Topic	Description
	For both oil and mining activities, according to the MECIE law the following process must be respected: EIA, joined by an Environmental Programme Engagement (EPE), with program detailed action plans before action is taken. EIA papers submitted to NEB should be evaluated by a multidisciplinary committee. All companies engaged in oil and mining projects pay fees to conduct the EIA process, equivalent to 2,5% of their initial investment. All projects need to be endorsed by the NEB and have an environment permit. The Oil Code dates back to 1996 and is largely considered as outdated, although a revision is currently being undertaken. The current Mining Code was completed in 2002 and foresees the adoption of a special legal framework for large-scale mining investments and a privileged tax regime for mining projects above an investment threshold. The threshold of $100 million was lowered to $25 million in 2005 to foster new investments. This contrasts with the many small-scale artisanal mining operations, still found in many locations across the country—which have significant impacts. With facilitated access, and a weak overarching legal and enforcement framework, there are concerns, within the development assistance community, that Madagascar's mining and hydrocarbon rents are being undervalued—and at the expense of the country's unique biodiversity endowment. At the local level, the sheer scale of projects can cause social disruption.[98] There is also a need to "clean up" the mining permit registry from "legacy mining permits", which do not bode well with the new context and would add to land use competition.[99]
Inter-ministry Regulation n° 12032-2000	This regulation was signed in 6, November, 2000 by the Minister of Energy and Mines and the Minister of the Environment. It guidelines for environment protection in the mining sector. It indicates administrative attributions and processes regarding environment assessments and environment management plans. This regulation is in sync with the regulations contained in the mining code and the MECIE decree.

The Protected Area System of Madagascar (SAPM)

PAs have so far been the main strategy for biodiversity conservation in Madagascar[100]. Currently, Madagascar is about to review of its National Strategy and Action Plan for Biodiversity (NSAPB).

Since the implementation of the EAP, the Government of Madagascar has made significant progress in extending the PA surface and improving PA management. Until 2007, only 3% of the country's terrestrial ecosystems were protected, and several ecosystems and threatened species were under-represented in the PA heritage. Since then, concerted efforts have been made to carry out a gap analysis, identifying key biodiversity areas and establish new protected areas (NAP)[101], within the SAPM.

The action plan of the current SAPM (2012), which was submitted to Convention of Biological Diversity (CBD), to meet the PoWPA requirements, offers a significant increase in the coverage of terrestrial, marine and coastal Protected Areas (MCPA). The plan will extend the SAPM, to cover six million hectares of terrestrial sites, and one million hectares of MCPA. About 90% of these sites currently have a temporary protection status.

The newly created NAP's (IUCN categories V ET VI de l'UICN) amount to a total of 93 protected areas, all of which have received permanent protection status. Under categories I, II and IV, four PAs of the MNP network have been issued permanent protection status.

PAs of all IUCN categories together amount an estimated surface of 6.9 million hectares (12% of the country's total surface area). 60% of PAs have been issued an Interministerial Order, which is a temporary decree, securing and protecting the area from potential investors, a step which precedes granting of the permanent protection status decree. The expiry date of these temporary Decrees was May 15, 2015, as described in the Law No. 2015-005, which revised the COAP (refer to Table 13 further up). All PAs were granted the permanent status since then. In order to continue building the PA network, the country will continue efforts to develop a strategy for the protection and conservation of PAs with local communities.

Furthermore, during the sixth *World Parks Congress* in Sydney (Australia), which took place in November 2014, the President of the Republic announced ambitious steps to be carried out by the country favour of environmental protection.

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[98] Time Magazine Online, Feb. 3013: *The White Stuff: Mining Giant Rio Tinto Unearths Unrest in Madagascar.* [Link]

[99] Much of the country's territory is covered by mining exploration concessions of one sort or another issued during colonial times. It had been relatively easy and inexpensive for a permit-holder to maintain and renew their mining permits—one reason why the artisanal mining sub-sector has flourished.

[100] Refer to PPG Study #1 (Ecosystems, biodiversity and protected areas, by Rabemananjara Henintsoa. March 2015), annexed to this PRODOC, for list of PAs and key biodiversity areas for the Atsimo Andrefana Region as identified by CI, WWF, in support of the Government of Madagascar through the MEEF and SAPM.

[101] As explained above the NAP fall under IUCN category V and VI, and are commonly referred to in Madagascar as New PAs of NAP's due to their recent creation and the type of category.

The Government of Madagascar committed to:

- Finalizing the expansion of SAPM by tripling the protected area surface, which the country had previously committed to doing, and is about to be reached, and; to mainstream PA in the core of the country's sustainable development strategy, as an asset for economic growth, political stability and to promote equity. In this context, in 2015, all new PAs identified through different studies will be officially declared as PAs. A new PA foundation will enhance PA management ensure their economic sustainability;
- Triple the number of MCPA in the next five to ten years;
- Develop and implement a zero-tolerance policy regarding illegal wildlife trade, stop wildlife smuggling and support the global fight to stop illegal activities.[102]

These new challenges will be assessed during the next World Parks Congress taking place in ten years.

Community natural resource management within the SAPM

Many local communities are engaged in building the PA system (categories I to IV), co-managing PAs in synergy with support agencies and ensuring the existence of a strong protection belt in the buffer zones of PAs. This strategy, which has been adopted in the last 20 years through the implementation of the country's environmental program (EP), ensures that the conservation strategy set up to build the SAPM is effective. The rate of participating communities in co-management is in constant growth thanks to their participation in different locally based institutions, such as, the COSAP[103], Parks Local Committee (PLC/CLP), and through CBO (COBA- *Communauté de Base*) and other associations[104].

The legal and institutional framework for PA management promotes the use and recognition of traditional community laws (*Dina*), as norms that regulate natural resource practices by local communities (see table above). The content of the *Dina's*, containing sustainable uses of natural resources, are valued and promoted within the formal legislative framework, endorsed and integrated as a component of the TDG contract developed through the GELOSE law.

The revised COAP has opened a new legislative path towards the legal recognition of co-management of PA by communities, and agents and operators managing PAs, providing New PAs (categories V and VI) a legal framework that secures the areas. Moreover, although PAs under categories I, II and IV do not allow productive land-uses within the boundaries of PAs and are managed without communities, these PAs are however surrounded by buffer zones where local communities live and practise sustainable development and NRM within the framework of the TDG and the *Dina's*, in support of PAs.

These two management types, which value traditional community practices may be encompassed within the definition of (Indigenous) Community Conservation Area (or ICCAs), in the specific context of Madagascar, as explained in Box 6.

Box 6: Indigenous Community Conservation Areas (ICCA)

The Consortium for ICCAs (Indigenous Community Conservation Areas)[105] defines community conservation areas (CCA) as territories traditionally conserved by local or indigenous communities, where subsistence activities have enabled, due to their sustainable nature, to conserve ecosystems and maintain their resilience and diversity. This conception highlights the central role of traditional culture in biodiversity conservation.

These areas are "natural and/or modified ecosystems containing significant biodiversity values, ecological services and cultural values, voluntarily conserved by Indigenous peoples and local communities through customary laws or other effective means" (IUCN)

Madagascar's experience in operationalizing the ICCA declaration is in its preliminary stages. In June 2013, for the first time, a network of local CSO's called Tafo Mihaavo, was accepted as a member of the ICCA consortium, representing the only official ICCA from Madagascar within the world's Register of ICCA.[106]

In Madagascar, the concept of ICCA is still evolving. With the recent revision of the PA Code (COAP, revision law), new possibilities have been opened to provide new legal frameworks to support the ICCA.

