents (or such other amount as may be determined by third party verification) and that the Makira Natural Park thereby will enable the State to sell up to approximately 35 million tons (or such other amount as may be determined by third party verification) of Makira Emission Offsets supported by the carbon stored in the Makira Forest, over such entire period;

WHEREAS, under the auspices of a workshop held in February 2003, the Ministry and WCS established a set of goals for the Makira Forest Project aimed at enabling the State to designate permanently the Land and the Makira Forest as a Protected Area, which included, in accordance with the MAP objectives, identifying and developing a mechanism for sustainable financing to support the protection and conservation of the Land and Makira Forest going forward;

WHEREAS, the sale of Makira Emission Offsets constitutes a source of payment for ecosystem services that would provide sustainable environmental financing to manage and conserve the Makira Forest as well as support alternative livelihoods for local communities in and around the Makira Forest, both of which are important to maintaining the permanent designation of the Land and the Makira Forest as a Natural Park;

WHEREAS, the Company is a non-profit carbon offset broker, established by WCS for the purpose of furthering conservation of the Makira Forest and the biodiversity therein through the marketing and sale, on a non-profit basis by the Company, of Makira Emission Offsets to the public and the education of the public on the conservation of the Makira Forest and the biodiversity therein, the benefits of carbon dioxide emissions reduction and the use of CO_2 offsets;

WHEREAS, because of its positive history of working in collaboration with WCS on conservation of the Makira Forest and the biodiversity therein and because of the Company's ability to market, on a non-profit basis, Makira Emission Offsets to achieve conservation and educational goals, the State and WCS entered into an agreement on 11 June 2008 (the "2008 Agreement") appointing the Company as the State's exclusive agent for the sale on behalf of the State of at least 35 million metric tons (or such other amount as may be determined by third party verification) of Makira Emission Offsets (the "Allocated Makira Emission Offsets") to be supported by a corresponding amount of CO_2 emission reductions in the Makira Natural Park;

WHEREAS, the Company and the State desire to enter into a new agreement on similar terms as the 2008 Agreement, whereby the Company shall serve as the State's exclusive agent for the sale on behalf of the State of the Allocated Makira Emission Offsets during the term of this Agreement, subject to the terms and conditions of this Agreement;

WHEREAS, the State intends to have the Net Proceeds (as defined in Section 2.07 below) from sales of Allocated Makira Emission Offsets allocated in the following manner: (i) 50% to support local communities in and around the Makira Natural Park who have engaged in forest resource management contracts with the State and thus in the co-management of the Makira Natural Park as defined in the Management Delegation Agreement 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 Natural Park; allocation of the 50% of Net Proceeds will follow the recommendations of the delegated manager of the Makira Natural Park and will be determined by a steering committee within the Designated Foundation in consultation and collaboration with the delegated manager of the Makira Natural Park; (ii) 20% to the delegated manager of the Makira Natural Park to support the management of the Makira Natural Park pursuant to the Management Delegation Agreement or such other applicable agreement, as the case may be, (iii) 20% to the Ministry, to support a range of activities including ensuring its contribution to the management of the Makira Natural Park and its protection zone, strengthening its capacity for climate change mitigation and adaptation, supporting the development [and] the implementation of the national action plan for mitigation and adaptation, and supporting the assessment, promotion and monitoring of carbon projects , (iv) up to 5% to the Company to reimburse it 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% to the delegated manager of the Makira Natural Park as needed to pay for third party monitoring, verification and certification of Allocated Makira Emission Offsets, 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 Tany Meva Foundation which is hereby designated by the State (the "Designated Foundation") for its overhead costs in association with the management and disbursement of funds made available under this Agreement;

WHEREAS, it is the intention of the Parties that this Agreement will be presented and approved or ratified by Decree in a Council of the government of Madagascar (the "Government").

