PLAN VIVO PROJECT DESIGN DOCUMENT

Voi Aina:
Agroforestry And Mangrove Restoration in Eastern Madagascar

Madagascar

Version 2.0
13/06/2024

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Contents

Overview

Project Title:	VOA AINA: AGROFORESTRY AND MANGROVE RESTORATION IN EASTERN MADAGASCAR
Location:	Madagascar: Antsiranana and Fianarantsoa provinces
Version:	2.0
Project Coordinators:	Climate Lab & Graine De Vie
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Validation Date:	31/08/2023 – 19/12/2024
Project Intervention(s):	Key project interventions include (i) mangrove rehabilitation and (ii) agroforestry planting, with a focus on Eastern Madagascar. A full list of specific project interventions is provided in §3.6.
Project Participants:	The project initial aim is to work with specific communities near two core project areas: 1 community in the Sava region and 1 community around the Fitovinany project zone.
Project Area:	The project initial aim is to establish restored ecosystems across ca. 337 hectares: 14 ha in the Sava region and 323 ha in Fitovinany region. Over time, the project area will be gradually extended to scale-up the project impact.
Project Period:	A project period of 30 years is applicable. The project started in January 2022 with baseline measurements and the first planting and environmental activities, and will end in 2052.
Methodology:	The project follows the PM001 Agriculture and Forestry Carbon Benefit Assessment Methodology, applied to the Mangrove Planting Specifications and the Agroforestry Specifications.
Expected Carbon Benefit:	107 403 tCO2e (initially)
Expected Ecosystem Benefit:	Boost for the floristic biodiversity (Shannon index) of the mangroves and woodlands within a broader agroecosystem mosaic
Expected Livelihood Benefit:	Combination of fish, crabs and shrimps with the sustainable collection of fruits (mango, avocado, lemon, medlar, plum, orange, jackfruit)

1 General Information

1.1 Project Interventions

The Voa Aina project aims to establish climate resilient (agro)ecosystems and support sustainable livelihood across Eastern Madagascar. For this purpose, a holistic, seedling-based approach is developed jointly with the participating communities, based on the socio-ecological context of two provinces (faritany mizakatena): Antsiranana and Fianarantsoa. The main intervention types are (i) to rehabilitate destroyed mangroves, and (ii) agroforestry planting. Implementation of the project will boost carbon sequestration, sustainable agricultural productivity, fruit production, fishery and climate resilience.

The triple interventions lead to:

- Improving biodiversity leading to enhanced ecosystem services;
- Regenerating vanished mangroves and improved marine ecosystem services and fisheries;
- Increasing climate resilience through carbon sequestration in soil and biomass;
- Improving sustainable agricultural productivity through agroforestry and planting fruit trees;
- Engagement of the members of the communities, living in and around the project areas, in project activities, tree planting and through socio-ecological plan vivo credit re-investments.

The project activities take place in two initial geographic clusters:

1) Fianarantsoa province, including Fitovinany region in the eastern part of Madagascar, near the town of Manakara (Betampona). The formerly forested region is to date highly degraded, to grassy savannah, due to devastating bush fires.
2) Antsiranana province, including the communes of Ambohitralanana, Sahantaha, Ampohibe, Tanambaon'I Daoud, Fanambana, Ampondra, Vohemar and Ambalambe, but with an initial focus on the village of Andasibe, at the northern coastline, where vanished mangrove areas will be restored.

The Voa Aina project initial aim is to establish restored ecosystems and agroforestry plots across ca. 337 hectares: 14 ha in the Antsiranana area and 323 ha in the Fianarantsoa area. In Fianarantsoa, in the first year, 105 ha will be established in Betampona; thereafter 54 ha in Mitanty, 18 ha in Ankitaina and 5 ha in Analavory; and around Mananjary moving to (and beyond) 337 hectares.

Over time, the project area will be gradually extended to scale-up the project impact.

1.2 Management Rights

1.2.1 Project Boundaries

In Annex 1, we present shapefiles showing the boundaries of the project regions and initial project areas. We refer to Annex 1, but to give an overview we provide a general map here below.

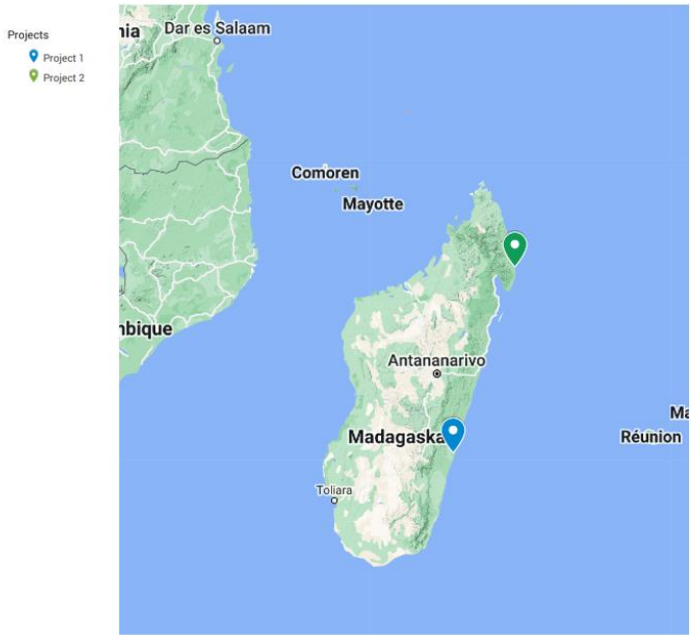


Figure 1.2.1 : Location map of the project sites: “project 1” or Fitovinany region (blue dot); and “project 2” mangrove areas (green dot). The capital Antananarivo is indicated.

1.2.2 Land and Carbon Rights

In its legal framework of 2006, the government passed Law No. 2006-031 (Loi No. 2006-031 de 24 Novembre 2006 fixant régime juridique de la propriété foncière privée non titrée). Law No. 2006-031 (2006) recognizes private property rights to untitled, customarily held land. It allows individuals and groups asserting rights to untitled land to obtain certificates recognizing their rights from the local land administration office (la Collective Décentralisée). The legislation has brought formal and informal tenure systems into alignment and thereby increased tenure security (Leisz 1998; Teyssier et al., 2008). Consequently, the land tenure at the different project zones is clear and secure, as summarized in Table 1.2.2.

Landholdings in Madagascar are highly fragmented. The average landholding is about 1 hectare, ranging from an average of 0.5 hectares for the poorer households to an average of 1.8 hectares for the wealthiest. Forty percent of the land held by the wealthiest households is irrigated, compared to 27% of the land held by poorer households. Madagascar has a formal land tenure system that recognizes individual freehold tenure under formal law and a community-based customary land tenure system. The systems are governed by national-level, formal law and community-based rules that regulate access and use (Evers et al. 2006). In terms of ownership, land can be owned by the state, individuals or groups. Landowners have the rights of exclusive possession and use of their land, and land is freely transferrable. Land can be held in ownership if it is titled or the ownership rights of an individual or group are recognized by a land tenure system and can be recorded. An estimated 90% of farmers own the land that they cultivate (World Bank 2003; Bellemare 2009; ROM Land Law 2005). Under formal law, both women and men have equal rights to land and natural resources (World Bank 2003; Jacoby and Minten 2006; Rasambainarivo and Ranaivoarivelo 2003).

Tenure security varies in Madagascar depending on the strength of customary systems and conflicts between the customary systems and formal land laws. Most land rights held under customary tenure are clearly defined and understood. A prior government policy that did not recognize many customary landholdings was a growing source of tenure insecurity. Under customary law, land in Madagascar is perceived as the land of the ancestors (tanindrazana). Although land may become individualized, many believe that land must be titled or recorded in some fashion before an individual can claim perpetual ownership rights to the plot (Bellemare 2009).

Around the Manakara project zone (Fianarantsoa), the valleys are typically cultivated and the principle crop here is rice, the hillsides (tanety) are used for growing dry-land crops such as manioc (cassava), ground nuts, beans and fruit trees. Rights to own and work on the land are determined by the social structure and history of migration. The valley floors are more fertile and have abundant water and are thus a scarce and treasured resource. At the project area (Betampona), the land ownership is private (ca. 30 owners) and determined by inherited rights and traditional Antemoro holdings. Land is passed down in families within tarikas. Immigrants are typically dependent on them as tenant farmers. The fokontay monitors the use of the land and decides how newly arrived people will gain access to the land. The hillsides are not scarce and land ownership is determined differently. One can sometimes gain right to the land simply by planting and working on the land. Interviewees (see further) stated that every hillside that is not cultivated, does not belong to anyone. The land can be used for pasturage or trees can be planted to claim ownership.

The mangrove rehabilitation activities take place in the intertidal zone (which is by definition a communal resource), while agroforestry activities take place on private lands. Community-based management of natural resources was brought about by the 1996 Law on Secure Local Management ("Gestion Locale Sécurisée" - GELOSE) (Law No. 96-025), which provides time-bound transfer of management rights ("transferts de gestion") for natural resources to local communities. Further enhancement for local communities was provided in 2000 under the Forest Management Contracts ("Gestion Contractualisée des Forêts", GCF) decree, which transfers management of the forests to local communities on mutually agreed contractual terms. Regulation N°2010-137 regulating the integrated management of coastal and marine areas of Madagascar ("portant réglementation de la gestion intégrée des zones côtières et marines de Madagascar", GIZC) on integrated management of coastal areas sought to create a more integrated and sustainable development path for coastal zones. The 2015 Law on the code of fishery and aquaculture (No. 2015-053 "portant code de la pêche et de l'acquaculture") addresses the governance role of local communities and bans most conversions of mangroves into aquaculture installation. The Environmental Investment Decree (referred to as "MECIE", Décret N°99-945 of 1999, amended in 2004) together with inter-ministerial order No 4355-97 on the definition and delimitation of sensitive areas (Arrêté No 4355-97) defines mangroves areas and their immediate impact areas as "sensitive zones". Such zones, except for those on titled land, are state property under Forestry Law N° 97-1200.

With respect to rights to potential carbon rights, Decret No. 2013-785, the Delegation of Management (for forests) confirms that ownership rights to carbon rest initially with the state. However, the national REDD+ coordination office (Bureau Nationale de Coordination (BNC)-REDD+) issued a policy document in May 2018 (Strategie Nationale REDD+ Madagascar) which was formalized by Decret No. 2018-500. This text states that, in relation to carbon incomes, project promoters who have generated GHG emission reductions through their active contribution have a legal right to carbon benefits.

Consultations have been undertaken with the REDD+ coordination office of the Government of Madagascar (Bureau National de Coordination REDD+) and the Office of the Minister of

Environment, Ecology and Forests. During the discussions, it became clear that Decret 1113 (dd. 12 January 2022) (Décret relatif à la régulation de l'accès au marché du carbone forestier) is only applicable to REDD+ projects, and does not apply to this Plan Vivo project as it is a tree-planting project related with the voluntary carbon market. We refer to the Letter of Approval in Annex 15.

Table 1.2.2 Land and Carbon Rights

Project Area	Ownership and user rights status	Carbon rights	Evidence
Mangrove intervention (Antsiranana Province)	Area tenured by fokotany (sea as a common resource)	Carbon rights initially belong to the State (but can be delegated)	Photographs of project area + Arrêté No 4355-97) + Law N° 97-1200 + agreement DRED
Agroforestry intervention (Antsiranana, Fianarantsoa)	Land tenured by individual citizen (private smallholder plot)	Carbon rights belong to the State (but can be delegated)	Project agreement with the owners of the private plots

2 Stakeholder Engagement

2.1 Stakeholder Analysis

2.1.1 Stakeholder Identification

Based on 3 subsequent community meetings (réunions villageoises) per project area, and after 50 semi-structured interviews near the project zones, we completed table 2.1.1 to identify and describe the main stakeholder groups that could influence or be affected by the project. We included the likely impact, influence and engagement of each stakeholder group and stated whether they are considered local stakeholders or secondary stakeholders.

Table 2.1.1 Stakeholder Analysis

Stakeholder Group	Stakeholder Type	Impact	Influence	Engagement
Coastal communities in Antsiranana (Andasibe)	Local stakeholder	Moderately positively impacted by project	Medium influence on project	Engaged through physical activities, fisheries, community project agreement and socio-environmental reinvestments
Individual participants engaged in agroforestry	Local stakeholder	Moderately positively impacted by project	Medium influence on project	Engaged through agroforestry, smallholder project agreement, fruit harvest benefits

Communities in Fianarantsoa	Local stakeholder	Moderately positively impacted by project	Medium influence on project	Engaged through physical activities and socio-environmental reinvestments
State of Madagascar (including the DREDD at regional level)	Secondary stakeholder	Low positively impacted by project	Medium influence on project	Engaged through regulatory processes and letters of agreement (see Annex 15)

2.1.2 Indigenous Peoples and Local Communities

We follow the IUCN Environmental and Social Management System definition of Indigenous Peoples: "(i) peoples who identify themselves as "indigenous" in strict sense; (ii) tribal peoples whose social, cultural, and economic conditions distinguish them from other sections of the national community, and whose status is regulated wholly or partially by their own customs or traditions or by special laws or regulations; and (iii) traditional peoples not necessarily called indigenous or tribal but who share the same characteristics of social, cultural, and economic conditions that distinguish them from other sections of the national community, whose status is regulated wholly or partially by their own customs or traditions, and whose livelihoods are closely connected to ecosystems and their goods and services" (IUCN 2016).

At the Fianarantsoa project zone, Antemoro people inhabit the area. The Antemoro (or Antaimoro) is one of the ethnic groups of Madagascar living between Manakara and Farafangana on the southeastern coast having around 500,000 people. The ethnic group traces its origins back to settlers who came from Somalia. They are descended from Muslim seafarers who are believed to have arrived on the southeast coast in the 15th to 16th century. In the Malagasy language, "Antemoro" means "people of the coast". The Antemoro adhere to the traditional spiritual beliefs and practices, common throughout the island, although different Antemoro clans and families incorporate aspects of Islam to varying degrees. East African Bantu, Arab and Islamic influences strongly mark Antemoro culture. The Antemoro were reputed across the island for being the only ethnic group to have developed a written form of the Malagasy language, sorabe, which used Arabic script. This form of writing was largely replaced elsewhere by the Latin alphabet under the Merina monarchy in the 19th century. The Antemoro were also widely reputed in the pre-colonial period for their astrologers who are known for predicting the future based on lunar phases. They were known all across Madagascar and acted as advisers at the court of many Malagasy kings. The Antemoro speak a dialect of the Malagasy language, which is a branch of the Malayo-Polynesian language group derived from the Barito languages, spoken in southern Borneo (Thompson & Adloff, 1965; Bradt & Austin, 2007; Campbell, 2012).

Other groups are less distinct from the national community and therefore not included in Table 2.1.2. In that respect, it can be noted that the most important ethnic groups near the Manakara zone include the Antemoro (see above), while there are also some Merina, Antefaisy, Sakalava, and Betsileo present. In the mangrove project zones, Betsmisaraka and Antankarana groups are present. To date and in practice, there are no known conflicts in the project zones.

Table 2.1.2: Indigenous Peoples and Local Communities

Indigenous Peoples or local communities.	Rights to land or resources in the project area(s)	Governance structure	Involvement of women and marginalised groups	Engagement
Antemoro	No direct right to the land of the Manakara project zone, but influencing as neighbouring communities	Centralized decision-making with important role for the traditional kings (*andrianony*) and informal caste system	Limited involvement of women and marginalised casts in decision making.	Involvement of the Antemoro king (*roi*) in the project design; involvement of neighbouring Antemoro communities in project design and execution

2.1.3 Disputed Land or Resources

In Central Madagascar, theft by Dahalo or cattle thieves can occur, who often may set fires in the tanety (hillsides) in order to hide the tracks of the cattle. The stolen cattle may sometimes be hidden in the forests before they are moved out of the area. Thieves work in two teams: one team steals the cattle to hide the cattle in the forest. There, the second team takes the cattle, moves the cattle and sells the animals. The cattle may be sold in big cattle markets in the capital or may be exported overseas.

However, this issue does not occur near our project regions in Eastern Madagascar, where land resources are not disputed. Sometimes, land demarcation conflicts occur with big land owners across Eastern Madagascar (who cultivate cacao, vanilla and clove), but this is not a problem near our project areas.

2.2 Project Coordination and Management

Graine De Vie and Climate Lab are the project coordinator organisations that will take overall responsibility for the project (see Table 2.2).

We refer to Annex 1 of the approved PIN for an information sheet on both organisations. We refer to Annex 2 for legal documentation.

The project coordinators will take care of the higher-level project activities, such as financing, developing project management guidelines, monitoring, and integrated assessment of the project activities. At the local level, they will be responsible in managing the project activities on the ground, including administrative bureaucracies and working with the direct beneficiaries of the project who will undertake the activities of the project. These include farmers, associations of farmers, or any parts of the community who can contribute to the project starting from seedling growth to forest management. In all the project activities, the involvement of other potential stakeholders, such as research institutions are appreciated (see §5.1).

Table 2.2 Responsibility for Project Coordination and Management Functions

Project Coordination and Management Function	**Responsible Party/Parties**
Stakeholder engagement during project development and implementation	GDV*/GDVM
Ensuring conformance with the Plan Vivo Standard and compliance with applicable policies, laws and regulations	CL
Developing technical specifications, land management plans and project agreements with project participants	GDV/GDVM
Ensuring that the PDD is updated with any changes to the project	CL
Registration and recording of management plans, project agreements, monitoring results, and sales agreements	CL
Managing project finances and dispersal of income to project participants as described by the benefit sharing mechanism	GDV/GDVM
Managing Plan Vivo Certificates in the Plan Vivo Registry	CL
Preparing annual reports and coordinating validation and verification events	CL
Securing certificate sales and other means of funding the project	CL
Assisting Project Participants to secure any legal or regulatory permissions required to carry out the project	GDV/GDVM
Providing technical assistance and capacity building required for project participants to implement project interventions	GDV/GDVM
Monitoring progress indicators, livelihood indicators and ecosystem indicators and providing ongoing support to project participants	GDV/GDVM
Measurement, reporting, and verification of carbon benefits	CL

*Both GDV Belgium or GDV Luxemburg, each responsible for specific subzones

2.3 Project Participants

Table 2.3 presents the initial and potential project participants and describes their location of residence in relation to the project areas and project region, their main use of natural resources within the project region and their typical use of labour for natural resource management activities.

The project does not directly include any Type II participants (see Table 2.3 for definition).