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[102] worldparkscongress.org/about/promise_of_sydney_commitments.html

[103] COSAP (*Comité de Soutien aus Aires Protégées*) Support Committee for Protected Areas: Composed by representatives of local authorities and civil society members working in the buffers zones of PAs. Their attributions are to provide advice to the manager of the PA, to do communication and awareness raising and to ensure lobbying and advocacy at the local and regional level.

[104] Fifth National Report to the Convention on Biological Diversity – Madagascar (2014).

[105] Legal and institutional aspects of recognizing and supporting conservation by indigenous peoples and local communities, an analysis of international law, national legislation, judgements, and institutions as they interrelate with territories and areas conserved by indigenous peoples and local communities, Jonas, Harry, et al., ICCA (2012)

[106] Website of ICCA registry

The CCA category, is contained in the revision law of the COAP and is similar to that of the definition provided for the ICCA, hence opening the opportunity to provide legal framing for the PAs with a community based management structure.

Consequently, in the Madagascar context, the management structure which is defined by the ICCA (which has international recognition) rests open to specific country based experiences that may be piloted by local communities and promoted by environmental constituents and the local government. There is no unique and legally defined form or management category for ICCA or CCA as of yet.

For the purpose of fitting the ICCA and CCA concepts within the Madagascar experience, current legislation combined, pertaining to community natural resource management (e.g. Gelose, GCF, COAP, revision law of the COAP etc.), form the legal framework on which new sites for community conservation, that will be created by the project, will be encompassed and promoted.

Source : www.iccaconsortium.org

The political turmoil, taken place in recent years, has led to an accelerated loss of natural resources, gravely deteriorating the state of the environment in the country. Good practise in natural resource management, and existing legislation, have frequently been violated and ignored. As a reaction to constant abuse by authorities, many local community networks were set up.

Some examples are: (1) The MIHARI network (or Locally Managed Marine Areas - LMMA), which assembles 134 coastal communities, which was established in January 2012 with support from international NGO's (CI and WCS). Thanks to this network, marine conservation areas, including MPAs, represent 7% of the Madagascar's Exclusive Economic Zone[107], and; (2) The TAFO MIHAAVO network, which assembles approximately 500 communities (fokonolona) spread across 18 of the 22 Regions of Madagascar, was established in May 2012 with support from National environmental institutions[108]. The Anja Declaration, issued by this network, during its constitutive General Assembly, declares the need for more efficient governance and sustainable management of natural resources based on the norms and values of the *fokonolona*. This was officially communicated during a side event of the COP held in Hyderabad.

Box 7: Legal Framework for Community Conservation Areas (CCA) in the Malagasy Context

Local communities in Madagascar (*le fokonolona*) have conserved local territories and natural resources as community patrimony of social and cultural interest, inherited from generation to generation, based on social conventions.

This responsibility has been granted legal recognition within the current judicial system through the natural resource management transfer law (*Transfert de Gestion des Ressources Naturels*, TGRN or *Transfert de Gestion*, TDG) to local communities (law 96-025 and related regulating decrees), in addition to the Forest Management Contract Law (*Gestion Contractualisée des Forêts*, GCF). The goals of both laws has been to reduce pressures on natural resources and encourage communities to participate in the formal management and conservation of natural resources.

The TDG is built on three guiding principles: subsidiarity, voluntarism, and non-discrimination. Today, almost one million hectares of forests and sites containing valuable natural resources have been secured and protected by way of the over one thousand management transfer contracts that have been signed. Some gaps still persist in spite of the good will and knowledge of communities to conserve resources, such as problems linked to weak management capacities and lack of sufficient economic incentives.

With local communities engaging in maintaining buffer zones, protecting each PA (IUCN categories V and VI) and practising sustainable resource management in their territories, it is possible to operationalize the landscape approach. This approach may be set up as a shared and organized management system under the management transfer regime, enabling traditional management and governance of resources, to lead the way as community conservation areas, (CCA).

Source: Report on the Fifth National Report to the Convention on Biological Diversity - Madagascar 2014

[107] Fifth National Report to the Convention on Biological Diversity- Madagascar (2014).
[108] Such as the GEF SGP, PNUD, Tany Meva, SAGE, C3EDM, SAHA etc.

Annex 6: Description of selected Sites

A) Summary of methodology

In response to the global biodiversity loss crisis, several methods for identification of important sites for conservation have been developed (Biodiversity Hot Spots, Global 2000 and KBAs). Most of these prioritization methods are based on the concepts of irreplaceability, vulnerability or extinction of certain species. These methods rarely include human and social dimensions when used for delimitation of conservation areas. Yet in a landscape approach, we cannot omit this reality and must include these aspects, by proposing participatory conservation and mitigations measures to maintain ecosystems services and biodiversity also outside strict conservation areas.

Heather Rogers et al. (2010)[109] from Southampton University proposed a methodology offering a series of spatial synthetic indicators in order to relate human pressures with a spatial quantitative measure of biodiversity importance score for conservation. The composite indicator of the human pressure includes aggregated scores derived from spatial data on human population and its location, data on road network, potential yield for agricultural soils and frequency and location of fires occurrences in the studied area (the island of Madagascar).

For the current study, we developed a similar composite indicator on human pressure and an indicator on priority for conservation of biodiversity at landscape level.

Our pressure indicator aggregates previously cited data sets for the region, but also additional data on agriculture and deforestation. Additional information layers, even if partially correlated, allows a higher resolution mapping of human pressures, which is necessary because our study focuses on a specific region of Madagascar (Figure 10), which harbors a number of key ecosystems (Figure 11) and therefore requires a closer look than whole Madagascar Island in the case of the geo-analytical study.

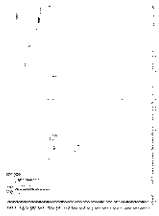

Fig10

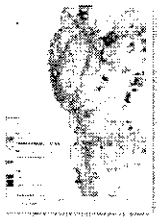

Fig11

Click here to access images

Figure 10: Project focus districts in Atimo-Andrefana region

Figure 11: Project focus zone ecosystems in Atimo-Andrefana region

The indicator on priority for conservation of biodiversity includes the results of a 2008[110] study by C. Kremen et al. from the University of Berkeley, meant to identify the expansion zones of conservation sites allowing the optimal additional contribution to the existing network of strict conservation areas in Madagascar. This is achieved with an approach prioritizing the conservation of populations through several taxa thanks to high resolution planning tools. The advantage of this approach is that it takes into account the highly complex patterns of endemism in Madagascar, which are different throughout the various taxa. The modeling result from Kremen study is based on land cover data from 2000, thus not reflecting the most recent changes in terms of forest loss. In order to consider recent changes that occurred in our study area, we also use data on the integrity of forested areas as of December 2014.

Finally, we identify three conservation scenarios taking into account the level of human pressure, that being either low, medium or high, within these priority conservation areas and then emit recommendations regarding the choice of sites, based on other qualitative criteria (proximity of management transfer and other sources of qualitative information) that enable us to offer a choice of the fifteen priority *fokontanys* within the project focus zone to harbour community conservation areas or other conservation initiative supported by the project.

We draw inspiration from an already field proven approach that we adapt to the reality of our study area in order to offer a reduced number of sites that, if they were the subject of participative management taking into account biodiversity, would significantly contribute to the maintenance of biodiversity at the landscape level.