NOW, THEREFORE, in consideration of the premises and for other good and valuable consideration, the receipt and sufficiency of which are hereby acknowledged, the State and the Company hereby agree as follows:

Article I
Appointment of Designated Representative; Appointment of Exclusive Agent

1.01 The State hereby appoints the Secretary General of the Ministry as the designated representative of the State (the "Designated Representative") empowered by the State to consult with the Company on all matters on which the State and the Company may wish to consult under this Agreement and to convey to the Company the views, positions and decisions of the State regarding such matters. The Secretary General must be accompanied by a representative from the Designated National Authority in the [abovementioned] consultation, communication and decision-making process.

1.02 The State hereby appoints the Company as exclusive agent of the State for the sale of the Allocated Makira Emission Offsets, in each case subject to the terms and conditions of this Agreement for the term as set forth in Section 5.05.

Article II
Covenants of the Company

2.01 The Company shall have the authority as the State's agent to act as an intermediary for the State in identifying, approaching and conducting preliminary negotiations with potential purchasers, carbon offset brokers and other similar entities interested in the marketing and sale of Allocated Makira Emission Offsets in the global carbon market, subject to obtaining the approval of the State for any such transaction, as set forth in Section 2.02. The Company also shall have the authority to engage one or more agents to assist the Company in carrying out its responsibilities under this Agreement, including with respect to monitoring, verification, certification and registration of Allocated Makira Emission Offsets.

2.02 The Company shall consult with, advise and provide training to the Designated Representative (with respect to training, as mutually agreed upon) (i) on the terms on which, including price(s), and (ii) on the other parties to which and through which, including brokers and other agents, Allocated Makira Emission Offsets may be offered for sale in the global carbon markets on behalf of the State, including whether the transaction contemplates resales or final retirement of existing Allocated Makira Emission Offsets or forward sales of offsets that correspond to CO_2 equivalents that will be generated and can only be retired in future years. The Company shall obtain the approval of the State through the Designated Representative on the terms of any sale of Allocated Makira Emission Offsets and of the other parties to which and through which, including brokers and other agents, any such sale shall be carried out, which approval shall be evidenced by the State's written notice to such effect delivered to the Company by the Designated Representative within 10 business days following consultation with the Company on the proposed transaction or such other time as the Designated Representative and the Company may agree in writing. If, following such 10 business day period or such other time as the Designated Representative and the Company may agree in writing, the Company receives no written notice from the State, the sale shall be deemed approved on the terms and with the parties presented by the Company to the State.

2.03 The Company shall not become or be deemed to be the owner of any Allocated Makira Emission Offset as a result of its agency activities performed under this Agreement.

2.04 The Company agrees to use commercially reasonable efforts to promote the sale of the Allocated Makira Emission Offsets on behalf of the State in the global carbon market during the term of this Agreement. Upon notification by the State, the Allocated Makira Emission Offsets can be transferred by the Company to a purchaser for its use in whatever way, consistent with applicable law, the purchaser chooses subject to the approval process set out in Section 2.02.

2.05 The Company shall cause to be maintained a registry relating to the Allocated Makira Emission Offsets (the "Registry") which shall contain, amongst other things, (i) the name of each purchaser of Allocated Makira Emission Offsets, (ii) the Allocated Makira Emission Offsets purchased by each such purchaser (expressed in metric tons of Allocated Makira Emission Offsets generated during a designated time period), (iii) the period in which the offsets were generated, (iv) the price paid by each purchaser for the purchase of Allocated Makira Emission Offsets, and (v) a copy of the purchase agreement relating to each purchase of Allocated Makira Emission Offsets. The Registry may be maintained by a third party agent. The Company shall select such third party agent, subject to the right of the State to disapprove of the selection of that third party by the Company, such disapproval to be evidenced by its written notice to such effect delivered to the Company within 10 business days of the State's receipt of written notice of the proposed engagement of such third party. If the State so disapproves, the Company shall not engage such third party but, in collaboration with the Designated National Authority, find and select another suitable third party to carry out registry functions. The Registry shall be made available to the State for inspection and copying from time to time upon request.