Graine De Vie and Climate Lab signed an ethical charter not to discriminate based on gender, age, ethnicity, religion or social status when selecting project participants; and aim to engage in community-driven fire management to reduce potential for tensions or disputes within or between communities.

We included a full list of initial project areas in Annex 3.

Table 2.3: Project Participants (grouped by village, area or region)

Project Participant	Participant Type*	Location of Residence	Typical Land Holding	Land and Natural Resource Use
Coastal project communities (Andasibe)	Type I participants	Village neighbouring the first mangrove rehabilitation project zone (see Annex 3)	Field sizes range from 0,2 ha to 2 ha, while total areas under cultivation range between 0,5 ha to a maximum of 4 ha per household (social survey, 2022)	All but one interviewee are engaged in fishing; in the village, about 635 people depend on fishing for their livelihood (social survey, 2022)
Community neighbouring Manakara project zone (Betampona)	Type I participants	Village neighbouring Manakara project zone (see Annex 3)	Average land size per household ranges between 0.5 and 2 ha (social survey, 2022)	Under a third of households have cattle. *Tavy* ("slash-and-burn") is a dominant mode of land management.
Agroforestry participants	Type I participants	Agroforestry participants' location of residence across the Antsiranana and Fianarantsoa Provinces	Average land size per household ranges between 0.5 and 2 ha (social survey, 2022)	Upland rice is commonly cultivated for one season. This is followed by a root crop such as manioc or sweet potato and after the harvest, the land is left to fallow.

* Type I = Project Participants that are resident within the Project Region; who manage and use land or natural resources within the Project Region for subsistence or small-scale production; and are not structurally dependent on year-round hired labour for their land or natural resource management activities; Type II = Project Participants that do not meet the Type 1 definition.

2.4 Participatory Design

During the very first phase of the project activity, the project (i) performed interviews near the project areas during "random walks" in order to gain in-depth understanding of the socio-environmental dynamics and livelihood challenges in the regions, and (ii) organized several meetings with the communities (réunion villageoise). The basis of the participatory governance design is thus the "réunion villageoise".

These first réunions villageoises included group discussions on the livelihood challenges of the community and thereafter involved the training on the participatory mapping procedure, while also ensuring that the communities have an understanding of climate and carbon benefits. If applicable, monitoring responsibilities are discussed, and it is explained that the project benefits may depend on the success of project interventions/sales of the project.

When the 'plan vivos' were developed, members of the project team were present and provided logistical support (paper, pens) but they never steer the 'plan vivo' development. The members of the réunion (and the smallholders) should have full freedom to add any element they prefer on the 'plan vivos'. The members develop a map of the present situation, and a map of the desired situation. Maps are developed in the regional language (Malagasy dialect) or French. After mapping, the local coordinator assesses the cartographic quality of the plan vivos (correct area delimitation, legend) and possibly invites the participating members to make cartographic corrections. The plan vivos are stored in the office in Antananarivo, and scans are stored on a separate drive. Examples are presented in Annex 11.

Through the joint creation of 'plan vivos', stakeholder participation is implemented beyond simply informing or consulting the communities, as not only the project design but also the control over the generated benefits is shared on the long term.

We provide evidence of stakeholder involvement in the participatory design process in Annex 4.

2.5 Stakeholder Consultation

2.5.1 Design Phase Consultations

As stated in §2.4, the design phase consultations started with community interviews and meetings or "réunions villageoises". First, the members of the fokotany are requested to join the meeting – and a date and location is set. Next, the réunion villageois is held; often between 30 to 150 people are participating. A minimum female participation share of 30% is required. The chef du fokotany should be present, as well as the "roi des Antemoro" (only at Manakara). In the réunions villageoises, democratic decision making is guaranteed through equal voting rights.

For every community site, community plan vivo maps were designed during these meetings. These plan vivos are handwritten spatial land management plans, voluntarily produced and owned by the community or community sub-group, which form the basis of an agreement to provide benefit sharing. This voluntary and participatory mapping/planning process addressed the following local socio-ecological needs and priorities:

- Local livelihood needs and opportunities to improve or diversify livelihoods and incomes
- Reduce pressure on the ecosystem by introducing zonal planning (plan vivo mapping)
- Identifying areas where supplemental trees can be cut cyclically
- Land availability and land tenure
- Food security
- Which (parts of the) nurseries could be reserved to establish charcoal-producing woodlots
- Practical and resource implications for participation of women
- Opportunities to enhance biodiversity through planting native or naturalized species

2.5.2 Stakeholder Engagement Plan

After 'plan vivos' are established, extra réunions, discussion sessions, training sessions and workshops are organized together with the local coordinator. During all activities and meetings, additional measures can be taken into account to ensure an improved or more democratic project design. The formalized basis for the long-term engagement is the annual réunion villageoise.

At least once a year, an annual réunion villageoise is organised per fokotany. Project feedback is requested and it is decided how to invest the proceeds of plan vivo sales (socioenvironmental investments) based on the provisions of the project agreement.

Participation of women in all réunions is actively encouraged, by striving towards 50% female participation. Nevertheless, no fixed quotas or legal obligations are given. If desired, separate meetings could be organized in the future (one for male members and one for female members of the community). Overall, gender participation within the projects is evidenced by a female participation grade in the meetings of over 30%. Regarding the project participation of women, it must also be noted that a significant number of nurseries are led by women and that mainly women are involved in nursery activities. It will mainly be women who will be responsible (and receive training) on the selling of fish and fruits.

Complaints and suggestions raised during the annual réunions (or at any other time) are recorded by the project coordinator. A "complaints and suggestions logbook" is available. The logbook is regularly updated and scans are digitally available. Where possible, remediating actions – following complaints and suggestions – are taken. The local project coordinator is responsible to organise extra consultation rounds (if required because of complaints) and remediation actions. We refer to the Grievance Mechanism and Project Agreement for actions in case of dispute.

At least every 5 year, a monitoring round is performed. This assessment also includes semi-structured interviews and group discussions with the communities.

Finally, the project also works together with the different relevant social structures:

(i) Associations. Associations are groups of citizens and households, working together for a common goal. For instance, Graine De Vie works with associations of women, fishermen, farmers, schools and environmental and religious associations (churches) to plant seedlings. Sometimes, associations can be grouped into federations (cooperatives).
(ii) State administration. The project coordinators also work in collaboration with the state administration. The key level of administration is the fokotany (village level). Each village or fokotany has a President appointed by the district administration. Next is the commune level. A commune is run by an elected mayor and consists of several fokontany. Further, Graine De Vie representatives also meet regularly with district, regional and state officials (e.g. DRED).
(iii) Traditional structure. The traditional level of governance also matters, especially in the Fianarantsoa area. The project coordinators have a good working relation with the Antemoro king (roi d'Antemoro). Graine De Vie also engages with rural tarikas and companies. A tarika can play an important role in the social organisation of the villages. A tarika is a family, including all those with common ancestors (a shared tomb). Each tarika has a chief and the chiefs of different tarikas in a village form the leaders of the fokonolona.

2.6 Free, Prior and Informed Consent (FPIC)

2.6.1 FPIC Legislation

We completed Table 2.6.1 to identify any national legislation or legal obligations under the United Nations Declaration on the Rights of Indigenous Peoples (UNDRIP) , International Labour Organization Indigenous and Tribal Peoples Convention 169 (ILO 169) , and other FPIC legislation applicable to the project region, and described the measures in place to ensure that the project follows these.

Table 2.6.1: National Legislation and International Standards on FPIC

Legislation/ Standard	Relevance to Project	Compliance Measures
Requirement of the Bureau National de Coordination REDD+ (BNC-REDD+) of Madagascar on the « Consentement libre, préalable et éclairé / consentement libre, informé et préalable (CLIP) »	Carbon benefit sharing should be based on clear legal rights to carbon, fair negotiation and the CLIP or free, prior and informed consent (FPIC) of participating communities; it should prioritise collective benefits while respecting community norms and preferences.	We refer to the project agreement.
UNDRIP	Article 8.2. One shall provide effective mechanisms for prevention of, and redress for: […] (b) Any action which has the aim or effect of dispossessing them of their lands, territories or resources; (c) Any form of forced population transfer which has the aim or effect of violating or undermining any of their rights	The project recognizes that the participant communities have the right to the project lands, territories and resources which they have traditionally owned, occupied or otherwise used or acquired. The communities have the right to own, use, develop and control the project lands, territories and carbon benefits in line with the project agreement
ILO 169	Article 6.1. In applying the provisions of this Convention, one shall: (a) consult the peoples concerned, through appropriate procedures and in particular through their representative institutions, whenever consideration is being given to legislative or administrative measures which may affect them directly; (b) establish means by which these peoples can freely participate, to at least the same extent as other sectors of the population, at all levels of decision-making in elective institutions and	The project recognizes that the participant communities have the right to the project lands, territories and resources which they have traditionally owned, occupied or otherwise used or acquired. The communities have the right to own, use, develop and control the project lands, territories and carbon benefits in line with the project agreement.

	administrative and other bodies responsible for policies and programmes which concern them; (c) establish means for the full development of these peoples' own institutions and initiatives, and in appropriate cases provide the resources necessary for this purpose.	All consultations carried out are undertaken in good faith and in a form appropriate to the circumstances, with the objective of achieving agreement or consent to the project.

2.6.2 FPIC Process

In Plan Vivo Projects, the term FPIC is used to describe the principles for the negotiation of conditions under which a Project is designed, implemented, monitored, and evaluated:

▶ Free = consent is given voluntarily and without coercion, intimidation, or manipulation.

▶ Prior = consent is sought sufficiently in advance of any authorization or commencement of activities to allow time to understand, access, and analyse information on the proposed activity.

▶ Informed = information provided prior to seeking consent is accessible, objective, and complete.

▶ Consent = a collective decision ("Yes", "No", or "Yes with conditions") made by the rights-holders following their own timelines and decision-making processes with the option to reconsider if the proposed activities change or if new information relevant to the proposed activities emerges.

As explained above, "réunions villageoises" are meetings of an organised group of individuals or households from the whole community that has come together in a shared interest at the invitation of the project team. These meetings were organised well before the start of the certification process and before the start of project activities, with the following mutually agreed upon modus operandi:

- Selection of participants;
- Publication at village hall;
- Open to all other neighbours or people who are interested without exclusions;
- Participation of traditional kings (roi at Manakara) and political leaders (chefs du fokotany);
- Explanation of the initial project aims with request for feedback;
- Creating plan vivo maps, as explained above;
- Agreeing on key for socioenvironmental investments, based on the project agreement;
- Democratic voting system with equal vote rights to formalize possible consent;
- Female participation grade of >30%;
- Agreement with the formal village structure (chef du fokotany) and nomination of representatives to sign the project agreement on behalf of the community.

2.6.3 Initial FPIC

We refer to §2.5.1 and §2.1.1 (initial FPIC was based on 3 subsequent réunions villageoises per project area, and following 50 semi-structured interviews near the project zones).

3 Project Design

Baselines

3.1 Baseline Scenario

We refer to Annex 7 for the description of the baseline scenarios based on an approved methodology. Below, we describe the baseline scenarios from a general perspective.

Fianarantsoa

Currently, the areas that are included in the Betampona project zones basically consist of degraded savannah without vegetation except for grasses (see photographs below). In a scenario without project activities taking place, we can reasonably expect a stable grassland system where future carbon sequestration will be very limited.

Satellite images show how the landscape has changed in the selected area of the Fitovinany project zone in Madagascar. We could compare Sentinel images of the years 2016 to 2022.

In the following images, the reader can recognize the project area over the course of the last years. The indicated black outline represents the planting zone.

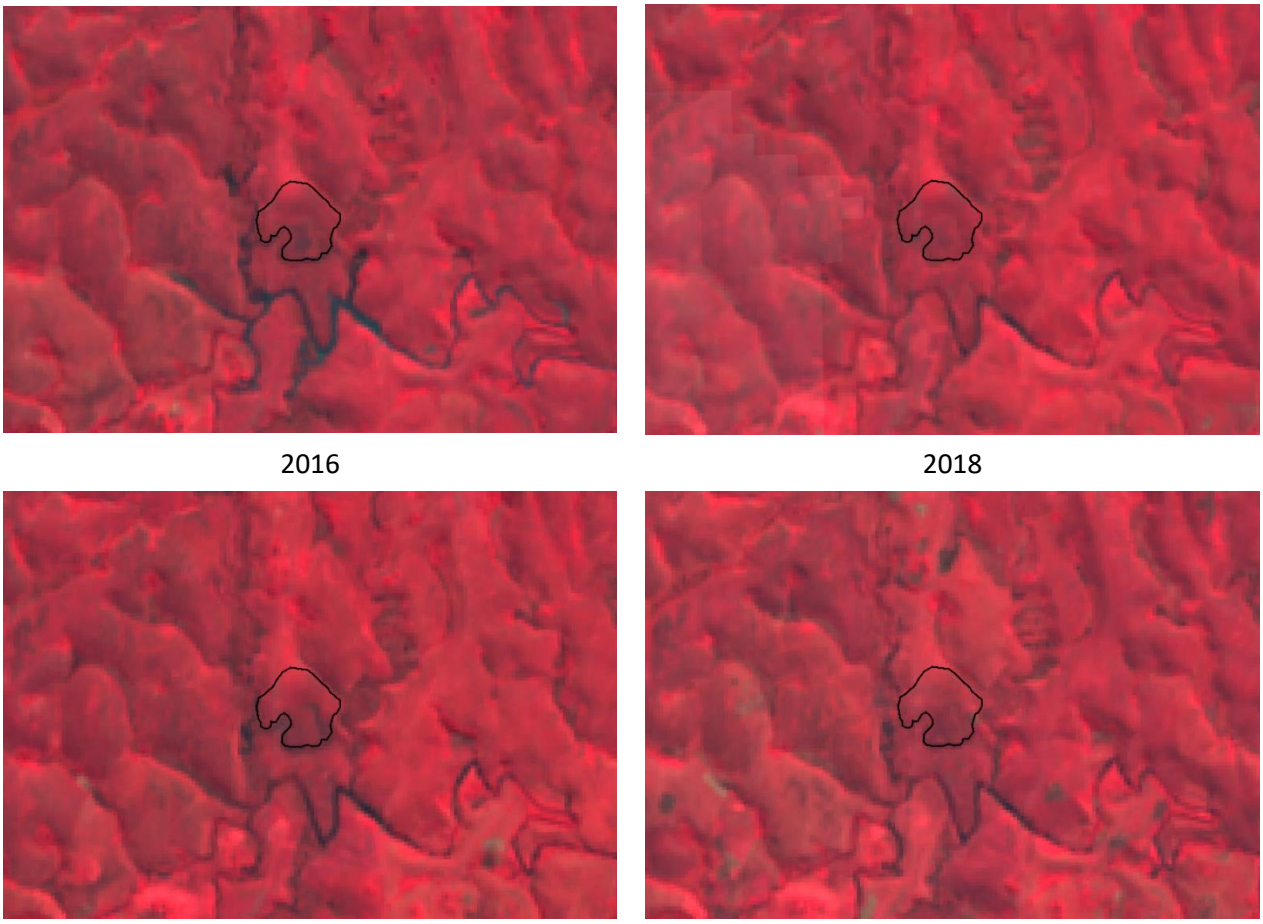


Figure 3.1.1: Sentinel-2 derived False Color Composites of Betampona (Manakara) in Madagascar between 2016 and 2022. The project zone is delimited by a black line on the satellite derived image.

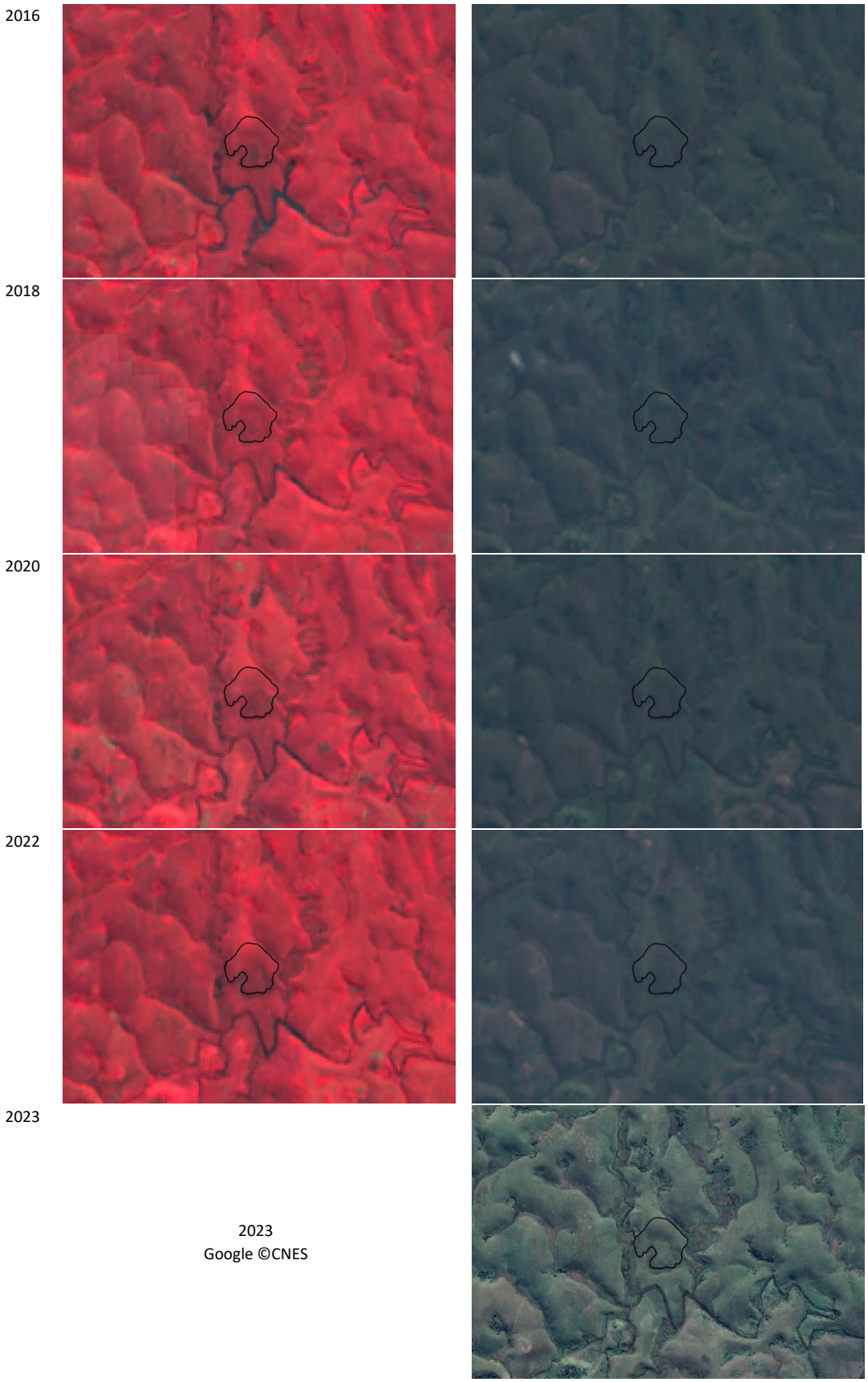


Figure 3.1.2: Sentinel-2 derived Images and False Color Composites of Betampona in Madagascar

between 2016 and 2022. The project zone is delimited by a black line on the satellite derived image.