[109] Prioritizing key biodiversity areas in Madagascar by including data on human pressure and ecosystem services (2009).
[110] Aligning Conservation Priorities Across Taxa in Madagascar with High-Resolution Planning Tools (2008).

B) Data, treatment and intermediate results from the geo-analytical study

Human pressures. To estimate the anthropogenic pressures affecting the studied area, we developed a composite indicator of human pressure composed of the 4 main elements that impact the environment at a landscape level, each of these elements having existing reliable and relatively recent data. These elements are roads, population density, deforestation and agriculture. This last element itself includes three combined sub-components expressing the intensity of agricultural activity: the potential yield for agriculture in the area, land use in terms of cultivated areas and finally bush fires, which are used in Madagascar as a traditional method for preparing the land for agriculture ("*hatsake*").

Each of these spatial components has then been separately standardized in a score out of 100, without affecting the relative distribution of the variable. This score was finally aggregated and normalized again to realize our final human pressure indicator ranging from 10.4 to 66.6

Population density. We have used the population data from the International Information Centre on earth sciences (CIESIN) at Columbia University. The data set is titled GPWFE and represents at a resolution of 2.5 arc-minutes an estimate of the population density for the studied zone in 2015. (See Figure 12.)

Road Network. The acceleration of ecosystem degradation is exacerbated by the development of road networks in the remaining wilderness areas (Spelleberg, 2002), although it is difficult to estimate the exact role of the roads in this matter, we can nevertheless assume that proximity to the road is proportional to the potential impact it may have on degradation of ecosystems. Our indicator is therefore calculated like the distance of each pixel of our study area to the nearest road or track. (See Figure 13.)

Bush fires. The role of bush fires remains complex and debatable, but it is mostly of anthropogenic origin (Kull, 2004) and is often linked to the local traditional farming practices. What is clear is that it represents a threat to biodiversity. We therefore generated a prevalence indicator based on remote sensing data showing the fire frequency for each pixel of the studied area from 2010 to 2015. This data is from the MODIS NASA satellite, from which we acquired images set stretching over the mentioned period. (See Figure 14.)

Cultivated areas and potential agricultural yield. The expansion of agriculture is a threat to global biodiversity and is often a source of conflict between conservation and satisfaction of local needs. High potential crop yield is a driver for agricultural settlements in new lands (O'Connell - Rodwell and al. 2000). We found some data from the remote sensing department of the University of Munich, showing the potential crop yield for 16 common plants in terms of tonnes per hectare. (See Figure 15.) This data is based on both climate and soil data in order to estimate production. It has also been standardized and reduced to a score on 100. Also, we have derived the agricultural areas of the study area from the classification of a Landsat image of December 2014. (See Figure 16.)

Deforestation. Deforestation is also an anthropogenic pressure indicator and has as a direct consequence on biodiversity loss due to the disappearance of viable habitat for species. Data from the University of Maryland (Hansen et al. Science 2013), produces the analysis of the overall loss of forest cover from 2000 to 2014 using a time series of Landsat imagery. We have managed to derive a deforestation intensity score on 100 expressing cover loss for each pixel (30m x 30m) of the studied area deforestation image. (See Figure 17.)

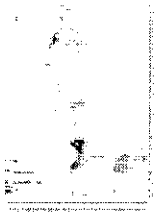

Fig12

Figure 12: Population density score map

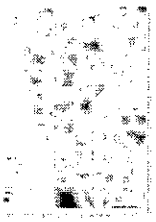

Fig13

Figure 13: Impact of road network score map

Fig14

Figure 14: Intensity of bush fires score 2010 – 2015 map

Fig15

Figure 15: Potential yield score 2011-2040 map

Fig16

Figure 16: Cultivated areas map

Fig17

Figure 17: Deforestation intensity Score map

Click here to access images

Intermediate Result 1: composite indicator of anthropic pressure

Each score presented previously is aggregated to form a spatial composite indicator of anthropic pressures.

Prioritization of biodiversity conservation. To assess and quantify the importance of a location in space for the conservation of biodiversity, we have also had to realize a composite indicator that estimates for each pixel of the studied area a score expressing the priority for conservation and maintenance of biodiversity. This indicator takes into account the data that we have obtained from the study of Kremen et al (2008) from the University of Berkeley. We have updated this data from 2008 by crossing it with a more recent data (2013) of intensity of tree cover, this update allowed us to take into account recent changes due to ongoing deforestation. (See Figure 18.)

High resolution modelling of prioritization. To obtain a quantitative indication of the relative importance of biodiversity for a given location in the landscape, we used the scores of a high resolution multi-taxonomic modelling study conducted by Kremen et al. (2008). This study helped prioritizing across key biodiversity areas the optimal areas contributing to maintaining biodiversity. The multi taxonomic approach takes into account the highly complex patterns of biodiversity in Madagascar. This study takes into account nearly 2,315 species, most of them endemic, through 6 taxa (ants, butterflies, frogs, geckos and lemurs) to produce a quantitative priority of conservation score. A zoning algorithm is used to optimize the prioritization based on the rarity of the specie, but also ensuring that there is no non representation of others. The algorithm also ensures the optimization of proportional representation of species across different taxa. We have managed to obtain the data resulting from this modelling exercise, giving a score out of 100, expressing the relative priority of each pixel of imagery for biodiversity conservation. We thus have an accurate digital measurement, a ranked representation of the areas to prioritize for the maintenance and conservation of biodiversity. This data comes to the same conclusions, but with more precision and information, than the identification of KBA realized by Conservation International (see Figure 19).

Biodiversity conservation rank score update with recent intensity of tree cover data. The prioritization score mentioned above is based on high-resolution modelling that is itself based, among other parameters, on the intensity of tree cover in forested areas. The presence of the considered species is in direct correlation with the presence of their natural habitat. Kremen based his research on data from 2000 concerning forest cover, an update has thus been made taking into account deforestation. This composite data was made from reference data on the intensity of tree cover

(2008) updated with data on deforestation from the University of Maryland (Hansen et al. Science 2013).[111] (See Figure 20.)

Fig18

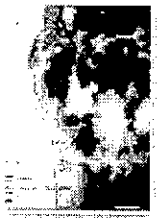

Fig19

Figure 18: Composite indicator of anthropic pressures score map

Figure 19: Biodiversity conservation rank score from Kremen study (2008)

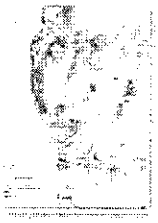

Fig20

Fig21

Figure 20: Tree cover intensity score map

Figure 21: Composite updated indicator of conservation priority score map

Click here to access images

Intermediate Result 2: Updated Composite indicator of conservation priority map

Each score presented above is aggregated to form a conservation priority composite indicator, which gives a score for each pixel representing their relative contribution to maintaining biodiversity. (See Figure 21.)

C) Synthesis: Identification of conservation scenarios and sites selection

We estimated for each *fokontanys* of the study area an average score of pressure based on the composite human pressure indicator described in details previously. In order to simplify and operationalize the project implementation, we identified three conservation scenarios based on the anthropic pressure level: low pressure level, moderate and high. We then distribute each *fokontany* across this discrete classification upon their respective average human pressure score.

These three scenarios can match specific intervention strategies that determinate the actions and resources to be invested according to the intensity of human pressures. (See Figure 22.)