2.06 The delegated manager of the Makira Natural Park hereby agrees to engage an independent third party (the "Monitor") to verify, measure and certify the Allocated Makira Emission Offsets based on project design standards developed by the Climate, Community and Biodiversity Alliance (the "CCB Standards"), the Voluntary Carbon Standards (the "VCS Standards") or such other standards accepted by the carbon market for their rigor and performance requirements, assuring the delivery of high quality CO_2 offsets, including delivery of climate change mitigation, biodiversity conservation and local community benefits. The engagement of the Monitor by the delegated manager of the Makira Natural Park is subject to the right of the State to disapprove of the selection of that third party such disapproval to be evidenced by its written notice to such effect delivered to the delegated manager of the Makira Natural Park within 10 [business] days of the State's receipt of written notice of the proposed engagement of the Monitor. If the State so disapproves, the delegated manager of the Makira Natural Park shall not engage the Monitor but find an alternative institution (subject to the same right of disapproval in the State) approved to certify against CCB Standards the VCS Standards or comparable standards. The delegated manager of the Makira Natural Park also shall cause the Monitor to develop a protocol for on-going monitoring during the term of this Agreement to verify Allocated Makira Emission Offsets generated by the Makira Natural Park during specified time periods. The delegated manager of the Makira Natural Park shall deliver to the State promptly a copy of all reports and other communications received by the Company from the Monitor during the term of this Agreement. In accordance with Section 2.04 below, up to 2.5% of the Net

Proceeds from sales of Allocated Makira Emission Offsets will be allocated to pay for monitoring, verification and certification services by the Monitor.

2.07 In this Agreement, "Net Proceeds" means all proceeds received by the State's broker(s) or other agent(s) during any calendar quarter (or other period) from the sale to purchasers in the global carbon market of Allocated Makira Emission Offsets, less any amounts due to any such broker(s) or other agent(s), pursuant to agreements therewith, in connection with such distribution and sales for such period. Without undue delay and, to the extent feasible, not later than 15 days after the end of each calendar quarter (or other period as set forth in purchase agreements for Allocated Makira Omission Offsets) during the term of this Agreement, the Company or its agent(s) shall remit or cause to be remitted by the State's broker(s) or other agent(s) such Net Proceeds as follows:

207.1 First, (a) 20% of such Net Proceeds to the Ministry to support including ensuring its contribution to the management of the Makira Protected Area and its protection zone, strengthening its capacity for climate change mitigation and adaptation, supporting the development and implementation of the national action plan for mitigation and adaptation, and supporting the assessment, promotion and monitoring of carbon projects , (b) 20% of such Net Proceeds to the delegated manager of the Makira Natural Park to support the management of the Makira Natural Park pursuant to the Management Delegation Agreement or such other applicable agreement, as the case may be, (c) up to 5% of such Net Proceeds to the Company to reimburse the Company for expenses incurred in connection with the marketing and sale of Allocated Makira Emission Offsets under this Agreement (and the management of such marketing and sale), and (d) up to 2.5% of such Net Proceeds to the delegated manager of the Makira Natural Park as needed to pay the Monitor for its monitoring, verification and certification of Allocated Makira Emission Offsets.

207.2 Further, the Company will transfer any portion of its 5% of the Net Proceeds not so expended to cover its expenses and the delegated manager of the Makira Natural Park any portion of the 2.5% of Net Proceeds not expended to pay the Monitor for its services to the Designated Foundation to be allocated as provided in Sections 2.07.4(a) or (b) below, in the discretion of the Designated Foundation.

207.3 Second and at the same time, the Company or its agent(s) shall remit or cause to be remitted by the State's broker(s) or other agent(s) to the Designated Foundation the remainder of such Net Proceeds from sales of Allocated Makira Emission Offsets in such quarter (or other period), to be distributed by the Designated Foundation as provided hereafter. The terms and provisions applicable to the disbursement of such funds by the Designated Foundation are expected to be set forth in a separate agreement by and among the Company, the State, via the Ministry of Environment and Forests, the Designated Foundation and the delegated manager of the Makira Protected Area. Notwithstanding the foregoing, the Company may engage in sales of Allocated Makira Emission Offsets to the full extent provided under this Agreement prior to the execution of such agreement provided that the Net Proceeds of such sales otherwise payable to the Designated Foundation shall be held by the Company in a separate escrow account for the benefit of the Designated Foundation until such time the parties to such other agreement have executed the same. The Company will disburse such Net Proceeds held in escrow as set forth in Articles 2.07.1, 207.2 and 207.4 of this Agreement.