The project area is indeed only grassy with no evidence of vegetation other than grasses. It is very clear that the situation remains stable over the years. We can reasonably conclude that the area is not naturally regenerating over the course of the last decade. Ecosystem regeneration will most probably not happen without the project intervention.

Figure 3.1.3: View of the project site at Manakara (near Betampona)

Regarding the other Agroforestry plots, we refer to the separate technical specification (Annex 7b) for a description of the baseline conditions. In any case, agroforestry activities are carried out on crop fields without significant woody vegetation standing at present.

Antsiranana

Regarding the **Mangrove rehabilitation project zones**, it is important to note that all project zones are currently located in the intertidal area, but behind the barrier reef. The mangrove seedlings are planted near the coast but in the intertidal zone, and in line with their natural zonation. Nevertheless, to better understand baseline conditions, the coastal changes of a focus zone near Andasibe was followed from 2016 till 2022 using Sentinel high-resolution satellite imagery (False Color Composites).

We thus analysed Sentinel-2 derived False Color Composites of the Andasibe mangrove in Madagascar between 2016 and 2022 (Google Earth Engine, 2023). Spectral band 8 of the Multispectral Imager (MSI) delivers the chlorophyll-reflecting central wavelength of 842 nm (Visible and Near Infrared, VNIR), suitable for mapping shorelines and biomass content, as well as at detecting vegetation changes.

Figure 3.1.4: Viewpoint of the same area, Andasibe, Sava, with project zone indicated in yellow.

As demonstrated by the images below, the coastline has not significantly changed over the past years. The northeastern mangroves have indeed completely vanished after 2004 (source: interviews during Social Survey, 2022). A succession of cyclones Hary (2000), Hudah (2002) and Gafilo (2004) had inflicted major damage to the mangrove ecosystems of the northern coasts.

The forest area on the other hand shows little signs of change over the past decade. We can notice the same dry spots on the map where the density of the trees reduced. The coastal forest is also relatively degraded, which could be linked with the absence of the mangroves since 2004 (which normally provides the protection against cyclones).

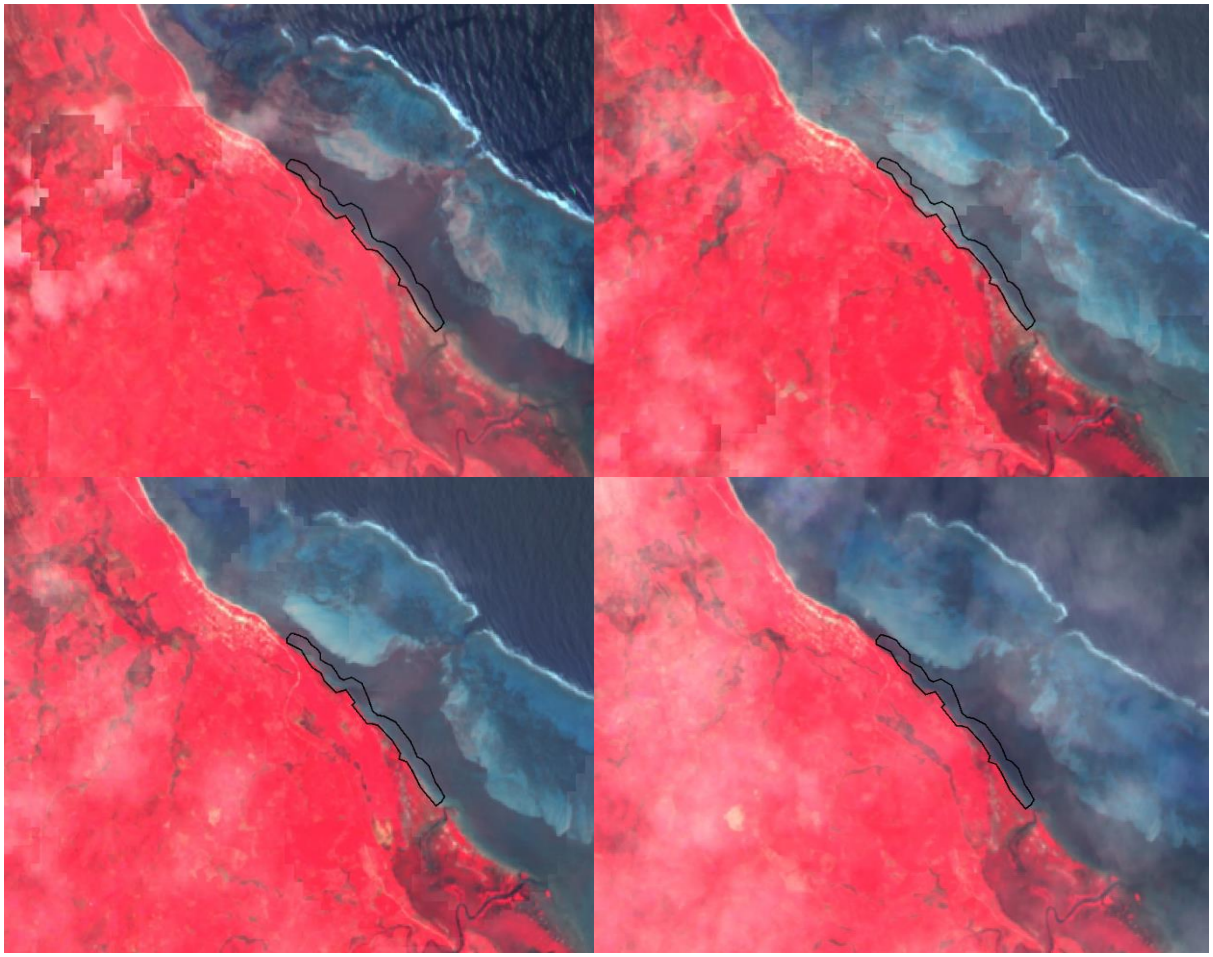


Figure 3.1.5: Sentinel-2 derived False Color Composites of Andasibe Mangrove in Madagascar between 2016 (top left), 2018 (top right), 2020 (bottom left) and 2022 (bottom right). The project zone is delimited by a black line on the satellite derived image.

In conclusion, the spatiotemporal analysis shows that there is no mangrove vegetation in Andasibe nor is there any significant intertidal vegetation change in the period 2016-2022. This corroborates the baseline scenario as presented in the technical specification (Annex 7a)

3.2 Carbon Baseline

The summary of net-greenhouse gas emissions from all initial project areas under the baseline scenario for each year of the first crediting period is included in Annex 7a and Annex 7b.

We refer to Annex 7 (a and b) for the description of the baseline scenarios based on Plan vivo approved methodology (PM001 Agriculture & Forestry Carbon Benefit Assessment Methodology V5). The carbon baseline of the mangrove project areas consists of coastal intertidal area. The degraded status of the nearby coastal forest testifies to the degraded coastal landscape. The time series of satellite images show a stable coastal landscape over the past decade. The expected carbon baseline scenario is therefore that without renewed efforts, no change in carbon stock is to be expected. This is further detailed in the technical specifications (Annex 7a).

The change in carbon stocks in the tree planting project zones can be expected to be zero or even declining in the baseline scenario, under continued pressure from among others fire. The absence of trees in the project zones testifies to the stable, degraded status in 2022. Besides, we follow the Methodology PM001 (Agriculture and Forestry Carbon Benefit Assessment Methodology): The change in carbon stocks expected under the baseline scenario for each project area is calculated with Module PU001 (P6). Module PU001 requires “no change in woody biomass carbon stocks if the conditions in AR-TOOL14 v4.2 section 5 are met” (§5.1.2).

AR-TOOL14 vs 4.2 states in section 5: “Changes in carbon stocks in trees and shrubs in the baseline may be accounted as zero for those lands for which the project participants can demonstrate, through documentary evidence or through participatory rural appraisal (PRA), that one or more of the following indicators apply:

i. Observed reduction in topsoil depth (e.g. as shown by root exposure, presence of pedestals, exposed sub-soil horizons)
ii. Presence of gully, sheet or rill erosion; or landslides, or other forms of mass movement erosion;
iii. Presence of plant species locally known to be indicators of infertile land;
iv. Land comprises of bare sand dunes, or other bare lands;
v. Land contains contaminated soils, mine spoils, or highly alkaline or saline soils;
vi. Land is subjected to periodic cycles (e.g. slash-and-burn, or clearing regrowing cycles) so that the biomass oscillates between a minimum and a maximum value in the baseline;

Module PU001 also requires “removals in soil organic carbon under the baseline scenario are zero for afforestation, reforestation and agroforestry activities that meet the applicability criteria in AR-ACM0003 v2.0 and/or if it can be demonstrated that soil organic carbon stocks are expected to decline under the baseline scenario” (§5.5.1). The applicability criteria in AR-ACM0003 v2.0 apply:

(i) The land subject to the project activity does not fall in wetland category;
(ii) Soil disturbance attributable to the project activity does not cover more than 10 per cent of area in each of the following types of land, when these lands are included within the project boundary: Land containing organic soils; Land which, in the baseline, is subjected to land-use and management practices and receives inputs listed in appendices 1 and 2 to this methodology: Grassland in which soil disturbance is restricted.

In conclusion, the changes in carbon stocks in trees, shrubs and soils in the baseline scenario of the tree planting zones may be accounted as zero.

Table 3.2 provides a summary of net-greenhouse gas evolution from all initial project areas under the baseline scenario for each year of the first crediting period. For details of the calculations, see Annex 7.

Table 3.2 Total net-greenhouse gas evolution under the baseline scenario

Year	Baseline change (t CO2e) Andasibe	Baseline change (t CO_2e) Agroforestry
0-30	0	0

3.3 Livelihood Baseline

3.3.1 Initial Livelihood Status

For Madagascar, the GDP per capita is 501 USD (current US$ 2021) (the seventh lowest in the world). The poverty headcount ratio at $2.15 a day (2017 PPP) is 80.7% of the total population (World Bank, 2023).

According to Global Data Lab (2023), the percentage poorest households (International Wealth Index < 35) is 82.7% in Fianarantsoa (Manakara), while this is 52.3% in Antsiranana and 68.8% at the national level. The mean years of education received by the population (aged 20+) is 4.2 years in Fianarantsoa, 5.8 years in Antsiranana and 5.0 years at the national level. The educational attendance of children (aged 6-8) is 55.3% in Fianarantsoa, 74.8% in Antsiranana and 61.8% nationally, while the percentage of households with electricity is 18.2% in Fianarantsoa, 58.8% in Antsiranana and 38.8% nationally.

Overall, the Antsiranana province has slightly more public service provision than the national average, while the Fianarantsoa province clearly has less. This is also reflected in food insecurity data: the percentage of underweight children is 26.5% in Fianarantsoa, 19.5% in Antsiranana and 26.2% nationally.

At the beginning of 2022, a socioeconomic survey was organized in all project areas. A total of 49 in-depth interviews were conducted (16 around a GDV project in the central highlands, 13 in Fianarantsoa and 20 in Antsiranana). The interviews focused on understanding the dynamics of landscape changes in relation to community livelihood strategies. As expected, grassland fires and tavy (and to a lesser extent forest felling) have been identified by the interviewees as major drivers of landscape change. Yet the interviews also revealed a multitude of other factors involved in landscape change, including cyclones, eucalyptus projects, grazing land maintenance etc.

Antsiranana mangrove zones

In the village Andasibe at the mangrove project zone, 13 men and 7 women have been interviewed. Most of the interviewees are heads of families; all of them are also engaged in crop cultivation. More than 90% of the interviewees cultivate rice, this rice is only used for self-consumption. To a lesser extent, also vanilla, clove nail, manioc and maize are mentioned; these are not intended for auto-consumption. A quarter of the respondents has no crops to sell. Field sizes range from 0,2 ha to 2 ha, while total areas under cultivation range between 0,5 ha to a maximum of 4 ha per household. An average annual rice yield equals to about 0,75 tonnes per ha per year.

Three quarters of the interviewees are actively producing fruits (coconut, banana, jack fruit, breadfruit, avocado, mango). Most of the interviewed households own animals, but these are mainly

chickens and ducks while only three respondents own a few cattle. Only two respondents sell animal products; the rest is intended for auto consumption.

All but one interviewee are engaged in fishing. In the village, about 635 people depend on fishing for their livelihood. Most focus on fish (Mandarantonina, Hemalaza, Fianalandy, Fianpotery), but often shrimps, octopus and crabs are mentioned as well. All fish will be sold (depending on its quality and quantity), ranging between 100 and 700 kg per year per household. Most fish is sold in the city of Antalaha. The prices mentioned vary between 5 000 to 10 000 Ar/kg, thus significantly contributing to the annual household budget. Four out of twenty respondents are member of an association (in this case the Village Saving Loan Association). Most interviewees are able to save cash money (although often not much).

Fianarantsoa zone: landscape change according to interviewees

In the eastern regions of Fianarantsoa, at Manakara, cattle raising is also common, but at much lower densities than in the highlands. Under a third of households have cattle. In comparison, 69 percent of the households in the Antsirabe region own cattle, with an average of 3.6 head per cattle-raising household.

Indeed, most respondents here relate landscape change with the practice of tavy. According to some interviewees, people fled the regime in the colonial era, and fled the coast and cities to start living more inland. People started cultivating and tavy was a big driver of deforestation. Yet, it was not only the native people that deforested the inland, since also the colonialists deforested the highlands to build their houses, the railroads and export the wood. The colonial era ended in 1960, but similar patterns persisted. According to the Manakara interviews, villagers mainly deforest to cultivate (tavy) and to take wood to build houses and make firewood or charcoal. Some call this “écrémage”: first one fells the best wood for construction (“écrémage”: enlever la crème, taking the best trees out); second one burns some other trees for charcoal; third one burns to create cropland (tavy). Some interviewees expressed frustration with the fact that traditionally, rich people were allowed to cut trees while poor people were not. Some suggested that as a result, some people set fire to be allowed to collect the deadwood.

The tavy around Manakara was named by the respondents as ‘culture sur bruli’. It is done in the months leading up to the rainy season, especially around November/December. Farmers burn the standing vegetation in the plot they intend to cultivate. The vegetation may be woodland or uncultivated grassland, long-fallow fields covered with grass, ferns, or bushes, short-fallow fields covered with grass, weeds, and crop stubble. After burning the plot, the farmer turns over large dry clods of the upper layer of soil, thus burying the nutritious ashes. After the rain has softened the clods, the field is levelled and the crop is planted. Sometimes farmers collect additional fuel to burn at their fields, like piles of dry rice straw or cut grasses, to provide extra fertilizer input.

Additional pasture fires remove old grasses, releasing their nutrients, and stimulate a flush of new growth. After the rainy season (December through March) the grasses begin to lignify, or harden with age. As the dry season progresses the stalks dry out and become poor in nutrition and largely unpalatable to cattle. At this point, herders pasture their cattle on crop stubble in fallow fields and on streamside vegetation, not in pastures. In the late dry season (September through November), however, crop stubble and rice resprouts in the valley bottoms are ploughed under in preparation for the rains. This is a difficult time for cattle since the old pasture grasses also do not have any nutritious value at this point but with increasing temperatures and the first tentative rains (September or October), pasture grasses begin resprouting. Burning has several important roles at

this point. First, it removes the dry stalks of old grasses that can impede the access of cattle to the small new shoots. Second, it releases nutrients which are stocked in the old grass back to the soil. This fertilizes the new growth. Third, it overrides the competitive effects of selective grazing, giving favoured forage species a better chance. The resprouts feed the cattle through the annual hungry season. Indeed, pasture fires are necessary “so that the cattle are full” because “what would the cattle eat without fire?”

3.3.2 Expected Livelihood Change

Livelihood changes at the Antsiranana mangrove zones can be expected to be closely connected to environmental changes such as continued mangrove disappearance, sea level rise and coastal and fish stock evolutions. In the Fianarantsoa (Manakara) zones, continued food insecurity can be expected.

Asked to describe the coastal and fish evolution over the past decade, all respondents describe a coastline retreat of about 20m and a weakening of the fish production. According to most respondents, natural mangrove areas shrank over time although most respondents claimed that mangroves do provide food for the aquatic animals. Indeed, in the Antsiranana region, many mangroves have completely vanished after 2004. According to the interviewees, a succession of cyclones Hary (2000), Hudah (2002) and Gafilo (2004) had inflicted major damage to the mangrove ecosystems of the northern coasts. Without further interference, the mangrove ecosystem may have regenerated naturally over a period of approximately five years. Yet, natural regeneration was impeded by the action of collecting and cutting wood (for cooking wood and construction of cabanes). After a few years, the mangroves had completely vanished; to date the areas are covered by sea. No respondents expect the mangrove to return without extra efforts, but most respondents expect further coastline retreat, possibly threatening the village.

In the village Andasibe, no respondents could list any disadvantages of mangroves, but mentioned the following advantages: coastal protection, wind breaking, food for aquatic animals, shade, crabs, shrimps, and safety/shelter for fish. In the future, most respondents are interested in any of the following socioenvironmental projects to take place: (i) mangrove restoration, (ii) establishment of a collaboration system between fishers and sellers so that they can all be economically connected to each other, (iii) having new associations to protect the mangroves and fishermen; (iv) to have groundwater wells installed in the village; (v) other items such as a small hotel to be opened by the association of women, a better school, and small investments such as an office, a concrete seawall and more support for female artisanship.

At the agroforestry project zones, respondents stated that low cattle densities result in undergrazing during the wet season, thus necessitating some form of pasture management. Burning is the most efficient and cost-effective solution (Vogl, 1974; Mistry, 1998). One could state that fire is necessary for pasture management. However, with less cattle in the region, less pasture land is needed for cattle to graze. This provides social opportunities for reforestation and tree planting. Many respondents indeed indicated that they would like to reforest, but only with a focus on the hills.