Subsequently, we selected about fifteen sites/*fokontanys*, through the three possible conservation scenarios (low human pressure, moderate or high) according to the approach described below:

First, we select sites that maximizes the prioritization indicator score for the maintenance of biodiversity described above. To do this, we discretize the prioritization of indicator data score by averaging inside polygons (squares) of 2.5 km2 and retain the squares whose sum of biodiversity conservation score is part of the highest decile of the score itself. These squares correspond to the highest priority areas for biodiversity conservation (1/10 higher). Translated in a more prosaic way, it means identifying within an area equivalent to 10% of the total area (thus corresponding to the national conservation target) the highest priority areas for biodiversity maintenance (Figure 23).

[111] Hansen et al. Science (2013).

Fig22

Fig23

Click here to access images

Figure 22: Intensity of human pressures classification map

Figure 23: Highest decile of conservation priority map: every yellow squares of 2.5 km sides represent a zone maximizing the conservation priority score (top 10% priority of conservation)

As can be seen on the map (Figure 23), outside of the already strictly protected areas (Mikea and Tsimanampesotse National Parks, both classified in category II of IUCN management system), the sites of the top decile are relatively confined in space. In order to implement any conservation decision regarding these priority sites, we need to relate them to administrative entities, we chose the administrative boundaries of the lowest hierarchical level for which exists delimitation data: the *fokontany*[112]. *Fokontanys* of the studied area containing squares part of the top decile for conservation priority are 138 out of a total of nearly 800 *fokontanys* within the region. However, the ultimate goal was to reach a maximum of fifteen ideal sites (this target is linked to the project resources and was established during stakeholder consultations in preparation phase). For the final selection, we have used qualitative criteria (non-systematic) which, in order of importance, are the following:

- Importance of the sites (notwithstanding the importance for biodiversity) for ecosystem services
- Sites close to protected areas of category II where a threat on the integrity of the protected area exists, sites allowing more connectivity between protected areas or between protected areas and unprotected untamed lands
- Results of community consultations performed by the national team consultants who scouted the study area
- Willingness of locals to get involved in community conservation as indicated by the presence or proximity of management transfers (TDG) or other probing elements

Table 14: Fokontanys chosen for the creation of CCAs or for other conservation initiatives

FOKONTANY	COMMUNE	DISTRICT
Low Human Pressure		
Ambohimandroso	Manombo Sud	Toliary-II
Maharihy	Basibasy	Morombe
Fiherenamasay	Manombo Sud	Toliary-II
Karimela Mamiratra	Manombo Sud	Toliary-II
Nosy Ambositra	Nosy Ambositra	Morombe
Ampilokely	Befandriana Sud	Morombe
Moderate / Emerging Human Pressure		
Ankatsankatsa Sud	Nosy Ambositra	Morombe
Analodolo	Analamisampy	Toliary-II
Ankiliabo	Ankililoaka	Toliary-II
Anjabetrongo	Analamisampy	Toliary-II
Andranovorindregataka	Antanimieva	Morombe
Iaborao	Basibasy	Morombe
Miary	Ankazombalala	Betioky Atsimo
Analatelo Sud	Antanimieva	Morombe
Tantalavalo	Nosy Ambositra	Morombe
Mamery	Maromiandra	Toliary-II
Antanimena Maikandro	Ankililoaka	Toliary-II

Almost all retained *fonkotanys* are therefore geographic areas hosting top priority sites (top decile) with the exception of a few (see Figure 24). These few one, even if not containing squares of the top decile, still have a biodiversity

[112] Délimitation cartographique des Fokontany, Madagascar BNGRC, National Disaster Management Office, 2011.

prioritization score in the 20% highest (see Figure 25). The exceptional criterion for their selection relates to their geographical position maximizing forest blocks connectivity in most cases. We will later detail reasons underlying their selection.

Finally, the final sites chosen *fokontanys* (refer to Table 14 and the two above-mentioned Figures) represent a coherent compromise between a systemic quantitative approach measuring conservation priority for biodiversity and the consideration of other qualitative arguments (ecosystem services and social dimensions) that are presented in the next section.

NOTE: Given the limited amount of resources, it would be ideal if the total number of finally retained sites to be beneficiaries of the project's Component 2 would be around a dozen, maximum 15. The choice can be further refined during project appraisal.

Fig24

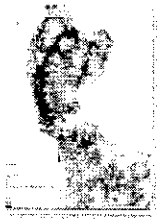

Fig25

Click here to access images

Figure 24: Fokontanys chosen for project conservation initiatives, the yellow squares represent the superior decile of priority for conservation score (areas constituting the top 10% priority conservation area of total area)

Figure 25: Fokontanys chosen for project conservation initiatives

E) Presentation of the selected sites, details and justification of choice

Sites of Lake Ihotry watershed

The Ihotry Lake watershed was delimited using a digital elevation model (Figure 26) that we were able to get from USGS (resolution of 30 arcs / second). Advocacy of site selection is made easier when considering the dynamics of watersheds. We thought it appropriate to enrich the discussion on the choice of sites by bringing up an extra dimension to the sole prioritization upon biodiversity (although these criteria stays the primordial one for selection). Indeed, watershed analysis allows consideration of dynamics that otherwise might go unnoticed. The services provided by the ecosystems in terms of water supply and irrigation for crops depends on watershed functions. Maintaining these services depending also on ecological integrity of ecosystems is a guarantee of sustainability in agricultural activities, and thus a guarantee of population stabilization in currently cultivated areas. This, as a side effect, makes it easier to achieve conservation goals through population stabilization and decrease of migratory pressures on lands still sparsely populated and rich in biodiversity.

Fig26

Fig27

Click here to access images

Figure 26: Lake Ihotry watershed, blue arrows indicate the direction of water flow

Figure 27: Lake Ihotry watershed land cover, blue arrow represent water flow direction, silting of the cultivation areas in the center of the basin causes enhance human pressure (red arrow) at West of the watershed on Mikea Forest area

Watershed analysis also explain partly the origin and dynamic of the silting problem, particularly acute in the Ihotry Lake watershed area. Selected *fokontanys* (in this watershed) to shelter community conservation areas (CCA) contain sites of the highest priority for biodiversity conservation (conservation priority top decile), but also prove to be of the upmost importance for the regulation of ecosystem services (in this case water supply). The selected *fokontanys* for Lake Ihotry's watershed fall into two sectors baptized as follows for convenience, and are described further down:

- **East corridor sector** (*fokontanys* of NosyAmmositra, Ampilokely, South Analatelo and Andranovorindregataka)
- **Ihotry North sector** (*fokontanys* of Maharihy, Tantalavalo and South Ankatsankatsa)

Ihotry watershed East sector corridor fokontanys: NosyAmbositra, Ampilokely, South Analatelo and Andranovorindregataka

This forest corridor (Figure 29) houses a western dry forest [113] of deciduous type that is otherwise very poorly represented elsewhere in the three districts of our studied area. This kind of forest is in fact generally found further north both of the Mangoky River and our study area (see also Figure 11 for the ecosystems' map). This biotope is similar to the type of forest found in the Kirindy Mitéa national park north of the study zone. The presence of this habitat south of the river is an exception that provides an additional argument for its conservation. The forest corridor stretches from Nosy Ambositra to the north, through Ampilokely, South Analatelo and Andranovorindregataka to the south (Figure 29).

This particular forest is characterized by the abundance and variety of its tree species. Most tree species are deciduous. From April to October, that is to say during the dry season, most of the trees are leafless. Their height is usually quite low (ten to fifteen meters) and their trunk very thin (20 centimeters for the largest ones). The Baobabs encountered frequently are very large though (up to 15 meters of circumference) and very high (20 to 25 meters). The shrub layer is almost non-existent and there are very few vines [114].