2.07.4 The Parties agree that the Net Proceeds held in escrow will be distributed, whether at the direction of the Company, the State or the Designated Foundation, upon its appointment, in accordance with the following allocations: (a) 50% of the Net Proceeds to support local communities in and around the Makira Natural Park who have engaged in forest resource management contracts with the State and thus in the co-management of the Makira Natural Park as defined in the Management Delegation Agreement 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 Natural Park; allocation of the 50% of Net Proceeds [referred to in (a)] will follow the recommendations of the delegated manager of the Makira Natural Park and will be determined by a steering committee within the Designated Foundation in consultation and collaboration with the delegated manager of the Makira Natural Park, and (b) up to 2.5% of the Net Proceeds to the Designated Foundation for its overhead costs in association with the management and disbursement of funds made available under this Agreement; .

2.07.5 For avoidance of doubt, the Parties note that (a) the Ministry already will have received 20% of such Net Proceeds to support activities as outlined above, and (b) the delegated manager of the Makira Natural Park already will have received 20% of such Net Proceeds to support the management of the Makira Natural Park pursuant to the Management Delegation Agreement or such other applicable agreement, as the case may be and (c) the Company already will have received up to 5% of such Net Proceeds to reimburse the Company for expenses incurred in connection with the marketing and sale of Allocated Makira Emission Offsets under this Agreement (and the management of such marketing and sale), and (c) the delegated manager of the Makira Natural Park already will have received up to 2.5% of such Net Proceeds as needed to pay the Monitor for its monitoring, verification and certification of Allocated Makira Emission Offsets.

Moreover, as noted above, the Company will transfer any portion of its 5% of the Net Proceeds not so expended to cover its expenses and the delegated manager of the Makira Natural Park any portion of the 2.5% of the Net Proceeds not so expended to pay the Monitor for its services to the Designated Foundation to be allocated as provided in Sections 2.04.4(a) or 2.04.4(b), above.

2.08 The Company agrees, to apportion a certain quantity of Allocated Makira Emission Offsets per year towards a contingency pool to cover possible forest losses due to natural disasters, fire, deforestation or other causes and that such apportionment shall set a minimum and maximum quantity in accordance with VCS Standards and risk assessment procedures to be determined within its exclusive discretion based on advice from the Monitor.

Article III
Covenants of the State

3.01 The State hereby grants to the Company the exclusive right to market, sell, distribute, promote, advertise or otherwise deal with the Allocated Makira Emission Offsets during the term of this Agreement subject to consultation as set forth in Section 2.02. The State shall pay the Company, or cause the Company to be paid, up to 5% of the Net Proceeds from sales of Allocated Makira Emission Offsets to reimburse the Company for expenses incurred in connection with the marketing and sale thereof (and the management of such marketing and sale), as set out in more detail in Section 2.07 above.

3.02 The State agrees that, during the term of this Agreement, except pursuant to transactions for which the Company has acted as intermediary as provided in this Agreement, the State will not directly market, sell, distribute, promote, advertise or otherwise deal with the Allocated Makira Emission Offsets and that it will not enter into any agreement with any party (other than the Company) which confers upon such party any rights to market, sell, distribute, promote, advertise or otherwise deal with the Allocated Makira Emission Offsets.

3.03 The State hereby agrees with the Company that the Ministry will manage, and will cooperate with WCS to manage, the Land and the Makira Forest in and through the Makira Natural Park, as agreed in the Management Delegation Agreement or such other applicable agreement, as the case may be, to maintain and sequester in the Makira Forest, for the term of this Agreement, the carbon necessary to support the Allocated Makira Emission Offsets, including by reforestation and/or afforestation activities in the event of any loss by fire or other event that damages or destroys, in whole or in part, the Makira Forest.