The key livelihood strategy of the project is to bolster food diversification. The project therefore aims to reinforce the annual income of fishery associations, including the volumes of fish, shrimps and crabs caught and the cash income. In the agroforestry areas, the project aims to strengthen the volume of fruits produced per smallholder (mango, avocado, lemon, medlar, plum, orange,

jackfruit), while holding up the volume of rice, maize, manioc, vegetables, cacao, coffee and/or vanilla produced by the same smallholders.

3.4 Ecosystem Baseline

3.4.1 Initial Ecological Conditions

Topographic and geological features

Madagascar's geology and topography is mainly characterized by a high plateau rising sharply from the narrow plain of the eastern coast and descending in a series of steps to the stripe of sedimentary rocks that stretches along the western coast (Stephenson et al., 2021; Voarintsoa et al., 2012; Tattersall & Sussman, 1975). Deep gorges and waterfalls cut the high plateau that is found much indented inland from the western coast. The Central plateau rises up to 1800 m leaving the lowest part at 800 m a.s.l. It consists of a wide variety of topographies: rounded and eroded hills, massive granite outcrops, extinct volcanoes, eroded peneplains, and alluvial plains and marshes.

Topographically, Madagascar falls into three major zones: the narrow eastern plain, including the steep escarpment, which demarcates it to the west; the rugged high plateau; and the great sedimentary plains of the west and northwest (Tattersall & Sussman, 1975). Fitovinany region lies in the eastern lower plain and the project mangrove areas are located near the northern coast.

The highest peak in Madagascar rises up to 2876 m a.s.l. at mt. Maromokotro in the Tsaratanana Massif in the northern part of the Island. Nearly half of its topography lies above 500 m, which represents a significant hypsometric deviation. The age and origin of this landscape are much debated (e.g. Emmel et al., 2012; Roberts et al., 2012; de Wit, 2003). It is dominated by the central Antananarivo and northern Maromokotro Highlands, each of which has an average elevation of 1.0–1.5 km (Stephenson et al., 2021). In terms of drainage, the rivers of Madagascar flow east and westwards from the central highlands (National Encyclopaedia, 2021). Some of the major lakes of Madagascar are Lake Alaotra in northern-central plateaus, Lake Kinkony in the northwest, Lake Itasy in the central plateaus, and Lake Ihotry in the southwestern part of the Island.

Precambrian (Archean and Proterozoic) rocks crop out in the eastern two-thirds of the island of Madagascar (Figure 2), including all project zones, most of which have been affected by Pan-African (650– 490 Ma) orogenic events (De Wit, 2003). The predominant soil types in the project zones (excluding the mangrove areas), as given in the current soil map (EU, 2013) and a geological map (Schlüter, 2008), are Ferralsols (FR) on acidic rocks and Plinthosols (PT) on basic rocks (i.e., the greenstone belt). Cambisols are found between two flat terrains. Regardless of the various climatic conditions, Haplic Ferralsols (FR-ha) are reported to be predominant on acidic rocks widely distributed from the east coast to the central highlands (Jones, 2013). Haplic Ferralsols are characterized as soils rich in kaolinite and oxides and are generally considered unfertile (Nishigaki et al., 2019). At the coastline, mangrove sediments are found.

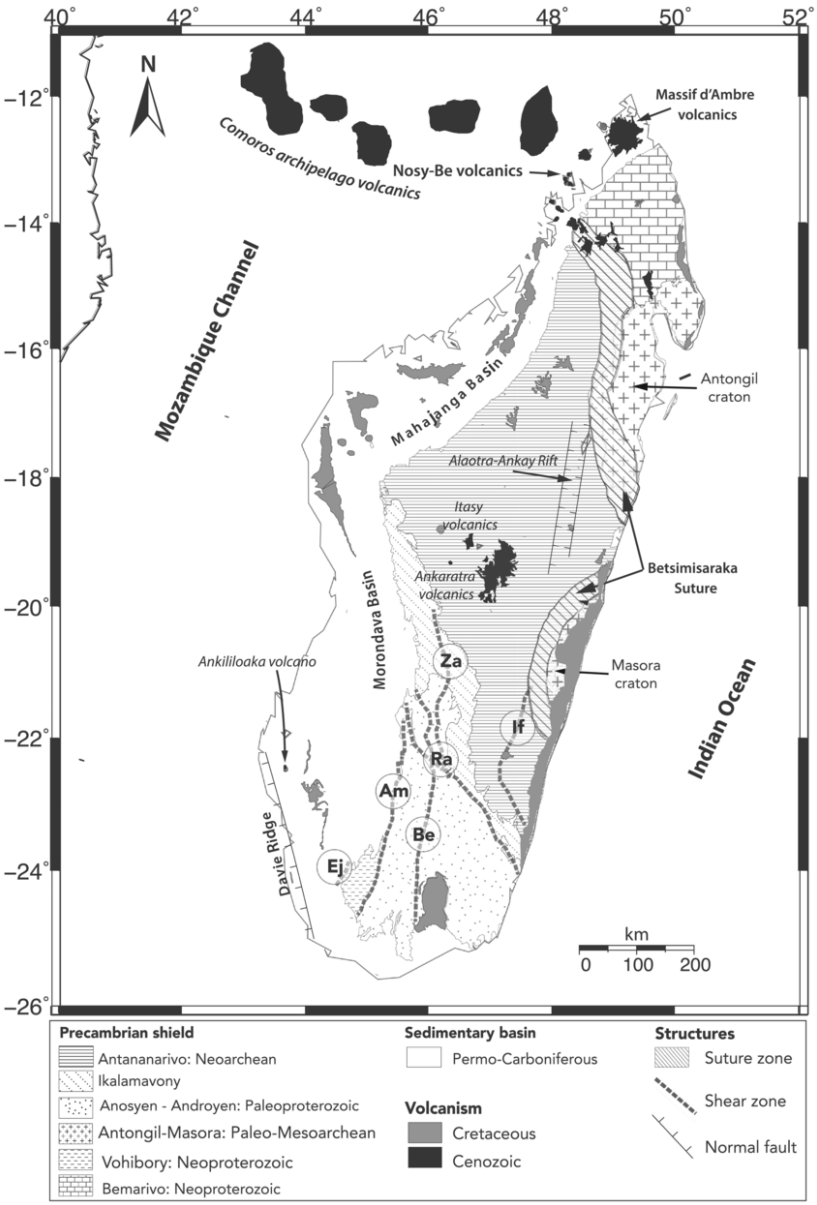


Figure 3.4.1: Simplified geologic map of Madagascar and the Comoros with key geologic features (Rajaonarison, 2020), showing that all project zones are located on the Precambrian shield.

Biodiversity

Madagascar is considered one of the most important islands for the world's biodiversity conservation due to its richness in biodiversity and endemic species. However, threatened by biodiversity loss, the island is a hotspot of habitat degradation (Whitehurst et al. 2009; Myers et al. 2000). It is one of the most biologically diverse places on the planet, with diverse inland environmental conditions and its position in the Indian Ocean. It is recorded that more than 80% of its species are not found anywhere else on Earth. As a barrel of biodiversity (comprising 3.2% and 2.8% of plant and vertebrate animal species, respectively), it was not given the due attention in environmental discourse and land management efforts. Consequently, diverse flora and fauna is threatened by habitat loss and fragmentation (Scales, 2014). Equally important to terrestrial biodiversity, Madagascar is endowed with rich marine biodiversity. Its unique marine biodiversity is

only currently getting protected, long after the first terrestrial protected areas (Ratsimbazafy et al., 2019).

The project zones in Fianarantsoa and Antsiranana are not registered as a protected biodiversity reserve-.

In the Antsiranana zone (the northern coastal area), a natural mangrove zonation should protect the littoral zones against cyclones and coastal erosion, whereas the species closer to the sea help to break waves and the species closer to the land help to break strong winds. Seven key indicator species should occur, along a (simplified) natural zonation rom coast towards the sea:

(i) Avicennia marina
(ii) Xylocarpus granatum
(iii) Rhizophora mucronata
(iv) Bruguera racemose
(v) Ceriops tagal
(vi) Lumnitzera racemosa
(vii) Sonneratia alba

In the Fianarantsoa project zone, which is a humid lowland ecozone, notable endemic/naturalized species include among others Intsia, Mantalise, Mandahifu, Kaya, Albisia, Manalisia and Forahofa. By contrast, key species of the primary dry forests at the central highlands would consist of Dodonea, Symphonia, Podocarpus, Ofiocolea, Eugenia and Tsipips. Russell Mittermeier states in The Eighth Continent: “Madagascar alone is responsible for 21 percent of all primate genera and 36 percent of all primate families, making it the single highest priority for primate conservation. Madagascar is so important for primates that primatologists divide the world into four major regions: the whole of South and Central America, all of southern and southeast Asia, mainland Africa, and Madagascar, which ranks as a full-fledged region all by itself.”

The biodiversity situation in the project zones can be summarized as follows:

Eco-system	Degraded situation	Mature situation
Mangrove		
	Mangrove forest disappeared in SAVA (since the year 2005).	Sideview on natural mangrove in SAVA, near Cap Est.
Dry forest	 	 

Climate information

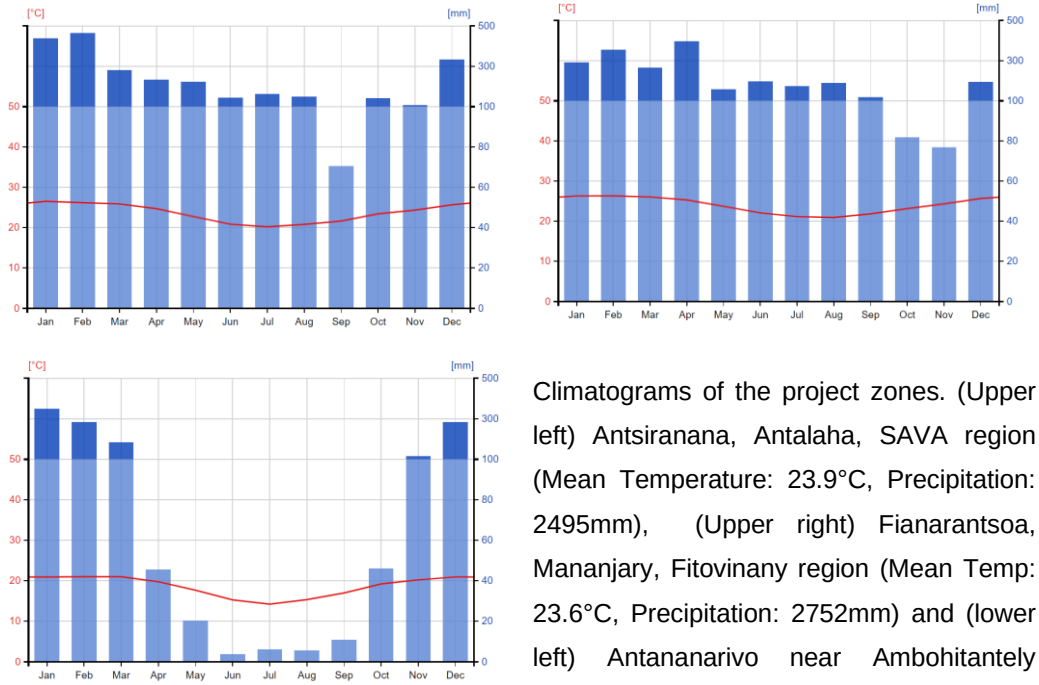
Due to its position in relation to the Indian Ocean, a wide range of topographical characteristics, and varying microclimates, Madagascar's climate is diverse. Madagascar has a N–S range of 1500m mountains located one-third from the east coast, leaving a broad plain in the west. The mountains split the trade winds which divert northward in winter. During summer (Dec - Mar) the trade winds are deep and thermally unstable, and rise over the island producing rainfall of 400 mm/month in the north compared to 100 mm/month in the south. Northern Madagascar is embedded in a tropical circulation fed by the Indian Monsoon (Jury, 2016).

The big rain season is in summer (November – April), whereas rainfall in the winter season is limited to the southern and eastern coasts. Hence, the eastern coasts near the Fianarantsoa and Antsiranana project areas are influenced by the easterly trade winds and receive rainfall much of the year. Further west, the steep topography causes warm and moist air masses resulting in rainfall. The central highlands and drier western regions receive rainfall during summer mostly due to convection

and thunderstorms linked to the Inter-Tropical Convergence Zone (ITCZ). Even during winter, rainfall is received in the southern region of Madagascar. This rainfall may be enhanced in regions of steep topography but remains small with much of the region receiving on average less than 800 mm each year. This contrasts sharply with regions in the northeast of the country which on average receive more than 3500 mm of annual rainfall (Fauchereau et al., 2009; Pohl et al., 2009; Macron et al., 2014).

Sea surface temperatures (SST) around the island exceed 28°C in summer due to pole-ward ocean currents that generate vigorous surface fluxes and tropical weather systems (Sengupta et al. 2001; Send et al. 2001; Halkides and Lee 2011). Mean annual temperatures are greatest along the dry west coast and coolest over the central upland plateaus. Temperature variations depend on location and altitude with minimum temperatures in winter on average less than 5 °C during June and July in the highlands (though some days reach below freezing). Maximum temperatures are highest in spring (October and November) over the west coast, on average greater than 36 °C in some regions, though some days are significantly hotter (Rouault et al., 2012; Biasutti et al., 2012; Fauchereau et al., 2009; Pohl et al., 2009; Macron et al., 2014).

As presented above, the southeast trade winds prevail over the east coast, create cool weather conditions, and release moisture from the ocean. Consequently, it rains throughout the year at the east coast, Fianarantsoa and Antsiranana project zones. From September to November, the rains are not too heavy, and this is valid in general for the entire east coast. The mean precipitation is 3370 mm (with mean temperature of 24.5 oc) along the northern-central east coast at Toamasina and it is 1680 mm (with mean annual temperature of 24.4oc) at Tolanaro, southern east coast. Along the east coast to the south of Toamasina, precipitation decreases gradually, with a more constant rainfall pattern throughout the year, and a relative minimum in September and October. Consequently, rainfall amounts to 2500 mm in Mahanoro and 2,100 mm in Manakara near to the Fianarantsoa project sites.



Climatograms of the project zones. (Upper left) Antsiranana, Antalaha, SAVA region (Mean Temperature: 23.9°C, Precipitation: 2495mm), (Upper right) Fianarantsoa, Mananjary, Fitovinany region (Mean Temp: 23.6°C, Precipitation: 2752mm) and (lower left) Antananarivo near Ambohitantely reserve (Mean Temp: 18.5°C, Precipitation: 1353mm) (Zepner et al. (2020), ClimateCharts.net)

3.4.2 Expected Ecosystem Change

Generally expected land fragmentation

Agriculture is dominated by traditional smallholder systems (Vagen, 2006; Scales, 2014). Generally, in the valley rice is the principal crop. The hillsides (tanety) are used for grazing and the growing of dryland crops such as manioc (cassava), ground nuts and beans (but also rice cultivation). Rights to own and work on the land are determined by the social structure and history of migration. The valley floors are very fertile and have abundant water and are thus a scarce and treasured resource to cultivate rice. The land ownership is determined by inherited rights and traditional holdings. Land is passed down in families within tarikas. Immigrants are typically dependent on them as tenant to farmers. The fokotany monitors the use of the land and decides how newly arrived people will gain access to the land. Only 3 to 15% of the total land area is in title (Fauroux, 1996; B, 1988).

The tanety is not scarce and land ownership is determined differently. One can gain right to the land simply by planting and working on the land (Klein et al., 2007). Uncertainty over landownership can fuel conflicts between recent migrants and established occupants. Sometimes, this may be a result of the inability of the traditional system and the modern legal system to recognize each other (Bertrand, 1999).

Several respondents recognise forest as state (fanjakana) property. This notion may go back to pre-colonial times. The forest is an important sacred place in the villages. It also provides different resources to local farmers like medical plants, honey, special types of wood and hunting. However, firewood is typically taken from planted eucalyptus trees closer to the villages (Klein et al., 2007).

Generally, five categories of land use are well known in Madagascar: forest, agriculture, areas equipped for irrigation, other land, and inland water (WDA, 2021). Agricultural land is the dominant land use with a relative share of three quarters of the land. This includes the share of land area that is arable, under permanent crops, and under permanent pastures. Arable land includes land defined by the FAO (2006) as land under temporary crops, temporary meadows for mowing or for pasture, land under market or kitchen gardens, and land under temporarily fallow. Land under permanent crops is land cultivated with crops that occupy the land for long periods, such as cocoa, coffee, and rubber. The second largest land use is the forested area with a relative share of about 21%. Smaller land use types are the areas equipped to provide water for irrigation, which include areas equipped for full and partial control irrigation, equipped lowland areas, pastures, and areas equipped for spate irrigation. In 2019, the total area equipped for irrigation for Madagascar was 1,086 000 hectares. "Other land" is the land not classified as agricultural land and forest area. It includes built-up area, barren land, other wooded land, etc. In 2019, "other land" for Madagascar was 4,842 000 hectares. Inland water is the area occupied by major rivers, lakes and reservoirs (WDA, 2021).

It is well known that the natural land use in Madagascar is under pressure by fragmentation. In Fianarantsoa, most forest is degraded to savannah grassland. Most Antsiranana mangrove areas have completely disappeared. For a detailed analysis of (baseline) land use change in the different project regions, we refer the reader to §3.1.

Drivers of expected environmental changes

As a driver of land degradation, deforestation has been a serious environmental problem in Madagascar. Initially, in mid of 1980s, it was already warned that forest clearance would lead to significant and apparently irreversible savannisation and even famine (MEEF, 1984). Indeed, after a decade, World Bank (1996) reported that "Madagascar has already lost 80 percent of its original forest cover" and the rest remaining under a sever threat. Poverty was considered one of the reasons for uncontrolled tree clearance. Besides, traditional form of itinerant and subsistent agriculture would have pushed towards burning of savanna and forests (Scales, 2014). Population increases would lead to accelerated deforestation and fragmentation in areas where agriculture is practiced (Pareliussen, 2006).

The dominant mode of land clearance is the "tavy" or slash-and-burn. The central and eastern highlands are marked as a consistently burned landscape in Madagascar. The slash-and-burn farming practice is widely used in the rainforest; rice and manioc are often planted on the burned areas. Hence, primary forest or secondary vegetation is cut, burned and upland rice is cultivated for one season. This is followed by a root crop such as manioc or sweet potato and after the harvest, the land is left to fallow (Styger et al., 2016).