The forest corridor proposed here is home to squares of the top decile of biodiversity conservation priority (Figure 23) according to the indicators previously defined in this document. Another study published very recently (in July 2015)[115] comparing several prioritization methods (irreplaceability, conservation index and species richness) ranks the Nosy Ambositra site north of the corridor as part of the top 50% of 22 sites already including protected areas and possible candidate areas for conservation across all Madagascar. This study leads to consider the establishment of a new protected area in this site. This matches with the results of our own study on conservation priority. Moreover, establishment of the corridor in the northern part would maintain the continuity and connectivity of these forest ecosystems with those of the Mangoky protected area near Nosy Ambositra.

The importance of biodiversity in this specific forest corridor is in itself reason enough to consider it for creation a Community Conservation Area (CCA). But in addition to that sole argument, if we take in account the dynamics of watersheds, we are strengthened in our consideration. Indeed, this forest corridor and its maintenance are also essential for the regulation of ecosystem services related to hydrography. The rivers constituting the watershed flow from east to west ending into Lake Ihotry (this flow direction is symbolized by the blue arrow in Figure 27). The waters go steeply downstream from the forest corridor that rests on a limestone plateau (about 800 meters) and then slopes gently from Befandriana through the vast cultivated plain down to Lake Ihotry. The river network is dense and well structured. Given the limestone bedrock, watercourses there are often temporary. The main rivers are the Bevato, the Befandriana, the Ambory and Tsivoro. They Flow from the limestone massif and are quickly lost in the sand cover upon their arrival in the coastal plain[116]. The water flow from these heights is intermittent in its surface run but is vital for the maintenance of human activities and alimentation of the underground waters.

Despite its low population density, the limestone plateau housing the forest corridor suffers of important deforestation, especially in its western part. Already in 1949, Segalen and Bioureaux[117] warned us about the future of these forests and the consequences of their loss:

> *"If the current situation continues, it is likely that primary forest will have soon disappeared. It will be replaced by savannah and grassland ... The loss of tree cover on these very sandy soils will accelerate the erosion. If the forest should disappear, then the risk of silting in the alluvial belt, now well cultivated, will increase. (...) The drainage system will undergo serious changes. Already, Befandriana, whose headwaters have suffered serious deforestation, has water merely a few days a year. (...) A torrential regime followed by sudden inflows of sand may become the reality if its headwaters are not protected. Finally, soil degradation by loss of the topsoil appears to be the inevitable consequence for all arable land."*

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[113] Atlas de végétation de Madagascar / RBG Kew, publication 2007 Réalisation: REBIOMA Edition: Novembre 2008.
[114] La végétation de la région de Béfandriana, (Bas Mangoky) par P. La végétation de la region de Béfandriana, (Bas Mangoky) par P. Ségalen et C. Bioureaux, 1949.
[115] Comparing Methods for Prioritising Protected Areas for Investment: A Case Study Using Madagascar's Dry Forest Reptiles. Charlie J. Gardner , Christopher J. Raxworthy, Kristian Metcalfe, Achille P. Raselimanana, Robert J. Smith, Zoe G. Davies, (2015).
[116] Etude de la vulnerabite du bassin versant du lac Ihotry a l'erosion en nappe ,M. Rabarimanana, R. Andriamasimanana, E.Rasolomanana, L. Robison (2012).
[117] La végétation de la région de Béfandriana, (Bas Mangoky) par P. La végétation de la region de Béfandriana, (Bas Mangoky) par P. Ségalen et C. Bioureaux, 1949.

Given these forecasts that proved to be accurate, it is absolutely necessary to preserve what is left of these forests and, ideally, adopt reforestation policies and soil stabilization practices in the highly erodible area downstream. To prevent erosion of the sandy basin by torrential water flows, it is crucial to preserve the forests upstream of the watershed. These conservation measures and if possible restoration of the watershed are primarily designed to correct the torrential phenomenon through conservation, improvement and implementation of forest cover. They have a very beneficial effect on water infiltration and storage, as well as exerting effective control over surface runoffs and flood flows[118].

The plain that lies between the hills of the eastern watershed and Lake Ihotry is one of the main agricultural areas of the Atsimo-Andrefana region (Figure 27). To the west of the National 9 passing by Befandriana, this plain is home to very large agricultural areas, some irrigated in cultivation mosaics, some not. During community consultations in Befandriana, the silting up of rice paddies in the area has been profusely discussed, fertility loss caused by silting being widely acknowledged as a critical issue by the Environmental Dashboard ONE [119].

Dandoy noted in 1972 that, between Manombo and Befandriana (including the watershed area of Lake Ihotry) east of the Mikea Forest, the "agriculture occupies only limited areas corresponding to the best soils and irrigable areas". It is clear that these lands of much agricultural value are now saturated and that to extend the cultivated areas, there is no choice but to do so by using new dry forest land[120]. When you combine this fact with loss of fertility of cultivated soils, it might explains why some of the human pressure for new cultivated area is now diverted on Mikea Forest boundaries westward (Figure 27).

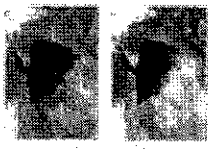

Fig28

Figure 28: evolution of the siltation situation of Lake Ihotry over 5 years (2000-2005)

Fig29

Fig30

Figure 29: East corridor sector: a very high biodiversity forest corridor on hills east of Befandriana, water flows from there to the lake, deforestation here leads to silting of important cultivated areas between proposed forest corridor and Lake Ihotry

Figure 30: Ihotry north sector: Maharihy, Tantalavalo and South Ankatsankatsa

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During the community consultations, the scarcity of drinking water during the dry season because of the major rivers drying up (including the Befandriana) was also reported. These intermittent streams originate in the wooded hills that shelter the forest corridor proposed as CCA. Even if not visible in the surface, undergrounds water still percolate from the forested hills to the cultivated plains. The importance of conservation is essential for the water supply for crops and human consumption. To ensure the sustainability of this support service, conservation is vital but should be accompanied by proactive community policies of reforestation.

According to the Befandriana community consultations reports, the issue of preservation of this forest corridor seems to have been understood by the local people, they encourage and strongly recommend the creation of new TDGs and Dinas as participatory management tools. This demonstrates the willingness of the community to participate in conservation efforts.

Human pressures remain relatively low for the *fokontanys* of Nosy Ambositra, Ampilokely and South Analatelo: the low population density may be explained by the presence of calcareous soils, not very suitable for agriculture. The fokontany of Andranovorindregataka is more densely populated and is subject to greater deforestation, the index of human pressure there is moderate-emergent.

Siltation also affects Ihotry Lake, mostly coming from the Befandriana River as shown in several studies[121]. Cloudy water in light blue on the picture of 2005 (Figure 28) shows the sediment inflow into the lake and indicates the

[118] Correction des torrents et stabilisation des lits, F. López Cadenas de Llano, FAO (1992).
[119] Rapport de synthèse sur l'état de l'environnement Région Atsimo Andrefana (2008).
[120] La culture pionniere du maïs surabattis-brulis (hatsaky) dans le sud-ouest de madagascar. Pierre Milleville et Chantal Blanc-Pamard (2001).
[121] Étude de la vulnérabilité du bassin versant du lac Ihotry a l'érosion en nappe (2012), M. rabarimanana, R.andriamasimanana, E. Rasolomanana, L. Robison

importance of erosion in the eastern part of the basin. This important site for fishery is home to a fishermen community that depends almost exclusively on the lake resources not only for subsistence, but also as an economic resource. The lake provides each year up to 10,000 tonnes of fish (mainly tilapia).