3.04 The State agrees it will cause the appropriate ministry or authority to:

(a) Cause the seal of the State to be affixed to certificates and other instruments representing the Allocated Makira Emission Offsets sold to purchasers in the global carbon market during the term of this Agreement, upon request of the Company;

(b) Support, upon request by the Company and only to the extent appropriate under Malagasy law, the application by the Company for exemption from all direct or indirect taxes (including VAT and sales tax), if any, and all applicable fees, if any, that may be incurred as a result of the Company's activities under this Agreement;

(c) Execute, acknowledge and deliver, or cause to be done, executed, acknowledged and delivered, all and every such further acts, conveyances, transfers, assignments, powers of attorney and assurances as reasonably may be required more effectively to convey, transfer to and vest in any purchaser title to the Allocated Makira Emission Offsets; and

(d) Notify, consult and collaborate with the Company in the event the State seeks to develop a national registry or other regulatory or market structures for CO_2 emission (or other "Green House Gas" emission) rights or credits that may affect the Company's responsibilities and rights hereunder. 3.05

The State hereby waives any right of sovereign immunity as to it and its property in respect of the enforcement and execution of any award rendered by an arbitral tribunal constituted pursuant to this Agreement.

3.06 The State agrees to approve or ratify the Agreement by Decree in a Council of the Government.

Article IV
Representations and Warranties

4.01 The State hereby represents and warrants to the Company that the State is the sole and exclusive owner of the Allocated Makira Emission Offsets, that the State has the power and authority to execute and deliver this Agreement and to perform its obligations hereunder, that such execution, delivery and performance have been duly authorized by all necessary actions on the part of the State, that this Agreement has been duly and validly executed and delivered by the State, and that this Agreement constitutes a legal, valid and binding obligation of the State, enforceable against the State in accordance with its terms.

4.02 The Company hereby represents and warrants to the State that the Company has the power and authority to execute and deliver this Agreement and to perform its obligations hereunder, that such execution, delivery and performance have been duly authorized by all necessary action on the part of the Company, that this Agreement has been duly and validly executed and delivered by the Company, and that this Agreement constitutes a legal, valid and binding obligation of the Company, enforceable against the Company in accordance with its terms.

Article V
Term; Termination of this Agreement

5.01 Subject to earlier termination as provided below, the agency conferred upon the Company pursuant to this Agreement shall commence on the date hereof and continue thereafter for an initial term ending at the close of business on December 31, 2020, it being understood and agreed that the term of the agency conferred upon the Company pursuant to this Agreement shall renew for successive terms of five years each, according to and following the assessment of results by the State, commencing on the expiration of the initial term or any such successive term, unless the Company or the State notifies the other Party of its intention not to renew the term of such agency not less than 90 days prior to the expiration of the initial term or any successive term. The State or the Company, as the case may be, may terminate the agency conferred upon the Company pursuant to this Agreement earlier for material breach of any provision of this Agreement by the other Party by giving not less than 45 days' written notice of such material breach to the other Party, unless such other Party has cured the material breach to the reasonable satisfaction of the non-breaching Party within 30 days of its receipt of notice of such material breach from the non-breaching Party.

5.02 Neither the State nor the Company shall be deemed to be in material breach of any provision of this Agreement, or otherwise be liable to the other Party, by reason of any delay in the performance or non-performance of any of its obligations pursuant to this Agreement to the extent any such delay or non-performance is due to any circumstance beyond the reasonable control of such Party, provided that such Party promptly notifies the other Party of the circumstance beyond its reasonable control and, provided, further, that if such circumstance remains in effect for a continuous period of six months either Party shall have the right to terminate this Agreement on 30 days notice to the other Party.

Article VI
Miscellaneous

6.01 The Parties agree that Allocated Makira Emission Offsets shall be sold or retired in accordance with the measured and certified quantity for a given year determined by the Monitor (as defined in Section 2.06). Once the Allocated Makira Emission Offsets for any one year have been measured, verified and certified, the quantity of Allocated Makira Emission Offsets for that year shall not thereafter be changed. The Parties intend that there shall be no "double counting" of Allocated Makira Emission Offsets or of the established yearly amount thereof, and the Parties agree to work together to assure that no such "double counting" occurs.