In the savannah areas, pasture burning to create grazing lands for zebu is also common. Zebu cattle plays an important role in social status and is used for different agricultural functions. They are owned by a few cattle owners, who are wealthy in traditional terms, and can possess up to 200-300 animals. People can negotiate with the owners to use the cattle to work the fields. Borrowers have responsibility for the cattle while they are in their custody. Cattle theft is an issue in some project areas. The cattle thieves (sometimes named Dahalo) often set fires in the tanety in order to hide the tracks of the cattle. The stolen cattle may sometimes be hidden in the forest before they are moved out of the area (Klein et al., 2007). It should be noted that sometimes fires can also happen accidentally, e.g. because of cigarettes and plastic bottles.

In any case, fire is an issue in all project regions. The burning was long seen through the perspective of a deforestation narrative dominated by classic western ecologists (see above: narratives of population pressure and fire agriculture). Indeed, the burning has often been criminalized by the colonial and post-colonial state, seeing fire as a threat to development and stability. Kull (2004) argues that the state's antifire politics can be dangerous and fuel disagreements between outside authorities and farmers. Conservation interests and local farmers often have conflicts around the complex issue of fire and local resource use.

However, the use of fire by rural people should not be seen as a merely destructive agricultural tool (Klein et al., 2007). It has a symbolic role as a protest against (colonial) state authority and is an affirmation of Malagasy identity (Jarosz, 1996). Furthermore, it can be an efficient and well adapted strategy for land management in certain agro-ecological systems (Kull, 2000). Slash-and-burn agriculture can be sustainable if the forest is large enough to allow recovery time between uses. The introduction by colonial authorities of cash crops like corn and coffee in the last 100 years in Madagascar has intensified the use of slash-and-burn agriculture (Jarosz, 1996). Areas previously used for rice production were expropriated and used for the cultivation of corn and coffee (Pareliussen, 2006). Fire was then used for pest and parasite control, to clear new land, to fertilize the ground, and to hide the tracks of cattle. Thus, for many farmers, fire is an important tool to sustaining livelihood and maintaining control of the grazelands and croplands (Klein et al., 2007).

Figure 3.4.2: Example of tavy for rice and manioc cultivation near Antalaha, SAVA region, Antsiranana.

To a lesser extent, charcoal production is also considered as another driver of expected environmental change in Madagascar. Charcoal is produced from a variety of ecosystems such as eucalyptus or pine plantations in the central highlands, and natural forests in the lowlands of Madagascar. Due to the lack of other viable energy supply options, nearly 90% of Madagascar's population relies on biomass for their daily energy needs. An estimated 18 million m^3 of wood is annually exploited for wood fuel, of which about half is converted to charcoal. A Malagasy family uses around 500 kg of charcoal per year (Meyers et al., 2006). Furthermore, accelerated

urbanization and rising prices for alternative fuels all contribute to what is expected to be a rise in demand for woodfuels over the next several decades. The charcoal sector is a source of income generation for tens of thousands of people, especially among the poorer citizens. Charcoal production is often focused at specific "charcoal-producing villages", but most villages do have charcoal producers and traders. The way the rural poor benefit from the charcoal value chain is in their roles as either charcoal producers, small transporters, wholesalers, or as contracted laborers involved in loading, repairing, or driving trucks. In urban areas, poorer citizens can work as transporters, retailers, and producers/retailers of stoves (Minten et al., 2013). Charcoal production and trade in Madagascar is regulated through a licensing system. It is however difficult to obtain an exploitation permit. As a consequence of this and because of the high demand for charcoal in urban areas, illicit production and marketing of charcoal is common. Around 80 to 95% of the volume of charcoal is marketed without the required permits (PPIM, 1999). In January 2022, three bags of charcoal would cost 54 000 Ar (use for 1 month). To compare, gas would cost 125 000 Ar (9kg gas, use for 1 month), i.e. more than double of charcoal.

On a final note, when asked about the expected ecosystem change for the mangrove project sites in the baseline scenario, no respondents in Andasibe expect the mangrove to return spontaneously in the intertidal zone without a lot of planting efforts. Most respondents expect further coastline retreat, possibly threatening the village.

Theory of Change

3.5 Project Logic

We completed Table 3.5 to provide a summary of the causal links between project activities and expected outcomes and key assumptions. For a full analysis of the project risks, we refer to § Risk Management.

Table 3.5 Project Logic

Aim To deploy high-quality tree nurseries for establishing climate resilient (agro)ecosystems and supporting sustainable livelihood in degraded lands across Northern and Eastern Madagascar		
	Description	**Assumptions/Risks**
Outcomes		
Carbon Benefit	~337 ha community and smallholder based land rehabilitating, planted with endemic/naturalized/mangrove tree species from local nurseries The project expands to adjacent areas to scale-up the project impact.	The project should not be 'anti-fire' but rather working towards community-based fire management. The project must establish fire breaks to protect regenerating ecosystems against uncontrolled fires. Distributing supplemental tree seedlings for planting in designated zones, will provide wood for subsistence use (charcoal for cooking, timber). Strong involvement of (fishing) communities as project designers and involvement of zebu herders in project

		activities will build a strong project support base. Political/legislative non-amendments are assumed.
Livelihood Benefit	Restoration of 14 towards 300 ha of vanished mangroves, with improved marine habitat conditions and allowing for small fish, crabs and shrimps to return. These directly benefit the income of fishing communities. At least 100,000 fruit trees distributed to the communities providing additional income through interspersed planting by smallholder farmers. Socio-ecological challenges are tackled by community decisions using re-investments.	Forest restoration must go hand in hand with income diversification through distribution of fruit trees (free-of-charge) to the community. Fruits from agroforestry can be sold at local markets. Mangrove restoration will allow for small fish, crab and shrimp populations to revive. These are caught by fishermen, and cleaned and sold by fisherwomen. Fish, crab and shrimp can be sold at local markets (Antalaha). Agricultural production improves through increased soil fertility (agroforestry). Activate community re-investments to tackle socio-ecological challenges.
Ecosystem Benefit	About 1,000,000 endemic/naturalized trees have been planted and are actively protected, these accelerate natural vegetation regeneration and provide a biodiversity habitat.	The restoration areas are protected by community members. Their role is mainly to engage in ecosystem restoration and engagement with communities.
Outputs and activities		
Output 1	~337 ha community and smallholder based land rehabilitating, grasslands planted with endemic/naturalized tree species from local nurseries and where necessary protected from burning by firebreaks.	The project should not be 'anti-fire' but rather working towards community-based fire management. The project must establish fire breaks to protect regenerating ecosystems against uncontrolled fires.
Activity 1.1	Establishing new nurseries provides tree seedlings for forest planting in project areas.	Distributing supplemental tree seedlings for planting in designated zones, will provide wood for subsistence use (cooking, timber), while mitigating against the risk of (displaced) deforestation.
Activity 1.2	Enrichment planting and direct sowing with endemic trees to accelerate ecosystem restoration (final density aim: 400 trees/ha).	Community members help to protect and observe (monitor) the restoration and agroforestry areas, to strengthen the longevity of the planted/sowed species. Which helps to mitigate against

		the risk of community carelessness leading to tree mortality.
Activity 1.3	The project areas are protected by community members. Their role is mainly to engage in ecosystem restoration and engagement with communities.	The main risk of fire is under control, with the help of among others firebreaks.
Activity 1.4	Provide trainings on sustainable forest and water management.	Strong involvement of communities as project designers and involvement of zebu herders in project activities will build a strong project support base. Which helps to mitigate against the risk of community carelessness leading to tree mortality.
Output 2	Restoration of 14 ha toward ~300 ha of vanished mangroves	Improved marine habitat conditions will allow for small fish, crabs and shrimps to return. These directly benefit the income of fishing communities. Which helps to mitigate against the risk of declining fish, crab and shrimp populations linked with degraded habitats.
Activity 2.1	Mangrove nurseries ("pépinières de mangrove ») are established near the project zones.	The nurseries contain a mixture of endemic mangrove species (approximately 10,000 per nursery) including *Avicennia marina, Xylocarpus granatum, Rhizophora mucronata, Brugueria gymnorhiza, Ceriops tagal, Lumnitzera racemosa and Sonneratia alba.* Which helps to mitigate against the risk of natural disturbances.
Activity 2.2	Mangrove seedlings are planted (in intertidal zone but behind the barrier reef)	The mangrove seedlings are planted near the coast but in the intertidal zone, in line with their natural zonation. A barrier reef may need to be present, to protect against the actions of the waves. We follow a cycle of approximately 18 months in total. Regular regarnissage is done to account for mortality rates. Ecologist monitors and studies the drivers of potentially high mortality / low regeneration rates. Regarnissage helps to mitigate against the risk of mangrove degradation.
Activity 2.3	After 2 years, the mangrove health is monitored and regularly	Regarnissage can be done using seedlings from the nurseries, but also using the direct sowing technique (at a

	maintained with enrichment planting ("phase of regarnissage").	1x1m grid) if sufficient mangrove mud is present. Regarnissage helps to mitigate against the risk of mangrove degradation.
Activity 2.4	Involve fishing associations: The mangroves are planted and protected by members of the nearby fishing associations.	Female members of the associations have a key role during planting. The role of the associations is not only to engage in ecosystem rehabilitation, but also to guard the mangrove during and after establishment. This is performed by a "petit comité pour la surveillance » under a rotation system. Community involvement helps to mitigate against the risk of community carelessness.
Output 3	At least 100,000 fruit trees distributed to the communities providing additional income through interspersed planting by smallholder farmers.	Smallholder farmers plant and effectively manage fruit trees
Activity 3.1	Establishing new nurseries provides fruit tree seedlings for agroforestry on smallholder plots	New nurseries are to be established at locations where water is easily available, which helps to mitigate against the risk of juvenile tree mortality.
Activity 3.2	Free distribution and interspersed planting with naturalized fruit trees according to techspec protocol	"Regarnissage" may need to be performed the next rainy season (after survival rate counting), in order to replace underperforming seedlings. Regarnissage helps to mitigate against the risk of mangrove degradation.
Activity 3.3	Long-term management and monitoring of the agroforestry plots in line with the techspec protocol	Weeding is a common aftercare technique. Deadwood is generally removed. Thinning activities may only be used to decrease the quantity of trees in an area to improve the advancement of the rest, and retaining the final tree density. Long term management helps to mitigate against the risk of forest loss.
Output 4	Strong involvement of community members in the project management, defined in project agreements.	Project participants sign a project agreement to engage in project management Smallholder farmers are interested to formally join the project
Output 5	Creating community benefits through socioenvironmental investments	Annual socioenvironmental investments are made in the project areas Community investments are used to tackle socioenvironmental challenges

Technical Specification

For each project intervention, we completed the technical specification template in Annex 7. Thus, two different technical specification are developed (Annex 7a, and 7b). We follow the PM001 Agriculture and Forestry Carbon Benefit Assessment Methodology.

- The Mangrove Specifications are presented in Annex 7a.
- The Agroforestry Specifications are presented in Annex 7b.

3.6 Project Activities

We completed Table 3.6 to provide a summary of the project activities and inputs for each project intervention. We also refer to the separate technical specifications for each project intervention in Annex 7 (a and b).

Tables 3.6 (a, b, c) Project Activity Summary

Table 3.6.a. Forestry planting (Fianarantsoa): Project Activities and Inputs

1. **Establishing new nurseries:** Four nurseries have been established near the project zones. Every year, 80k seedlings are raised (~20k per nursery), of which 40k are planted in the project zones. Species include mainly Intsia, Canarium, and Calophyllum (see Annex 7b), but also Mantalise, Mandahifu, Kaya, Albisia, Manalisia and Forahofa. Every year, another 40k fruit and cacao trees are distributed for free in the four surrounding villages and/or these can be interplanted with the woody seedlings. These seedlings benefit the surrounding communities, by providing fruits and covering daily needs (e.g. heating, construction, fences).

2. **Establishing firebreaks.** The project protects and restores 323 hectare of highly degraded ecosystem areas. The project actively creates effective firebreaks to allow biodiversity recovery, in close consultation with the communities of the villages. The firebreaks have a width of 50m.

3. **Enrichment planting in the project zone**. Through enrichment planting and direct sowing, additional trees are planted per hectare. The survival rate for planted seedlings is about 75% after 6 months. The survival rate for direct sowing is about 40% after 6 months. Every year, more and more areas form the focus of planting, and replenishment planting is foreseen regularly. The final density is 400 trees/ha. The nursery employees and smallholders are involved in protecting the project zone. Their role is mainly to engage in planting, caring and engagement with communities.

4. **Supplemental trees raising.** The four nurseries involved also provide extra seedlings (or equivalent), not to plant in the project zone but to distribute to the communities. These seedlings can be planted in specifically designated zones, allowing for use after 4 years (cutting, charcoal). Obviously, these trees are excluded from the carbon benefit calculations. Nevertheless, the distribution additionally reduces general pressure on the woodlands.

5. **Activate ecosystem co-benefits**. Boosting woody vegetation cover of the project zones is important to improve the *natural water cycle* supplying water access for all the nearby villages and thus also for agricultural production. The project will provide trainings on sustainable water management practices (e.g. water wells as

socioenvironmental reinvestments). Besides, the project will monitor *biodiversity* in a quantitative way, including key flora species.

6. **Involve surrounding communities in post-planting activities**. The local communities will be involved in each step of the project and will be activated in the project as co-designers, daily labourers to collect the seeds, potting, maintaining the nurseries, creating and maintaining firebreaks, and planting, micro-irrigating and taking care of the trees. Zebu herders and charcoal producers are integrated into the meetings and trainings to establish sustainable grazing and charcoal practices as alternatives for traditional fires, on the longer term.

7. **Activate community re-investments**. There are many socio-ecological challenges that could be supported by the plan vivo re-investments at the decision of the communities (Community Fund). Examples are to improve water accessibility by installing wells, to improve children's access to school (in Madagascar, school is not free and many children are deprived of access to schools because their parents do not have sufficient resources), to improve access to power tillers to support farmers in the five nearby communities, etc. We refer to the project agreement for the framework of the re-investments.

Figure 3.6.1: Nursery of Vohipeno (near project zone Manakara). Note that these tree seedlings are strong enough to be collected for planting activities: they do not need shading constructions anymore at this stage.

Table 3.6.b. Mangrove Rehabilitation: Project Activities and Inputs

The mangrove rehabilitation project interventions and activities are described below.

1. **Establishing mangrove nurseries:** Mangrove nurseries (“pépinières de mangrove ») are established near the project zones. The nurseries contain a mixture of endemic mangrove species (approximately 10,000 per nursery) including *Avicennia marina, Xylocarpus granatum, Rhizophora mucronata, Bruguieria gymnorhiza, Ceriops tagal, Lumnitzera racemosa* and *Sonneratia alba.*

2. **Mangrove planting (at intertidal zone but behind the barrier reef).** The mangrove

seedlings are planted near the coast but in the intertidal zone, in line with their natural succession. A barrier reef is present, to protect against the actions of the waves. We follow a cycle of approximately 18 months in total:

a. The first planting phase starts close to the current coastline, with a planting density of approximately 1000 seedlings/ha (Avicennia).
b. During the second cycle, after approximately 6 months, Xylocarpus (ca. 1000 seedlings/ha) and Lumnitzera (1000 seedlings/ha) are planted just seawards of the Avicennia.
c. Rhizophora is planted during a third phase, after another 6 months, at a density of 1000 seedlings/ha.
d. The last planting phase, after about 18 months in total, consists mainly of Sonneratia (at 1000 seedlings/ha). The total amount of seedlings planted thus equals ca. 5000 per ha.

Figure 3.6.2: Fishing community of Andasibe, Sava, with project zone indicated in yellow.

3. **Mangrove regarnissage**. After 2 years, the mangrove health is monitored and regularly maintained with enrichment planting ("phase of regarnissage"). Regarnissage can be done using seedlings from the nurseries, but also using the direct sowing technique (at a 1x1m grid) if sufficient mangrove mud is present. After a total period of approximately 5 years, a naturalized mangrove ecosystem is restored. The area of restoration extends about 50m seawards (in reference to the former coastline) nearby the fishing village, towards about 100m seawards further from the village. The above-mentioned rehabilitation methodology was successfully tested by Graine De Vie at Cap Est since 2011. To date, this mangrove provides evidence for the efficacity of the methodology.

4. **Involve fishing associations in post-planting activities.** The mangroves are planted and protected by members of the nearby fishing associations. Female members of the associations have a key role during planting. The role of the associations is not only to engage in ecosystem rehabilitation, but also to guard the mangrove during and after establishment. This is performed by a "petit comité pour la surveillance » under a rotation system. Besides, a natural mangrove ecosystem provides a habitat for species such as small fish, crabs and shrimps. These are often caught by fishermen, and cleaned and sold by fisherwomen. The project will also support the associations with trainings on sustainable fishery practices and marketing of their products, and on the long-term management,

protection and care of the mangrove planting zone.

5. **Activate community re-investments.** There are many socio-ecological challenges that could be supported by the plan vivo re-investments at the decision of the communities. Examples are to improve fishing materials, to improve children's access to school, to improve access to local fishing markets, etc.

Table 3.6.c. Agroforestry: Project Activities and Inputs

We also refer to Table 3.6.a for the Manakara tree planting. The agroforestry interventions and activities are summarized below.

1. **Establishing nurseries for naturalized fruit trees.** Across the two *faritany mizakatena* involved, nurseries are established with on average 50% of their seedlings being fruit species. The nurseries thus contain approximately 5000 fruit trees per nursery. The dominant species include Mangifera indica (mango) and Persea amaricana (avocado), but also some Citrus limon (citronnier), Mespilus germanica (néflier), Eugenia cumini (jamblon) (and cacao, girofliers, jujube, ravintsara, oranger, jacquier). Grains are often derived from organic waste or from nearby orchards.

2. **Free distribution.** After occasional radio broadcasts and community meetings, interested households can pick up 10 up to 150 and more fruit seedlings to plant at their agricultural fields (at no cost). Generally, people come from a radius of about 20km from the nursery. Planting on the basis of agroforestry techniques not only provides fruit, but also lessens the stress from the illegal exploitation of wood in the area.