Ihotry watershed North West sector fokontanys: Maharihy, Tantalavalo and South Ankatsankatsa

These three fokontanys north of Lake Ihotry all host squares of the top decile of conservation priority according to the synthetic index defined by this study (Figure 24). These are deciduous dry forests progressing towards spiny thickets formations. West and south of the lake, we find one of the most prestigious baobab in the world: Grandidier's Baobab (*Adansonia grandidieri*), is the biggest and most famous of Madagascar's six species of baobabs. This imposing and unusual tree is endemic to the island of Madagascar, where it is an endangered species threatened by the encroachment of agricultural land.

This area bordering the lake possesses quite a good population [122] of two species of birds endemic to Mikea Forest: the long-tailed ground roller (*Uratelornis chimaera*) (Figure 32) and the subdesert mesite (*Monias benschi*) (Figure 33). The long-tailed ground roller is part of the list of wildlife species requiring special protection according to the Nairobi Protocol (1985) and is classified as a vulnerable species by the IUCN. Both species are also brought up in the PIF of this project in section 23 (Incremental Cost Reasoning), when identifying the global benefits of the projects on biodiversity[123].

Regarding the services provided by this ecosystem, we must emphasize the role played by the forest west of Lake Ihotry as a buffer strip against the progress of the huge sand dune that stretches from the western part of Maharihy toward south-west (see Figure 30) threating Ihotry Lake. As we can see on the map, for the part of the watershed west to Lake Ihotry, the water flows from west to east (Figure 26). A portion of the forest is contained within the protected area of Mikea while another one remains unprotected. The conservation of Lake Ihotry depends on the success of the conservation of the Mikea forest within its protected part, but also in the parts currently without status. The protection of this forest strip between the lake and the dunes is not only a priority for the conservation of biodiversity, but its maintenance is also essential to avoid the progression of the sand dune towards the lake [124] causing silting and sedimentation. These consequences would additionally cause declining fish catches, economic and social instability, and therefore increased pressure on ecosystems.

An additional reason for these *fokontanys* (Maharihy, Tantalavalo and South Ankatsankatsa) to be home for the creation of CCA or other conservation initiatives is to maximize connectivity with the detached and isolated portions of the protected areas of Mikea and Mangoky that they shelter. These parts of protected areas are enclosed in non-protected areas that have a high level of conservation priority for biodiversity. Corridors should be put in place to maintain this connectivity and minimize fragmentation within the forest. For now, a gélose type of TDG[125] is used mainly for the management of fish resources in the lake.

Maharihy is subject to relatively low anthropic pressures and its population density is lower than Tantavalo's and South Ankatsankatsa's, which are more densely populated, especially on the banks of the Mangoky River along the National Road #9. In this area, the rice paddies productivity and the irrigation canals network state are some of the local population main concerns. These considerations were raised during the community consultants' visit to South Ankatsankatsa. Supporting and maintaining them in good condition would allow population stabilization, social and economic security, both guarantees of stability.

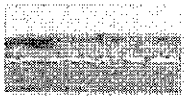

Fig31

Fig32

Fig33

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Figure 31: Flamingos on Ihotry Lake

Figure 32: The long-tailed ground roller (Uratelornis chimaera)

Figure 33: Sub-desert mesite (Monias benschi)

[122] La conservation de la nature à Madagascar: la perspective du CIPO (1987), p.106, N.J. Collar, T.J. Dee et P.D. Gori

[123] PROJECT IDENTIFICATION FORM (PIF), A Landscape Approach to conserving and managing threatened Biodiversity in Madagascar with a focus on the Atsimo-Andrefana Spiny and Dry Forest Landscape

[124] Étude de la vulnerabite du bassin versant du lac Ihotry a l'erosion en nappe (2012), M. rabarimanana, R.andriamasimanana, E. Rasolomanana, L. Robison.

[125] Lohanivo Alexio Clovis, 2014, Cartographie des Transferts de gestion Atsimo Andréfana, DGF/CIRAD-DP.

East Mikea Sector sites: Iaobaro, Analodolo, Anjabetrongo and Ankiliabo

According to Lalaina Rakotobe: "The Mikea forest is renowned both for its biological diversity and by its species endemism (Microgale jensae, Macrotarsomys petteri, Pyxis arachnoid brygooï, Furcifer antemena, Liohidium chabaudi, Uratelonis chimaera, Monias benschii, Alluaudiopsis marinierana). It is also characterized by the presence of the Mikea people, who rely exclusively on its natural resources. In the past, the Mikea area covered about 700 000 ha, of which 558,870 ha were covered by dense dry forest, these forests form the Dalbergia, Commiphora and Hildegardia series. During the 1980s, this forest was partly destroyed because of the corn culture and in the 1990s, this deforestation was worsened by illegal commercial operations such as the production of charcoal and logging.

With a financial support from Conservation International, the World Bank and the Global Environment Facility implemented by the United Nations Development Programme, the Mikea complex received a temporary protection status in April 2007. Its surface is 371,340 ha including 184,630 ha of the National Park, surrounded by 186,710 ha of a community protected area. The Mikea people are now subject to a safeguarding plan duly approved by the public and donors. Since 2005, Madagascar National Parks (MNP) manages the Mikea National Park. The Complex of Protected Areas is co-managed between partners as Fikambanana Miaro ny Ala Mikea (FIMAMI) and farmers' organizations in 15 towns nearby[126]. Even though the creation of Mikea National Park is official since 2011, deforestation is still an actual threat.

According to Pierre Milleville and Chantal Blanc-Pamard (2001), in the Mikea Forest, deforestation occurs on the eastern side of the massif, along the axis Tulear - Morombe between Ankililoaka and South Befandriana. From the eastern edge of the massive, operators choose a "front" that they then extend westward. The expansion of this front or its lateral extent is the subject of very subtle strategies, related both to the acquisition of cultivable land and a coordinate occupation strategy by contiguous pioneers. In general, the stretch of the Mikea Forest narrows from east to west. Initially, three sectors appear to be in danger of deforestation in this area: the Ankililaoka sector, Antseva sector and Ampasikibo sector. These large populous villages are departure points for migrations. These three sites are also access points to the sea through the forest. In the case of Ampasikibo, the trail existed before 1949. The tracks are quite recent in the case of Ankililaoka and Antseva. They were created during the 1970's oil exploration in the region (...) corn, which was once the predominant food crop, has become a major cash crop in the region, leading to speculative behaviours, the appearance of large producers and the widespread use of hired labour. The considerable expansion of clearings has resulted in severely affecting many forest massifs[127].

The Mikea forest has an exceptional biodiversity and high endemism level, making it a **zero extinction site**[128].

The protected area is classified within IUCN management category II, which implies strict conservation within the National Park boundaries. Yet Mikea Forest integrity is still threatened in the areas that we have selected for intervention in the eastern part of the park. These frontiers of Mikea Forest are subject to clearing and fragmentation right inside the park boundaries, as shown in the following map (Figure 34). It is therefore imperative to take action within these sites to ensure the enforcement of strict conservation regulations that their category II classification implies. Respect of the park boundaries should be non-negotiable. For that to be possible, we would need to reinforce the capacity of responsible authorities in terms of surveillance, alert and response. Modern remote sensing tools allow to obtain quasi real time data on forest cover, forest fires and other threats. One of the goals of this project is to make such monitoring tools available within a near real time information system.