6.02 This Agreement and the other agreements referred to herein contain the entire agreement between the Parties relating to the subject matter hereof and thereof and supersede all previous agreements between such Parties with respect to the subject matter hereof or thereof, as well as that certain letter dated May 16, 2007 sent by the Ministry to WCS regarding carbon offsets and the Makira Forest Project (and WCS is a third party beneficiary of this Agreement for the purposes of this sentence). This Agreement may not be amended except by a written agreement signed by the State and the Company. To be effective, any waiver of any provision of this Agreement must be in writing and signed by the Party against whom enforcement is sought.

6.03 Each of the State and the Company agrees to execute and deliver such additional instruments and agreements and to take such other actions as the other party may reasonably request from time to time to carry out, comply with and effectuate the terms and provisions of this Agreement. The Parties agree that wherever "including" appears in this Agreement, it means "including without limitation."

6.04 This Agreement shall be governed by, construed and enforced in accordance with the laws of the Republic of Madagascar, without regard to the choice of law provisions thereof.

6.05 In the event of any claim, counterclaim, dispute or other matter in question between the Parties arising out of, or relating to, this Agreement, the Parties shall first seek to resolve the matter in question through informal discussions. In the event any matter in question cannot be resolved between the Parties informally within 60 days, the Parties agree that such matter shall be submitted to binding arbitration administered by the International Centre for Settlement of Investment Disputes in accordance with its Convention, Regulations and Rules [and in accordance with the applicable Malagasy law].

6.06 Each of the State and the Company agrees to indemnify, defend and hold the other Party harmless from and against any and all claims, causes of action, liabilities or expenses suffered or incurred by such other Party as a result of any material breach by the State or the Company, as the case may be, of any of the provisions of this Agreement.

6.07 Neither the State nor the Company may assign any of its rights or obligations under this Agreement, except as contemplated by Sections 2.01and 2.02 hereof, without the prior written consent of the other Party.

6.08 This Agreement may be executed in one or more counterparts. If any provision of this Agreement is held to be invalid or unenforceable in any jurisdiction, the other provisions of this Agreement will remain in full force and effect.

6.09 Any notice or other communication relating to this Agreement shall be in writing, in the French language and shall be deemed given for all purposes of this Agreement upon delivery to the addressee personally, via overnight courier or mail, or facsimile (with evidence of receipt) addressed as follows:

Makira Carbon Company LLC
Address: 1133 Avenue of the Americas, Room 2200
New York, New York 10036, USA
Tel: + 1 212-336-2000
Fax: + 1 212-336-2222
Attention:

With a copy to:

Wildlife Conservation Society
2300 Southern Boulevard
Bronx, New York 10460
USA
Tel: + 1 718-220-5962
Fax: + 1 718-220-2573
Attention: Christopher J. McKenzie
General Counsel

Ministry of Environment and Forests (Ministère de l'Environnement et des Forêts)

Address:
Tel:
Fax:
Attention:

6.10 Nothing in this Agreement, express or implied, is intended or shall be construed to create any joint venture or partnership between the Company and the State or to confer upon or give to any person, firm or corporation other than the Parties hereto (and WCS with respect to the first sentence of Section 6.02) and their successors and assigns, any remedy or claim under or by reason of this instrument or any term, covenant or condition hereof, and all the terms, covenants and conditions, and agreements contained in this instrument shall be for the sole and exclusive benefit of the Parties hereto (and WCS with respect to such sentence) and their successors and assigns.

6.11 With respect to any translation of this Agreement that may be prepared by either Party, whether or not signed by the Parties, the French language version shall be the official version and shall govern if there is a conflict with this English language version. All disputes under this Agreement shall be resolved and all proceedings therefore shall be conducted, regardless of the means or authority, in the French language.

IN WITNESS WHEREOF, the Parties have caused this Agreement to be executed and delivered as of the date first above written.

REPUBLIC OF MADAGASCAR

MINISTRY OF ENVIRONMENT AND FORESTS

MAKIRA CARBON COMPANY LLC