3. **Interspersed planting and post-planting activities.** Interspersed planting of agroforestry/fruit trees is done on the individual fields, after an individual plan vivo agreement is made (see Project Agreement). All farmers can receive free agroforestry training. Generally, the planting density for fruit trees is 400 seedlings per hectare. The individual smallholders are thus involved as co-designers, tree planters and tree caretakers, also maintaining firebreaks, micro-irrigating young plants and taking care of the trees on the longer term.

3.7 Additionality

We completed Table 3.7 to provide a summary of the main barriers to project implementation and how they will be overcome for each project intervention. Full details of the additionality assessment, following an approved methodology, are provided in Annex 7 (a and b).

Table 3.7 Additionality Assessment Summary

Manakara tree planting	Main Barriers	Activities to Overcome Barriers
Financial	- Limited funds - Lack of government nurseries - Other priorities	Start-up capital secured; payment for ecosystems scheme supported by Plan Vivo

	Limited private credit availabilities	
Technical	Technical knowledge on intensive nursery keeping, planting techniques and long-term protection is still limited.	Input of environmental scientists; skilled local coordinators; training for local communities; attention towards (socio-economic) ecosystem service valorization (e.g. fruit trees)
Institutional/Social	- "Top-down approach" by the State regarding conservation policies - Century-long tendency towards "anti-fire" policies and politics	- Bottom-up approach with *réunions villageoises*, continued workshops and benefits for nearby communities - Plan Vivo maps as basis for community-based fire management - Installing fire breaks to control fire propagation while not forbidding nor criminalizing fire setting

Mangrove Rehabilitation	**Main Barriers**	**Activities to Overcome Barriers**
Financial	- Limited funds - Other priorities Limited community credit availabilities	Start-up capital secured by Graine De Vie; payment for ecosystems scheme supported by Plan Vivo
Technical	Mangroves disappeared after 2004. Technical knowledge on mangrove service valorization is still limited. Thus, to strengthen the existing efforts, there is ample opportunity for projects focusing on the development of fishery associations.	Academic input of environmental scientists; skilled local coordinator; training for local communities; focus on (socio-economic) fishery valorization.
Institutional/Social	- "Top-down approach", although room is given for local initiatives - Climate policies (e.g. REDD+) large-scale instead of community-based Transferring only responsibilities, not rights, to the local communities	- Bottom-up approach with first consultation round, continued workshops and benefits for fishery communities - Rewarding for implementation results Local communities are not the problem, they are the solution for the environmental issues

Agroforestry	Main Barriers	Activities to Overcome Barriers
Financial	- Very limited farmer cash income to buy seedlings - Limited community credit availabilities Very few other nurseries or governmental nurseries available	- Free distribution of seedlings - High-quality nurseries established by Voa Aina, producing high-quality seedlings Smart use of agricultural lands (optimal combination of crops, fruits, trees)
Technical	- Focus on exotics introduced by French colonizer: Eucalyptus spp. And Pinus spp. Few trainings on agroforestry; expensive technical consultants	Academic input of environmental scientists; skilled local coordinator; technical training for local farmers (for free); fruits production becomes possible.
Institutional/Social	- "Top-down approach", although room is given for local initiatives - Climate policies (e.g. REDD+) large-scale instead of small-scale - Transferring only responsibilities, not rights, to the local communities	- Bottom-up approach with consultation round, continued workshops and benefits from agroforestry - Rewarding for implementation results - Local communities are not the problem, they are the solution for the environmental issues

3.8 Carbon Benefits

We refer to Annex 7 (a and b) for a summary of the expected carbon benefits from each project intervention over the first crediting period and full details of our procedures for estimating carbon benefits, following an approved methodology.

Table 3.8a: Mangrove Rehabilitation: Expected Carbon Benefits Summary

Project Intervention	Initial woody carbon stock (tCO2e/ha)	Baseline Emissions (t CO_2e/ ha)	Project Emission (t CO_2e/ha)	Leakage Emissions (t CO_2e/ha)	Carbon Benefit (t CO_2e/ha)
Mangrove Restoration Planting	0	0	-1426 tCO2e/ha	0%	-1426 tCO2e/ha

Table 3.8b: Mangrove Rehabilitation: Plan Vivo Certificate Potential

Project Intervention	Carbon Benefit (t CO_2e/ha)	Project Area (ha)	Total Carbon Benefit (t CO_2e)	Risk Buffer (t CO_2e/ha)	Achievement Reserve	Uncertainty Buffer	Potential PVCs (t CO_2e)
Mangrove Restoration Planting	-1426	14.1	-20 107	20%	10%	0%	14 075
TOTAL	-1426	14.1	-20 107	20%	10%	0%	14 075

Table 3.8c: Agroforestry - Expected Carbon Benefits Summary

Project Intervention	Initial woody vegetative carbon stock* (tCO2e/ha)	Baseline Emissions* (t CO_2e/ ha)	Project Emission (t CO_2e/ha)	Leakage Emissions (t CO_2e/ha)	Carbon Benefit (t CO_2e/ha)
Woodland restoration	0	0	-402	0%	-402
Orchard	0	0	-348	0%	-348

**Based on AR-TOOL14 v4.2 section 5*

Table 3.8d: Agroforestry - Plan Vivo Certificate Potential

Project Inter-vention	Carbon Benefit (tCO_2e/ha)	Project Area (ha)	Total Carbon Benefit (t CO_2e)	Risk Buffer (tCO_2e /ha)	Leakage Buffer (tCO2e /ha)	Achievement reserve (tCO2e /ha)	Un-certainty buffer	Pot. PVCs (t CO_2e)
Woodland restoration	-402	323	129 846	20%	0%	10%	-	90 892
Orchard	-348	10	3480	20%	0%	10%	-	2436
TOTAL	-375	333	133 326	20%	0%	10%	-	93 328

Risk Management

3.9 Environmental and Social Safeguards

3.9.1 Exclusion List

The project does not include any activities listed in the Plan Vivo Exclusion List (see Annex 8).

3.9.2 Environmental and Social Screening

We completed Table 3.9.2 to provide a summary of the potential risks and impacts identified in the environmental and social risk screening. We refer to §3.9.3 for the environmental and social assessment. We refer to §3.9.4 for the environmental and social management planning.

The focal areas identified in the environmental and social risk screening are related with the issue of fire and the potential leakage from displaced wood cutting.

We include the complete environmental and social screening report in Annex 9.

Table 3.9.2 Environmental and Social Risks

Risk Area	Likelihood (1-5)	Magnitude (1-5)	Significance (low <7, moderate <13, severe <19, high <26)
Vulnerable Groups	3	3	Moderate
Gender equality	3	2	Low
Human Rights	2	1	Low
Community, Health, Safety & Security	2	4	Moderate
Labour and working conditions	1	1	Low
Resource efficiency, pollution, wastes, chemicals and GHG emissions	1	1	Low
Access restrictions and livelihoods	2	4	Moderate
Cultural heritage	1	1	Low
Indigenous Peoples	2	2	Low
Biodiversity and sustainable use of natural resources	1	2	Low
Land tenure conflicts	3	3	Moderate
Risk of not accounting for climate change	3	3	Moderate
Other – eg. cumulative impacts	1	1	Low

3.9.3 Environmental and Social Assessment

We refer to Annex 10 for the environmental and social assessment report.

3.9.4 Environmental and Social Management Plan

We completed Table 3.9.4 to describe the mitigation measures in place to address environmental and social risks and impacts.

Table 3.9.4 Environmental and Social Risk and Impact Mitigation Measures

Risk/Impact	Mitigation Measures	Project Activity
Political risks • The selection of target groups creates social bias. • Political opposition to the project	To minimize the risk from instability and disinterest in Madagascar, we consider it important to work closely with the Office of the Minister of Environment, Ecology and Forests of Madagascar and other relevant authorities at district and fokotany levels.	Activity 1.1 to Activity 3.3

Economic risks: • Insufficient incentive to support project activities • Community support for the project is not maintained • External parties carry out activities that reverse climate benefits, such as cutting and charcoal burning • Rights to benefits are disputed	The project provides regular trainings on (i) technical (forestry) issues; (ii) commercial (NTFP/fishery sales) issues; and (iii) methodological issues (Plan Vivo methodology, responsibilities). The project agreement prohibits external parties to carry out activities that reverse climate benefits, while the project agreement discusses the procedure to handle disputes. Most nurseries provide extra seedlings. These seedlings can be planted in specifically designated zones, allowing for use after 4 years (cutting, charcoal). Obviously, these trees are excluded from the carbon benefit calculations.	Activity 1.1 to Activity 3.3
Administrative: • Capacity of the project coordinator to support the project is not maintained • Technical capacity to implement project activities is not maintained	The project aims to expand its workforce over the course of the project, maximally involving local community members.	Activity 1.1 to Activity 3.3
Carbon leakage risk in mangrove zones: • Passage to the sea and passage of zebu during ebb tide • Risk of partial cyclone destruction of mangrove	The surrounding mangroves and woodlands are included in the zonation maps and village discussions – and are also guarded by “les petits comités de surveillance”; Access routes and routing of zebu during ebb tide are agreed during village meetings.	Activity 2.1 to Activity 2.4
Agroforestry carbon leakage risk: • Fire • Pest and disease attacks • Extreme weather	To reduce risks of pests and disease attacks, seedling planting will involve a biodiverse mix of different endemic and naturalized species. Biodiversity will be monitored (see monitoring section). Firebreaks are installed when relevant. Training sessions are organised at least once per year (e.g. focussing on community-based fire management).	Activity 3.1 to Activity 3.3
Carbon leakage risk at sites (Manakara): • Fire • Tree cutting • Cyclone and inundation	At all project sites, fire breaks (parfeus) are constructed where relevant (15 to 50 m wide). Training sessions and sensibilisation meetings are organised for all communities; community members help in protection.	Activity 1.1 to Activity 1.4

	The project zones and nurseries will always be repaired, replenished and rehabilitated after passage of fire, pests, a cyclone or inundation. Extra seedlings are planted by community members (free distribution) and/or in specifically designated zones, allowing for use after 4 years (cutting, charcoal). Obviously, these trees are excluded from the carbon benefit calculations.	

3.9.5 Native Species

We completed Table 3.9.5 to identify any non-native tree species that will planted or other non-native plant or animal species that will be introduced to the project. All used species are native, except for some naturalized fruit trees involved in the agroforestry intervention (source used: https://powo.science.kew.org/)

Table 3.9.5: Non-Native Species Overview

Project Intervention	**Non-Native Species Planted/ Introduced**	**Justification**	**Risk Assessment and Management**
Agroforestry	Mangifera indica	Mango is widely established and naturalised right across Madagascar. It is an important food source. It will be used in agroforestry plots with some grafted and improved varieties. It can be moderately invasive but is a useful plant already present in the area and provides economic and environmental benefit.	Slight risk of spreading but will be planted amongst indigenous species. Will be used in agroforestry areas only, both in upland and lowland areas. Already naturalised in Madagascar: The mango spread throughout South-East Asia about 1500 years ago and to the east coast of Africa about 1000 years ago (PROSEA, 2013), possibly together with the Austronesian migrations.
Agroforestry	Persea americana	Avocado is widely established across Madagascar and is a	Low risk species – seed quickly loses viability and should be

		useful plant to many communities who use the fruit as a source of food. It is not an invasive species, although it can be easily germinated in nursery conditions. Seedlings grow quickly and continuously under warm, moist conditions.	sown within 7 days (PROSEA, 2023). Will be used in agroforestry areas only, both in upland and lowland areas due to lack of invasive threat. Already naturalised in Madagascar. There is mentioning of avocado in Mauritius in 1780 (Schaffer, 2013).

3.10 Achievement of Carbon Benefits

The project will generate fPVCs and rPVCs (to be transformed to vPVCs after every verification cycle), so a 10% proportion of carbon benefits will be held as insurance against non-achievement of carbon benefits.

3.11 Reversal of Carbon Benefits

We completed Table 3.11 to describe the impact and likelihood of risks to the long-term maintenance of Carbon Benefits from the project. In the Score column, we multiplied Impact and Likelihood scores to give a total score between 0 and 9.

Table 3.11 Risk of Reversals

Risk Factor	Impact	Likelihood	Mitigation Measures*	Score**
Social				
Land tenure and/or rights to climate benefits are disputed	2: Climate benefits would not be issued for affected project area, but the project geographical spread across different project areas would limit the total impact	2: Tenure is secure and agreements and contracts are in place	Project agreements agreed and signed by relevant stakeholders Project logic with wide fire breaks (parfeus) Inclusion of different ethnic groups in voting system of “réunion villageoise”	4
Political or social instability	2: Instability would impact administrative capacities of the project coordinator (see Administrative)	1: After independence, Madagascar has known no (civil) wars	To work closely with the Office of the Minister of Environment, Ecology and Forests of Madagascar and other relevant authorities at district and fokotany levels.	2

			Involve all communities in the project area in all aspects of project implementation to avoid politically driven non-acceptance of the project	
Community support for the project is not maintained	3: Potential impact would be important, although our project areas are explicitly trivial for communities (private plots for voluntary agroforestry, mangrove planting on the sea, Manakara private lands not used for grazing nor cropping)	1: The project is community-driven and communities receive the bulk of the benefits	The project provides extra trainings on (i) technical (forestry) issues; (ii) commercial (NTFP/fishery sales) issues; (iii) methodological issues (Plan Vivo methodology, responsibilities); and iv) a clear understanding from the onset of the proportions of benefit sharing among different stakeholders.	3
Economic				
Insufficient finance secured to support project activities	3: There would be insufficient incentive to support project activities, although that situation would only be temporary	1: The project coordinators are well-established organisations, capable to provide funding even in the absence of carbon benefits	Financial plan developed	3
Alternative land uses become more attractive to the local community	2: Climate benefits would not be issued for affected project area, but the project geographical spread across different project areas would limit the total impact	1: Benefit sharing mechanism ensures attractive benefit delivery to the project participants	Project agreements agreed and signed by relevant stakeholders; extra seedlings can be planted in specifically designated zones, allowing for use after 4 years (cutting, charcoal).	2
External parties carry out activities that reverse climate benefits	2: Climate benefits would not be issued for affected project area, but the project geographical spread across different project areas would limit the total impact	2: Tenure is secure and agreements and contracts are in place	The project agreement prohibits external parties to carry out activities that reverse climate benefits, while the project agreement discusses the	4

			procedure to handle disputes. Project logic with wide fire breaks (parfeus) Inclusion of different ethnic groups in voting system of "réunion villageoise"	
Environmental				
Fire	2: The project zones and nurseries will always be repaired, replenished and rehabilitated after passage of fire, pest, a cyclone or inundation.	2: At all sites, fire breaks (parfeus) are constructed where relevant	Project logic with wide fire breaks (parfeus) Fire management plan elaborated Fire risk assessment conducted and updated regularly Training sessions and sensibilisation meetings are organised for all communities; community members help in protection.	4
Pest and disease attacks	2: The project zones and nurseries will always be repaired, replenished and rehabilitated after passage of fire, pest, a cyclone or inundation.	1: Seedling planting involves a biodiverse mix of different endemic and naturalized species.	Biodiversity will be monitored (see monitoring section).	2
Extreme weather or geological events	2: The project zones and nurseries will always be repaired, replenished and rehabilitated after passage of pest, a cyclone or inundation.	2: Cyclones occur although the project coordinators and communities are experienced and adapted	Cyclones, inundation, fire and pests are included in the monitoring targets to ensure strict follow-up Regarnissage included in the monitoring scheme and annual reporting and follow-up	4
Administrative				
Capacity of the project coordinator to support	3: Potential impact would be important but the communities could	1: The project coordinators are well-established organisations,	Financial plan developed	3

the project is not maintained	take over some responsibilities	capable to provide support even in the absence of carbon benefits		
Technical capacity to implement project activities is not maintained	3: Potential impact would be important but the communities could take over some responsibilities	1: The project coordinators are well-established organisations, capable to provide support even in the absence of carbon benefits	Financial plan developed, nursery manuals developed, technical specifications developed	3

* Generally applicable for Activities 1.1 to 3.3

** If the score is greater than 4 for any risk factor, additional mitigation measures are required to reduce the risk to an acceptable level.

3.12 Leakage

We describe the risk of leakage (outside the project areas), the estimation and monitoring of leakage and leakage mitigation measures for each project intervention in Annex 7 (a and b), based on an approved methodology.

Table 3.12 Leakage Risk Mitigation

Project Intervention	**Leakage Risk**	**Mitigation Measures**
Woodland restoration	AR-TOOL15 version 2.0 states that leakage emission attributable to the displacement of grazing activities is considered insignificant and hence accounted as zero if animals are displaced to existing grazing land and the total number of animals in the receiving grazing land (displaced and existing) does not exceed the carrying capacity of the grazing land. See more details in Annex 7.	A statement of a government official must be made to confirm the location of the grazing lands to where cattle can be displaced (e.g. an area in line with the plan communal de développement), as well as the fact that these grazing lands are not under significant pressure. Above conditions are safeguarded as applicability conditions. In mangrove areas, access routes and routing of zebu during ebb tide must be agreed during village meetings in every project zone. A legal DINA (bylaw at village level) must be available as evidence, and
Mangrove Rehabilitation		

Agroforestry		state that zebu can be displaced towards existing grazing lands. The agroforestry nurseries also provide extra trees and distribute these free of charge. See more details in Annex 7 and risk mitigation activities in table 3.5*.

* Cross reference activities from Section 3.5 (e.g. Activity 1.1.1)

3.13 Double Counting

There are no other greenhouse gas emission reduction and removal projects, programmes or initiatives that overlap with the project areas or that would generate transferable emission reduction or removal credits from carbon pools or emission sources already included in this project.

Carbon benefits achieved by the project will not be included in any other form of greenhouse gas emissions trading.

In every annual report, the project will check emerging regulations that relate to trading carbon credits in Madagascar and state how compliance will be organized (if applicable).

Table 3.13 GHG Emission Reduction and Removal Projects and Programmes in the Project Region

Project, Programme or Initiative	Scope	Carbon Credit Generation	Risk Mitigation
No GHG emission reduction/removal project programmes or initiatives overlap with the project region	-	-	-

Agreements

3.14 Land Management Plans

For every site, community or smallholder plan vivo maps were designed during the “réunions villageoises” or by the smallholders. These plan vivos are handwritten spatial land management plans, voluntarily produced and owned by the community, community sub-group or smallholders, which form the basis of an agreement to provide payments for ecosystem services. This voluntary and participatory mapping/planning process addressed the following local socio-ecological needs and priorities:

- Local livelihood needs and opportunities to improve or diversify livelihoods and incomes
- Reduce pressure on the ecosystem by introducing zonal planning (plan vivo mapping)
- Identifying areas where supplemental trees can be cut cyclically
- Land availability and land tenure
- Food and income security
- Which (parts of the) nurseries could be reserved to establish charcoal-producing woodlots

- Practical and resource implications for participation of women
- Opportunities to enhance biodiversity through planting native or naturalized fruit species.