The *fonkontany* of Iaobaro, Analodolo and Anjabetrongo are those for which the phenomenon of forest clearing and fragmentation is the worst (see Figure 34). These sites require a targeted intervention strategy taking in consideration the migration dynamics and their relationship to the economic activities of charcoal production and new lands clearing. Conservation in these areas cannot be achieved without the cooperation of local populations. Their engagement as conservation partners, especially in theses most sensitive sites is vital for success. The project must therefore not only strengthen the capacities of the authorities for enforcement of strict conservation policies but also establish and/or strengthen the TDG and Dinas near the periphery of the park boundaries.

As we can see on the map (Figure 34), the tracks through the park to the coast are access roads to new clearing zones, they cross or are adjacent to the *fokontanys* selected as intervention sites. The installation of checkpoints just outside the park boundaries on these tracks with an effective authority presence would help control the situation. In the current situation, the permanent presence of the authorities is based at Ankililoaka, a representation of Madagascar National Parks is located in the village, almost fifteen kilometers away from the park boundaries. The remoteness to the park boundaries and the lack of equipment probably represents a problem for effective surveillance and law enforcement. Yet exercising authority effectively is a necessity if we really want the conservation of this last frontier of the original natural heritage of the region to be a success.

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[126] Le Complexe d'Aire Protégée Mikea par Toany (MNP) et Zo Lalaina Rakotobe, Conservation International, Madagascar, Bulletin trimestriel (2010).

[127] La culture pionnière du maïs sur abattis-brulis (hatsaky) dans le sud-ouest de Madagascar. Pierre Milleville et Chantal Blanc-Pamard (2001).

[128] http://www.zeroextinction.org/

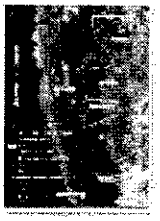

Fig34

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Figure 34: Selected sites, East Mikea sector

Iaobaro, Analodolo, Anjabetrongo and Ankiliabo have all been main subjects to GEF small grants programme to value monka[129] (old clearings) in order to stabilize populations and reduce the pressure on the remaining untouched forests (crop diversification, use of legumes for restoring soils fertility deep soil with legumes, control of the crop calendar, etc.). These initiatives should be maintained, supported and sustained in order to perpetuate the gains already achieved.

The *fokontany* of Ankiliabo (site also proposed to strengthen the existing TDG[130]) near Ankililoaka does not suffer of clearings within the park boundaries and its TDG seems to fulfill its mission. Ankiliabo also constitutes one of the main entries to the visitors of Mikea National Park and yet has no accommodation space for potential visitors, the equipment is virtually nonexistent. The park is very difficult to access, from the nearest village, a 3 hours hike is necessary to get to the park edge. Accessing it remains an adventure that some might appreciate, but developing easier access to potential tourists and visitors would definitely value the park as an asset for neighbouring population.

These four sites are subject to a human pressure considered moderate/emerging. The population density is relatively low, but the human pressure index is nevertheless expressed as emerging because of the intense deforestation level. This sparsely populated area (for the moment) leaves room for rapid intervention in terms of enforcement of regulations inside and outside parkboundaries, in order to respect the limits and the ecological integrity of Mikea National Park.

Southwest corridor of Mikea: Fiherenamasay, Karimela Mamiratra and Ambohimandroso

The choice of these 3 adjacent *fokontanys* has essentially two main objectives:

(i) Located on the southwest coast of Mikea park (Figure 35), these three *fokontanys* are the obligatory passage for all people or goods coming from the west coast using the coastal path along the west of the park. For now, the forest strip between the western boundaries of the park and adjacent Mikea coastal forests are virtually untouched and are spared. Anthropogenic pressures are very low because the population density is very low. To preserve a status quo and prevent the arrival of threats to this last no man's land, a simple measure could be put in place: the control of the goods brought through this unique coastal track. The establishment of a forestry control post or any other permanent surveillance on this axis could help monitor and curb illegal activity, it being the unique gateway to the western part of the Mike national park.

(ii) The second objective would be to maintain connectivity between the PA of Mikea and Ranobe PK 32. Fiherenamasay is adjacent to the national park of Mikea and includes squares of the top decile of conservation priority for the maintenance of biodiversity in its eastern parts (see Figure 24). For the rest, it is mainly composed of a relatively intact forest in continuity with the ecosystem of Mikea (Figure 35). A Coba type of management transfer[131] already exists for the management of the forest resources.

This forest area goes stretch south through the adjacent *fokontany*, Karimela Mamiratra, which is also proposed to host a CCA. A protected forest corridor could be established and stretch to the banks of the Manombo River a little further south. Fiherenamasay and Karimela Mamiratra also comprise mangrove sites that are the subject of a Gélose type of TDG[132], these sites have been identified by community consultants as important sources of raw material for handcrafts and as important nesting sites for fishes and crabs. There is a project of dune fixation at Fitsitike to protect mangroves against the invasion of the sands in the rural commune of South Manombo (GEF Small grants programs, Madagascar).[133]

Finally, south of the corridor (Figure 35), the Ambohimandroso fokontany on the south shore of the Manombo river has the particularity of belonging to the protected area of Ranobe Pk 32 in its eastern parts. Deforested particularly in its

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[129] GEF Country Portfolio Evaluation: Madagascar (1994–2007).
[130] Lohanivo Alexio Clovis, 2014, Cartographie des Transferts de gestion Atsimo Andréfana, DGF/CIRAD-DP.
[131] Ibid.
[132] Ibid.
[133] Fixation des dunes à Fitsitike pour protéger les mangroves contre l'envahissement des sables dans la commune rurale de Manombo Sud et prévention en amont, (GEF) Small grants programs, Madagascar

western part, this fokontany could be the site of a reforestation project in order to create a forest corridor, thus restoring connectivity between forests of Mikea and Ranobe PK 32.

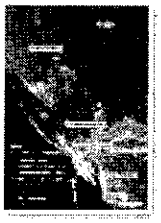

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Figure 35: Selected sites, South-West Mikea corridor

Ranobe Sector fokontanys: Antanimena Maikandro and Mamery

The **Antanimena Maikandro fokontany** (Figure 36) houses the Coba Mahavita Tsara, which manages a forest identified as a biodiversity hotspot (Antsihirike forest) as it contains squares of the top decile of conservation priority according the present study (Figure 24). This site is adjacent to the protected area Ranobe PK 32, which is one of the areas of highest biodiversity and endemism in Madagascar. The creation of a CCA in this site could help maintain connectivity and continuity of forest areas outside the protected area. The richness of the site had already been recognized before this study and was rewarded with the award of a GEF grant for the conservation of biodiversity; the project will end in October 2015. This site is located upstream from the sacred water source of Ambobaka (essential for the irrigation of nearly 2000 hectares of crops and social cohesion) and is part of the watershed of the important Ankiloaka cultivating area, the conservation of this forest contributes to regulating runoff, erosion, and is an obstacle to the silting of rice paddies and irrigated crops downstream.

The **Mamery fokontany** (Figure 36) is vast and have portion of its total area that goes beyond the boundaries of the study area in its northern part. We have nevertheless decided to include it among the intervention sites as it is the only fokontany part of the project intervention districts (here Toliara II) which comprises a portion of its area for which the company World Titanium Resources has obtained an operating license.

The Mining Lease Area (MLA) of Tulear Sands project currently has a surface of nearly 12 square kilometers, making it the largest active mining project in the region (see location in Figure 36 and peak of the works in Figure 37). The ilmenite sands deposit are found several hundred square kilometres around in the area, so expansion projects are already on the map[134]. The operation is planned for the hundred years to come and its operations will consume nearly 30,000 litres of water per minute[135]. One of the infrastructure projects is the construction of a haul road that would cross portions of primary forests still untouched (a portion of this road would be included in the Mamery *fokontany* proposed as a project intervention site)[136].