We provide example land management plans in Annex 11.

3.15 Crediting Period

The initial crediting period is 1 May 2022 – 30 April 2052 (30 years period). In any case, the project will monitor and safeguard project implementations over 50 years. The project period (50 years) is thus longer than the initial crediting period.

3.16 Benefit Sharing Mechanism

The discussions on the benefit sharing mechanism were part of the first “réunions villageoises”.

The community-based benefit sharing mechanism distributes the carbon revenues as follows, after payment of any charges, taxes or similar fees levied by the host country:

- 45% allocated for investment for local community projects in priority sectors (each community may have different priorities, as decided at annual plan vivo assemblies);
- 15% allocated to local community education projects;
- 20% allocated to reforestation projects in the project zones managed by Graine de Vie;
- 20% allocated to project coordinators for administrative and overhead costs.

This distribution key ensures that at least 60% (45%+15%) of income from the sale of Plan Vivo Certificates (after payment of any charges, taxes or similar fees levied by the host country) will directly benefit project participants and other local stakeholders. The annual disbursements will be reported in the annual reports. Once a plan vivo assembly agrees upon a certain investment and a fitting investment budget is estimated, payments will be made to the contractor that wins the bid of the investment. Investments will be subject to standard contracting practice, allowing fair competition for regional contractors. All contracts will be overseen by Graine De Vie.

For more details, monitoring responsibilities, targets and corrective actions, we refer to the (community) Project Agreement. For the smallholder-based benefit sharing mechanism, we refer to the (smallholder) Project Agreement.

3.17 Grievance Mechanism

Complaints and suggestions raised during (annual) meetings (or at any other time) are recorded by the project coordinator. A “complaints and suggestions logbook” is available. The logbook is regularly updated and scans are digitally available. We refer to the project agreement for actions in case of dispute.

During all community meetings the complaint and suggestion book is presented and consulted. In case of a complaint, a remediating solution is sought through community deliberation, and a follow-up trajectory is initiated upon on the complaint. The steps that determine this trajectory depend on the remediation process:

First, in case the issue can be resolved in mutual agreement or consensus during the community meeting, no extra actions are required (except for monitoring the follow-up). If the issue is fully resolved by the consecutive meeting, the follow-up process is ended.

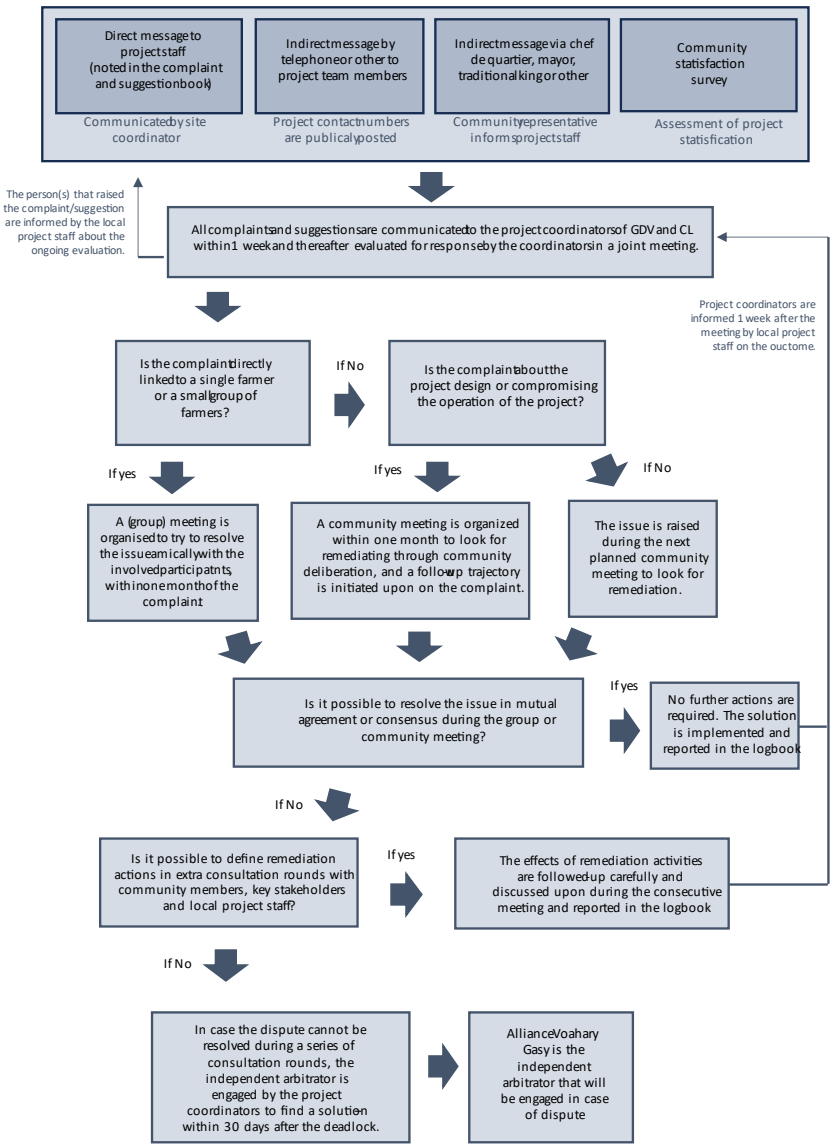
Second, in case no solution is found in mutual agreement during the meeting, the project coordinators are responsible to organize extra consultation rounds to refine remediation actions. Next, the effects of remediation activities are followed-up carefully and discussed upon during the consecutive meeting. If the issue is fully resolved by the consecutive meeting, the follow-up process is ended.

Third, in case the dispute cannot be resolved during consultation rounds, the independent arbitrator is engaged to find a solution – within 30 days after the deadlock. Thus, any grievances that cannot otherwise be resolved, will be mediated through an independent arbitrator. The final arbitrator would be the Alliance Voahary Gasy.

Fourth, regarding suggestions, a community meeting can approve a suggestion in consensus – thereafter actions are defined to implement the suggestion. The effect is followed-up carefully and discussed during the consecutive meeting.

We refer to the Flowchart below, for the full decision flow in case of a complaint.

FLOWCHART
for complaints or suggestions



3.18 Project Agreements

The agreement period equals the crediting period (30 years period), since this is a reasonable time period to expect significant ecosystem changes and mature trees (see Annex 7 a and b).

We refer to Annex 12 for example project agreements, showing all details, the process for entering into project agreements following FPIC principles and measures in place to ensure that project agreements do not remove, diminish or threaten project participant's rights to land and/or resources.

4 Monitoring and Reporting

Indicators

4.1 Progress Indicators

We completed Table 4.1, providing SMART indicators and means of verification for the project operational progress as included in the project logic (Table 3.5). For the Carbon Indicators (indices used to monitor changes in carbon stocks and greenhouse gas emissions in Project Areas relative to the Carbon Baseline), we refer to §4.2.

Table 4.1 Progress Indicators

Output/Activity	Indicator	Means of Verification	Result on non-progress indicators
Output 1 ~337 ha land rehabilitating, grasslands planted with endemic/naturalized tree species from local nurseries and where necessary protected from burning by firebreaks.	P1: Project areas with agreement ensuring protection , from 2022 onwards.	Legal agreement declaring the status of protection and photo report of firebreaks, Annual survival rates	C1, C2, C3, E1, E2, E4
Activity 1.1 Establishing new nurseries provides tree seedlings for planting in project areas.	P2: Nurseries operating and delivering 5000 tree seedlings yearly per nursery for planting in the project areas.	Annual tree seedlings produced per nursery.	C1
Activity 1.2 Enrichment planting with over 600 endemic trees per hectare and direct sowing with about 1000 endemic trees per hectare	P3: Long-term stem density of 400 trees in the project areas with a survival rate of 65% or more for planting (and 40% for direct sowing).	Amount of tree seedlings planted or sown and survival rate per hectare.	C1, C2, E1, E2, E4
Activity 1.3 The project areas are protected by community members. Their role is mainly to engage in	P4: The project planting areas are supervised by community members.	Appointed responsible field supervisor per project area. Reported incidences of	C3, E1, E2, E4

planting, caring and engagement with communities.		disturbance into the restored area	
Activity 1.4 Provide trainings on sustainable forest and water management.	P5: Organization of minimally 1 training or village meeting on sustainable forest and water management per year per village.	Number of trainings provided per village supported by meeting photographs.	L3, E2, E3
Output 2 Restoration of 300 ha of vanished mangroves	P6: Vanished mangrove land protected for ecosystem restoration, starting with 14 ha from 2022 onwards.	Legal agreement declaring the status of protection. Annual Survival rates	C5, C6, C7, E1, E2, E4
Activity 2.1 Mangrove nurseries (“pépinières de mangrove ») are established near the project zones.	P7: Mangrove nurseries operating and delivering >5000 tree seedlings for mangrove restoration.	Annual mangrove seedlings produced per nursery.	C5
Activity 2.2 Mangrove seedlings are planted or regenerated (at sea but behind the barrier reef)	P8: 4000 mangrove seedings regenerated or planted per hectare during a planting cycle of 2 years with a survival rate of 65% or more.	Number of mangrove seedlings planted or sown and survival rate per hectare.	C5, C6, E1, E2, E4
Activity 2.3 After 2 years, the mangrove health is monitored and regularly maintained with enrichment planting (“phase of regarnissage”).	P9: Additional enrichment planting in year 2, based on the specific mangrove conditions.	Number of mangrove seedlings planted in year 2 for “regarnissage” purposes.	C5, C6, C7, E3
Activity 2.4 Involve fishing associations: The mangroves are planted and protected by members of the nearby fishing associations.	P10: Organization of minimally 1 training or village meeting with the fishing associations per year per village.	Number of trainings/meetings organized with the fishing associations per village supported by meeting photographs.	L2, L3, L5
Output 3 At least 100,000 fruit trees distributed to the communities providing additional income	P11: Annual distribution of 4000 fruit and rent trees per municipality to	Number of fruit and rent trees distributed, supported by signed declarations and mini Plan Vivos.	C4, C8, L1

through interspersed planting by smallholder farmers.	community smallholder farmers.		
Activity 3.1 Establishing new nurseries provides tree seedlings for agroforestry on smallholder plots	P12: Nurseries operating and delivering 4000 fruit and rent tree seedlings yearly per municipality for agroforestry on smallholder plots.	Annual amount of fruit and rent tree seedlings produced per nursery.	C8
Activity 3.2 Free distribution and interspersed planting with naturalized fruit trees according to techspec protocol	P13: Planting of 4000 fruit trees by smallholder farmers, with a survival rate of >65%	Amount of fruit and rent tree seedlings planted.	L1
Activity 3.3 Long-term management and monitoring of the agroforestry plots in line with the techspec protocol	P14: The agroforestry plots are sustainable managed by smallholder farmers; leading to a long-term stem density of 400 trees.	Agroforestry mini Plan Vivo maps and milestone-based payment scheme.	C9, L1, L3
Output 4 Strong involvement of community members in the project management, defined in project agreements.	P15: % of smallholders having agreement on protecting the project areas	Smallholder agreements on project areas	L2
Output 5 Creating community benefits through socioenvironmental investments	P16: Annual socioenvironmental investments made in the project areas (in Ariary)	Reports and contracts of socioenvironmental investments, photographic evidence	L4

4.2 Carbon Indicators

We completed Table 4.2 to provide a summary of the carbon indicators included in Annex 7, that will be monitored for each project intervention.

Table 4.2 Carbon Indicators

Project Intervention	Carbon Indicator	Means of Verification
Fianarantsoa (agro)forestry	C1: Number of seedlings planted per hectare in the project areas	Registration of tree seedlings leaving the nurseries for enrichment planting in the project areas and coordination of planting activities by the project team.
	C2: Survival rate of seedlings planted and DBH growth of trees planted	Monitoring of survival rate of seedlings planted, around 6 months after the planting event. A dedicated monitoring team is specialized in this activity. This also includes survival rate counting in year 3; DBH monitoring based on a representative sample of 10% of the trees in year 5, 7 and 10. (see Annex 7b - techspec)
	C3: Number of observations of uncontrolled fires and displaced cutting and charcoaling in and around the project zones	Registration of observations made by project staff and/or mentioned during the yearly meeting with the community.
	C4: Number of extra tree seedlings planted by community members and/or in designated zones	Registration of supplemental tree seedlings leaving the nurseries for planting by community members and/or in designated zones.
Mangrove rehabilitation	C5: Number of mangrove seedlings planted per hectare during a planting cycle of 2 years	Registration of mangrove seedlings leaving the nurseries for enrichment planting in the mangrove rehabilitation areas and coordination of mangrove planting activities by the project team.
	C6: Survival rate of the mangrove seedlings planted in the mangrove rehabilitation area and DBH growth of trees planted	Monitoring of survival rate of mangrove seedlings planted, around 6 months after the planting event. A dedicated monitoring team is specialized in this activity. This also includes DBH monitoring based in the fixed plots to be resampled every 5 years (see Annex 7a - techspec).

	C7: Number of observations of cyclones, uncontrolled fires, displaced cutting and diseases.	Registration of observations made by project staff and/or mentioned during the yearly meeting with the community.
Agroforestry	C8: Number of fruit and rent tree seedlings planted in agroforestry plots	Registration of fruit and rent tree seedlings leaving the nurseries for planting in agroforestry plots, supported by smallholder Plan Vivo maps.
	C9: Long-term survival rate and DBH growth of fruit trees planted in agroforestry plots	Long-term milestone based monitoring of tree growth by the project team. This includes survival rate counting in year 1 and 3; DBH monitoring based on a representative sample of 10% of the trees in year 5, 7 and 10. (see Annex 7b - techspec)

4.3 Livelihood Indicators

We completed Table 4.3 to describe the indicators that will be used to monitor the livelihood status of project participants and other local stakeholders, and risks of negative social impacts. The indicators were defined after discussion with the project team, after taking in the feedback from 3 community meetings per project area. The set is selected to be able to track the project impact on livelihood conditions.

Table 4.3 Livelihood Indicators

Livelihood Indicator	**Means of Verification**
L1: % of communities having established agroforestry plots with fruit and rent trees	Reporting or photographs
L2: % female participation during the annual *réunion villageoise* per project area	Reporting and photographic evidence in Annual Report
L3: Organised trainings on sustainable tree management, fishery and agroforestry	Reporting and photographic evidence of trainings in Annual Report
L4: Ariary spent on socioenvironmental reinvestments	Financial reporting in Annual Report
L5: Annual income of fishery associations, including cash income and volumes of fish, shrimps and crabs caught	Financial statements of the fishery associations

L6: Volume of fruit produced (mango, avocado, lemon, medlar, plum, orange, jackfruit) by smallholder, as well as the volume of rice, maize, manioc, vegetables, cacao, coffee and vanilla produced by the same smallholder	Five-yearly social questionnaire taken from subsample of smallholder participants

4.4 Ecosystem Indicators

We completed Table 4.4 to describe the indicators that will be used to monitor ecological conditions risks of negative environmental impacts in the project region.

Table 4.4 Ecosystem Indicators

Ecosystem Indicator	Means of Verification
E1: Above Ground Biomass conditions in the restoration areas	Systematic vegetation monitoring in nested plots (see Annex 7 for all details). Baseline assessment in 2022, to be repeated every 5 years.
E2: Plant-species richness in the mangrove rehabilitation areas	Based on the vegetation survey, the total number of species in the community (richness S), as well as the proportion of species i relative to the total number of species (pi) can be calculated. We use the Shannon's diversity index as a robust index for biodiversity status in the project areas. The evolution of the Shannon index will be reported every 5 years.
E3: Fire occurrence, cyclones and pests in the ecosystem areas and in the direct vicinity of the project area	Observations of fire are reported in community meetings.
E4: Soil organic carbon content in the mangrove rehabilitation areas	Systematic soil organic carbon monitoring with mixed samples (see annex 7a for all details). Baseline assessment in 2022, to be repeated every 5 years.
E5: Faunal recolonization by crabs of the previously degraded mangrove areas as an indicator of ecosystem health	Counting crabs in six fixed 1x1 m quadrants across the project area (during 1-hour observation sessions), to be resampled every 5 years

Monitoring

4.5 Monitoring Plan

We refer to the monitoring plan in Annex 13 for an overview and flowchart of specific monitoring and verification activities. Hereunder, we provide the general project monitoring guidelines:

Method: The sampling approaches and methods are described in §4.2, §4.3 and §4.4.

Frequency: Overall, as fPVCs and rPVC are issued based on the expected carbon benefits, annual progress reports will present activity-based indicators to determine whether the project activities are being carried out as needed to achieve the expected benefits.

In parallel, every 5 years (at minimum) a full-scale (carbon) monitoring round will be organised to transfer towards vPVCs with yearly verified carbon measurements.

Responsibility: The monitoring plan is a shared responsibility of the project team. Climate Lab takes the lead in preparing the annual and 5-yearly Plan Vivo monitoring reports. Graine de Vie has the resources and capacity to collect the required monitoring data.

Area: progress and carbon indicators are monitored in representative samples areas with similar baseline and project interventions.

Risk mitigation: progress indicators for risk mitigation are monitored in a representative sample.

The project will start with a dedicated monitoring team responsible for data gathering (see Annex 13.2 for the "monitoring flowchart"). However, the project has the ambition to train more and more community members over the coming years, enabling local communities to collect data (with a focus on ecosystem observations, survival countings and DBH measurements).

4.6 Progress Monitoring

The annual milestones or targets of the progress indicators are listed in table 4.6. The targets are subdivided in three categories: full, partial and missed target.

There are the following consequences for certificate issuance and corrective actions that will be implemented if the yearly performance targets are not met (mitigation actions):

(i) If the values for all indicators meet or exceed their performance target, the full issuance is received;
(ii) If one or more of the indicator values are below its performance target for one monitoring period, the full issuance is received but corrective actions must be implemented;
(iii) If one or more of the indicator values are partially achieved for two consecutive monitoring periods, the full issuance is received but corrective actions must be implemented.
(iv) If one or more of the indicator values are missed for two consecutive monitoring periods or partially achieved for three consecutive monitoring periods, certificate issuance is withheld until corrective actions have been implemented and the performance target(s) have been reached.