Figure 36: Selected sites for Ranobe sector

Figure 37: Drilling operation in the mining lease of Tulear sands project

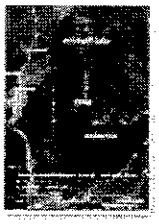

Fig36

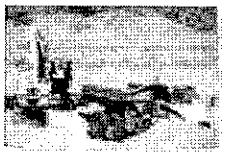

Fig37

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In addition to its impacts on biodiversity, the mine will move whole villages, sacred burial sites and will consume a large amount of water that of which we ignore the long-term environmental consequences. This could affect the living conditions of populations and the hydrology of this semi-arid region. Although some notables of the region are tempted

[134] http://www.worldtitaniumresources.com/ranobe-project/mineral-resource/

[135] WTR Ranobe forest mining, Madagascar, Environmental Justice Atlas Online (2015).

[136] Coastal & Environmental Services (CES), 2013, Ranobe Mine Project Southwest Region, Madagascar: Draft Environmental and Social Impact Assessment, Draft prepared by CES for World Titanium resource (WTR), April 2013

to go ahead, local people through advocacy groups have expressed strong opposition to a project with that many unknown possible impacts.[137]. An environmental permit has nevertheless been issued by ONE (March 2015).

It seems important that the project have presence in this major emerging threat site to strengthen the capacity of local people to learn about their rights in this kind of situation. According to its social and environmental assessment plan, World Titanium complies with the Equator principles[138] and therefore must comply with their specifications. The company has social and environmental responsibilities and is accountable for the impacts of its activities. The firm has to propose mitigation and compensation measures and must provide auditable business indicators of social and environmental performance.

Mamery *fokontany* has portion of is surface in Ranobe PK32 protected area and in its southern part includes sites with very high conservation priority (top decile of conservation priority for biodiversity). Until very recently, new species and / or populations of species that were thought lost or absent were discovered in the area[139]. A very strong deforestation took place in the northern part of the *fokontany* between 2001 and 2015 due to charcoal production activities and Tavy cultures.

The protected area of Ranobe PK32 is a category V area according to IUCN, with a co-management model. The project could reinforce the capacity of stakeholders in the development and implementation of management plans. A WWF aerial surveillance project in partnership with the Belgian aviation and Protected Areas System of Madagascar (MPI), has been relatively successful in reaching its current target of a 50% reduction of slash and burn practices in the Ranobe Protected Area PK32 by 2017[140]. Such initiatives should be strengthened and supported.

Both the *fokontanys* (Antanimena Maikandro and Mamery) selected in this area for intervention and/or CCA creation undergo considerably high human pressure according to our index This is resulting from a high deforestation rate and a very high amount of bush fires. Furthermore, Antanimena Maikandro has a relatively high population density.

Betioky Sector: Miary

The fokontany of Miary (Figure 38) in the town of Behavoha Ankazombalala, Betioky District, contains in its southern part a good portion of the special reserve Bezaha Mahafaly. Although this fokontany includes in its northern part but a small portion classified as top decile of conservation priority, it still houses patches of primary forest slightly connected to the Bezaha Mahafaly protected area that have a great score in terms of conservation priority (Figure 25). These patches of forest are connected to consistent forest areas extending almost continuously north up to Onilahy River. These forests north of the Miary site are subject to relatively little deforestation and human pressure (Figure 38). It would be interesting to strengthen the connectivity between the forests of the Miary site with the rest of the landscape by the establishment of a forest corridor in the Miary fokontany from Bezaha Mahafaly protected area towards the northern borders of the fokontany.

The protected area of Bezaha Mahafaly has experienced strong deforestation in its southern part and Miary is classified as having a high human pressure index because of its deforestation rate. Also, the fokontany is crossed by one of the unique tracks of the region (which promotes human pressures by accessibility). One of a kind, the protected area Bezaha Mahafaly was, until recently (2009), home to the only protected gallery forest in Madagascar (Figure 39). It is classified category IV according to IUCN. This reserve benefits from a partnership with the School of Agricultural Sciences (ESSA-Forests) and is financially supported by the Liz Claiborne Art Ortenberg Foundation and is helped by the Tany Meva Foundation for the implementation of research and training programmes in the reserve and its surroundings. There is, therefore, a good synergy for the development of a landscape type of conservation approach that does not simply stick to the boundaries of the reserve.

In addition to its values in terms of biodiversity, the area has many cultural attractions that make it interesting for tourism. As for wildlife, it is one of the good bird watching sites west and south of Madagascar, including 6 species of the endemic families of Vangidae, giant Coua and green pigeons. The diurnal lemurs of Beza (sifaka lemurs) are easy to find and seems to accommodate with close observation.

Beza Mahafaly also offers a multitude of landscapes such as gallery forest, xerophytic thicket, grasslands savannas bristling with termite mounds, a temporary wetland, favourite place of wild ducks in the rainy season, but gradually giving way to various crops (onions, corn, beans) as well as canyons of sandy and rocky areas. Added to this is the culture of the Mahafaly people. Their name means "those who make taboos". They are very attached to their zebu which are omnipresent in the veneration of the ancestors. Graves are expertly decorated of aloalo (wooden funerary sculpture) and many zebu horns killed in the preparation of the funeral. In addition to all this, visitors to Beza Mahafaly can visit

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[137] Toliary Sands dans la tourmente, mardi 7 avril 2015, par Léa Ratsiazo, tribune.com Madagascar

[138] Coastal & Environmental Services (CES), 2013, Ranobe Mine Project Southwest Region, Madagascar: Draft Environmental and Social Impact Assessment, Draft prepared by CES for World Titanium resource (WTR), April 2013

[139] New population of rare giant-mouse lemurs found in Madagascar - See more at: http://wwf.panda.org/wwf_news/?191725/New-population-of-rare-giant-mouse-lemurs-found-in-Madagascar#sthash.TD95qkLW.dpuf

[140] WWF, Bulletin d'informations, MWIOPO, Madagascar, Juillet 2013.

the rock salt deposits and the manufacture of local rum. To top it all, it has a museum that helps appreciate the reserve and its biodiversity, the Mahafaly culture[141].

To the local community's request, the reserve was enlarged up to 4600 ha in 2005. This is an excellent indicator of the willingness of local people to engage and participate in community conservation.

Fig38

Fig39

Click here to access images

Figure 38: Site selected, Miary sector

Figure 39: Forest gallery in the reserve of Behaza Mahafaly

[141] https://essaforets.wordpress.com/sites-dapplication/beza/

Annex 7: Summary of Technical Reports from PPG phase

Study 1: Baseline study on ecosystems, biodiversity and protected areas, Rabemananjara Henintsoa. March 2015

Study 2: Report, PPG activities, BDLUP, technical functionnal and environnemental requirement, Djoan Bonfils, Avril 2015

[this report can be viewed in the PRODOC Addenda: http://bit.ly/1PiE3CW].

Study 3: Report, PPG activities, Potential sites for creation of community conservation areas, Djoan Bonfils, July 2015

Study 4: Résultats des Consultations Communautaires pour le développement du PPG (Partie Nord et Sud de la Région de Atsimo Andrefana).

Annex 8: Social and Environmental Screening Checklist and Template

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

The SESP file in MS Word can be accessed at: http://bit.ly/1ORi8YZ.