Table 4.6 Progress monitoring

Progress indicator	**Annual milestone or target**		
	Full Target Achievement	**Partial Target Achievement**	**Missed Target**
P1: Project areas with project agreement ensuring protection by community groups	100%	-	<100%
P2: Nurseries operating and delivering tree seedlings for planting in the project areas	≥ 5000 seedlings nursed per year	Between 5000 and 3000 seedlings nursed per year	<3000 seedlings nursed per year

P3: Survival rate of forest tree planting	≥ 65%	Between 50% and 65%	< 50%
P4: All project planting areas are supervised by community members	1	-	0
P5: Organization of minimally 1 training or village meeting on sustainable forest and water management per year per village.	≥1	-	<1
P6: Protection of vanished mangrove land for ecosystem restoration	1	-	0
P7: Mangrove nurseries operating and delivering tree seedlings for mangrove restoration.	≥ 5000 seedlings per 2 year	Between 3000 and 5000 seedlings per 2 year	<3000 seedlings per 2 year
P8: Mangrove seedlings regenerated or planted per hectare during a planting cycle of 2 years	≥ 4000 seedlings/ha per 2 year	Between 3000 and 4000 seedlings/ha per 2 year	<3000 seedlings/ ha per 2 year
P9: Survival rate of mangrove planting	≥ 65% and regarnissage in year 2 and when necessary	Between 50% and 65% and regarnissage in year 2 and when necessary	<50% or no regarnissage in year 2 and when necessary
P10: Organization of minimally 1 training or village meeting with the fishing associations per year per village.	≥1	-	<1
P11: Distribution of fruit and rent trees to community smallholder farmers.	≥ 4000 fruit seedlings distributed for free	Between 2000 and 4000 fruit seedlings distributed for free	< 2000 fruit seedlings distributed for free
P12: Nurseries operating and delivering fruit and rent tree seedlings for agroforestry on smallholder plots.	≥ 4000 fruit seedlings nursed per year	Between 2000 and 4000 fruit seedlings nursed per year	< 2000 fruit seedlings nursed per year
P13: Survival rate of planting of fruit trees by smallholder farmers	≥ 65%	Between 50% and 65%	< 50%
P14: Milestone-based stem density of agroforestry plots that are sustainable managed by smallholder farmers.	≥ 400 trees/ha	Between 250 and 400 trees/ha	<250 trees/ha
P15: % of smallholders having agreement on protecting the project areas	100%	-	<100%
P16: Annual socioenvironmental	≥ 45% allocated for local community	-	<45% allocated for local

investments made in the project areas (in Ariary)	projects in priority sectors and ≥ 15% allocated to local community education projects		community projects in priority sectors and <15% allocated to local community education projects

4.7 Carbon Monitoring

The carbon monitoring scheme follows a double track:

- At annual pace, the performance indicators are monitored throughout the crediting period. This allows to follow-up on the activity based indicators underpinning the carbon estimation as described in Annex 7a and b.

- At a 5-year pace, carbon verification rounds are organized. This allows verification of estimated carbon sequestration and recalibration of the carbon model to fit the measured carbon sequestration rates based on field measurements. Every verification round is verified by a VVB. If the project expands, the frequency of VVB verifications could be accelerated in the future.

4.8 Livelihood and Ecosystem Monitoring

4.8.1 Livelihood Monitoring

For each of the livelihood indicators listed in Section 4.3, we identified targets for each period of 5-years throughout the crediting period.

Livelihood Indicator (section 4.3)	**Baseline (2022)**	**5-year target**
L1: % of communities having established agroforestry plots with fruit and rent trees and number of households enabled by the project (fishery/agroforestry) to meet their livelihoods threshold	0	100% of the communities
L2: % female participation during the annual *réunion villageoise* per project area	0	30%
L3: Organised trainings on sustainable tree management, fishery and agroforestry	0	1 training per community per year
L4: Ariary spent on socioenvironmental reinvestments	0	See Project Agreement
L5: Annual income of fishery associations, including volumes of fish, shrimps and crabs caught	523 kg fish and 184 kg shellfish	Statistically significant increase of the association income, ceteris paribus
L6: Volume of fruit produced (mango, avocado, lemon, medlar, plum, orange, jackfruit) by	0	Statistically significant increase of the smallholders income, ceteris paribus

smallholder, as well as the volume of rice, maize, manioc, vegetables, cacao, coffee and vanilla produced by the same smallholder		

4.8.2 Ecosystem Monitoring

For each of the ecosystem indicators listed in Section 4.4, we identified targets for each period of 5-years (or less) throughout the crediting period.

Ecosystem indicators (section 4.3)	**5-year target**
E1: Above Ground Biomass conditions in the restoration areas	Statistically significant increase in Above Ground Biomass in the restoration areas in line with Annex 7 - techspec
E2: Plant-species richness in the mangrove rehabilitation areas	2% increase of plant-species richness, based on the Shannon diversity index.
E3: Fire occurrence, cyclones and pests in the ecosystem areas and in the direct vicinity of the project areas	Min. 1 regarnissage organised after each disturbance event
E4: Soil organic carbon content in the mangrove rehabilitation areas	Statistical significant increase in in soil organic carbon content in the ecosystem regeneration areas in line with Annex 7a – techspec
E5: Faunal recolonization by crabs of the previously degraded mangrove areas as an indicator of ecosystem health	Statistical significant increase in crab presence over time ($p<0.05$)

4.8.3 Sharing Monitoring Results

Performance-based, ecosystem and livelihood monitoring results are discussed directly with all local stakeholders involved to the project during the annual réunion villageoise. This allows for direct feedback from the community members in réunions villageoises and to adjust the project design if issues arise.

Parallel, the project will disseminate monitoring results to the broader society by setting-up joint workshops with local governments to inspire communities outside the project areas.

In addition, monitoring results will be shared in the annual report submitted prior to verification, transparently published on the Plan Vivo website.

Reporting

4.9 Annual Report

The project annual cycle runs in parallel with the calendar year, with a start of the annual cycle on 1 January. Indeed, the baseline measurements and environmental activities began in 2022. Annual reports will be submitted in January of the running year.

Monitoring rounds will be organized (at minimum) in 2027, 2032, 2037, 2042, 2047 and 2052 (end of the project).

4.10 Record Keeping

All project data are stored on a shared project drive with limited access (Google Drive). The project data (technical data, financial data, monitoring data) are updated on the drive at least once per month.

In Annex 14, an overview of the general database architecture is included. Note that this a dynamic environment, subjected to changes over time. The database includes the following first-level folders:

A. Admin
B. Financing
C. Land titles, rights and agreements
D. Environmental
E. Livelihood
F. Government
G. Plan Vivo documents
H. Spatial data
I. Media
J. Monthly reports

5 Governance and Administration

5.1 Governance Structure

The schematic diagram of the governance of the Project Organisational Structure is presented in Figure 5.1. The governance structure comprises two parts. The first part is the direct governance structure of the project with the project coordinators and the local project coordinators, and the parts of the community, respectively. The project will be coordinated by Graine de Vie and Climate Lab.

In short, Climate Lab will take care of the higher-level monitoring activities, such as developing project management guidelines, carbon monitoring, and integrated assessment of the project activities. Graine De Vie will be responsible for managing the project activities on the ground, including administrative reporting (see §2.2, Table 2.2).

At the other level of the structure, the participating communities of the project, who will undertake the activities of the project, are present. The participants include farmers, associations of farmers, fishermen, or any members of the community who can contribute to the project starting from seedling growth to forest management. As described before, the basis of the governance of the communities is the (annual) réunion villageoise.

After ‘plan vivos’ are established, extra réunions, discussion sessions, training sessions and workshops are organized together with the local coordinator. During all activities and meetings, additional measures can be taken into account to ensure an improved or more democratic project design. In case of suggestions or complaints, remediating actions are taken (see Grievance Mechanism). The local project coordinator is then responsible to organise extra consultation rounds (if required because of complaints) and remediation actions.

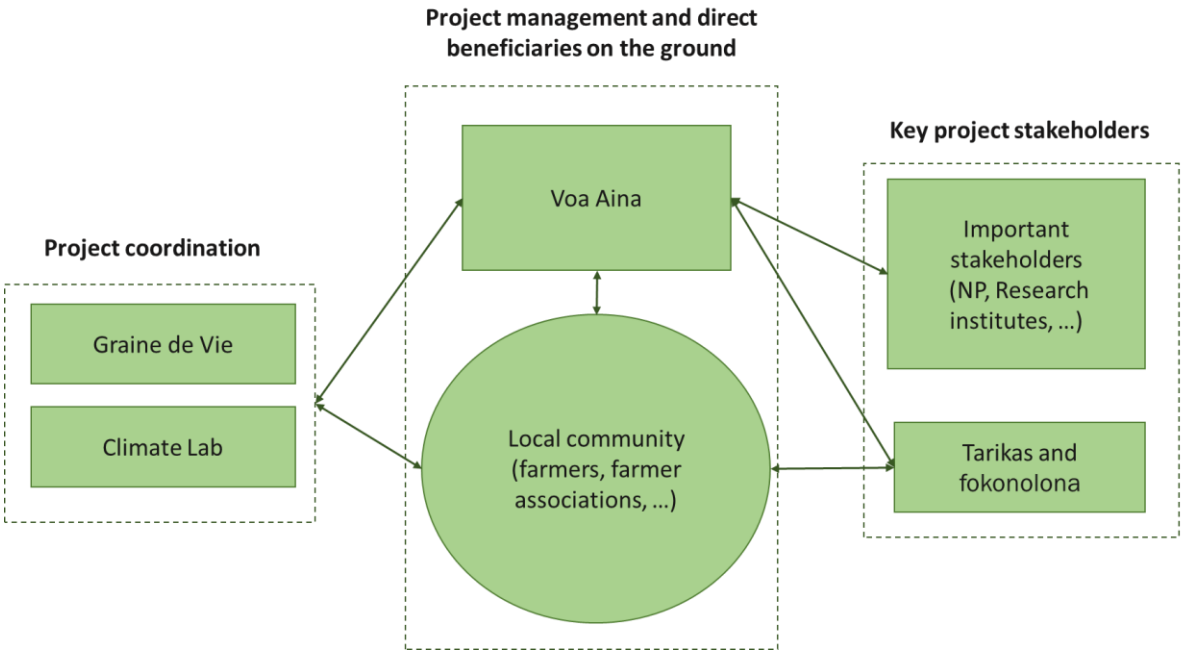


Figure 5.1: Schematized summary of the governance structure of the project.

In all project activities, the project will involve other potential stakeholders, such as research institutions (e.g. the Centre National de la Recherche Appliquée au Développement Rural / Foibem-pirenena momba ny Fikarohana ampiharina amin'ny Fampandrosoana ny eny Ambanivohitra (CENRADERU/FOFIFA), and Ghent University).

5.2 Equal Opportunities

The project partners signed an ethical charter not to discriminate based on gender, age, ethnicity, religion or social status when selecting project participants (§2.3).

Besides, as explained in §2, stakeholder participation is embedded in the design phase consultations of the project using "réunions villageoises" and is maintained throughout the project lifetime. These reunions are held with 30 to 150 people representing the community. The project actively encourages participation of women in all meetings and strives towards equal participation, with an absolute minimum of 30% female participation.

5.3 Legal and Regulatory Compliance

We complete Table 5.3 with national and international policies, laws and regulations that may affect the project, and demonstrate that the project will operate in full compliance with these.

A letter of approval from the national government is included in Annex 15.

Table 5.3: Legal and Regulatory Compliance

Policy, Law or Regulation	Relevance	Compliance Measures
Loi No. 2006-031 de 24 Novembre 2006 fixant régime juridique de la propriété foncière privée non titrée	Law No. 2006-031 (2006) recognizes private property rights to untitled, customarily held land. It allows individuals and groups asserting rights to	The land tenure at the different project zones is clear and secure.

	untitled land to obtain certificates recognizing their rights from the local land administration office (la Collective Décentralisée). The legislation has brought formal and informal tenure systems into alignment and thereby increased tenure security (Leisz 1998; Teyssier et al., 2008).	
Loi n° 2015-005 du 26 février 2015: The Protected Areas Code of Madagascar	This law proposes a contract between the Ministry of Environment, Ecology and Forests (MEEF) and the project developers to determine potential financing mechanisms for the protected area and local development.	Not applicable, see LoA
Decret No. 2018-500: Strategie Nationale REDD+ Madagascar	This law states that, in relation to carbon incomes, project promoters who have generated GHG emission reductions through their active contribution have a legal right to carbon benefits	The legal rights of the carbon credits can be valorised by the project team.
Decret 1113 (dd. 12 January 2022): Décret relatif à la régulation de l'accès au marché du carbone forestier	This law regulates access to the forest carbon market for REDD+ projects.	Consultations have been undertaken with the REDD+ coordination office of the Government of Madagascar (Bureau National de Coordination REDD+) and the Office of the Minister of Environment, Ecology and Forests. The law does not apply to this Plan Vivo project as it is not a REDD+ project, see LoA

5.4 Financial Plan

We refer to Annex 16 for the detailed financial Plan.

5.5 Financial Management

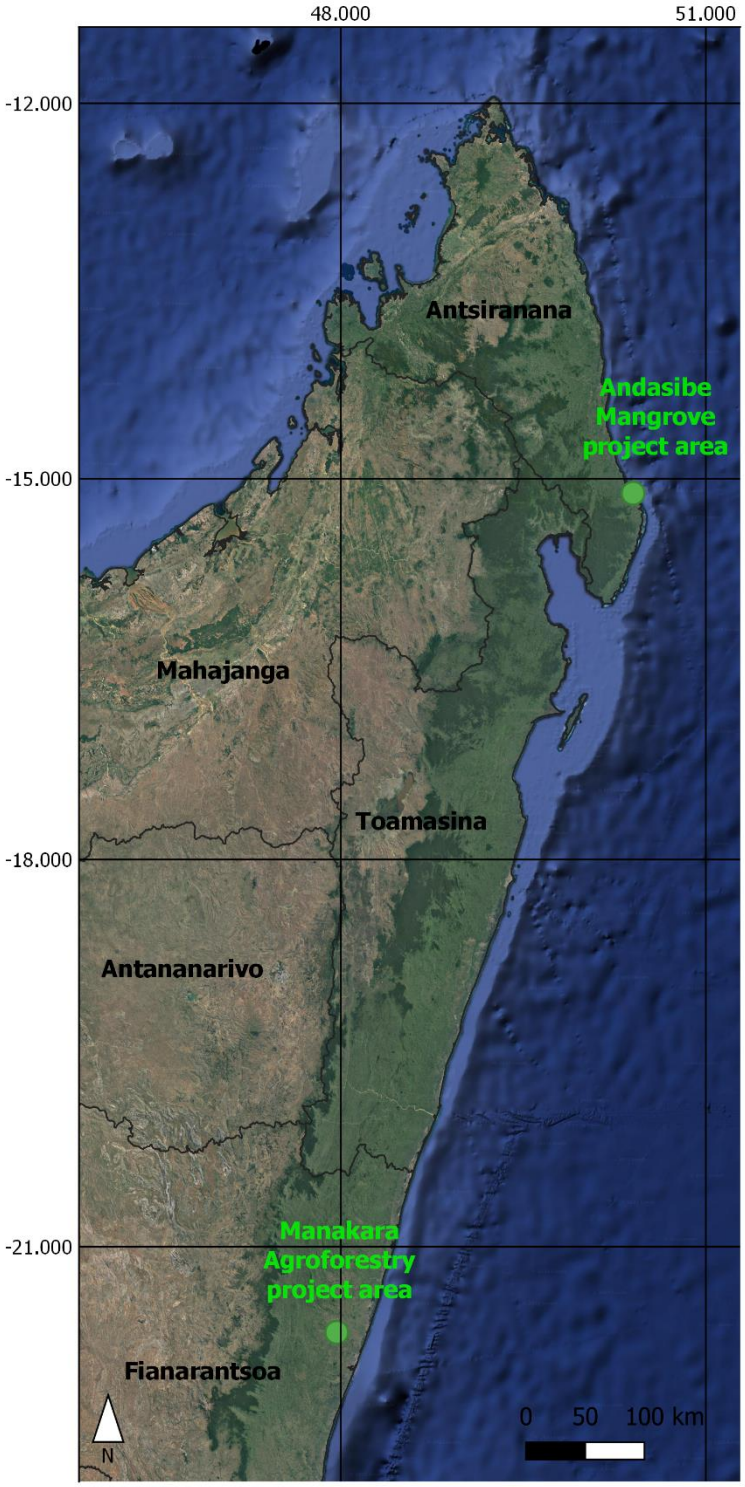
The annual benefit sharing will be transparently reported in the annual reports.

The responsible accountant is Vandelanotte Accountants, an approved legal entity by the ITAA (Institute for Tax Advisors and Accountants), with ITAA number 50792735. Vandelanotte performs an annual audit and submits the annual accounts to the Belgian national Bank.

Annexes

Annex 1 – Project Boundaries

See below for project region and potential project area boundaries (Andasibe and Manakara (Betampona)).



Contact: Ialy Rakotoarivelo
Graine de Vie Madagascar


Andasibe
Mangrove
Project area
N
0 100 200 m


21°41'11.22" S 48°05'08.58" E
21.686450° S 48.085717° E
1:32 900 15/20
500 m
Betamp2
12
15
16
New
14
11
betamp 2
13
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18
17
Betamp2
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Razafijaona Suzanne Eric,
responsable reboisement
DREDD V7V
Google

Annex 2 –Registration Certificate and Partner Agreements

The following documents have been made available to the Plan Vivo Foundation, and are available upon request:

- Copy of Graine De Vie's and Climate Lab's registration certificates
- Signed agreement between the organisations - Ethical charter signed by project partners
- Agreement with the DREDD

Annex 3 – Initial Project Areas

See Table below

Project area	**Name of Participating community**	**Location**	**Inter-vention**	**Extent of project area**	**Project agree-ment ref.**	**Start date**	**Req. 2.3.1 and 2.3.2 met ?**
Manakara	Manakara (Betampona)	Manakara	Woodland planting	323 ha (starting with 105 ha in Betampona)	1	01/01 / 2022	Y
Sava	Andasibe	Sava	Mangrove Rehabilitation	14 ha	2	01/01 / 2022	Y

Annex 4 –Participatory Design

See participatory maps (Annex 11), participatory community sessions in Betampona (Manakara) and attachment below (example attendance list).

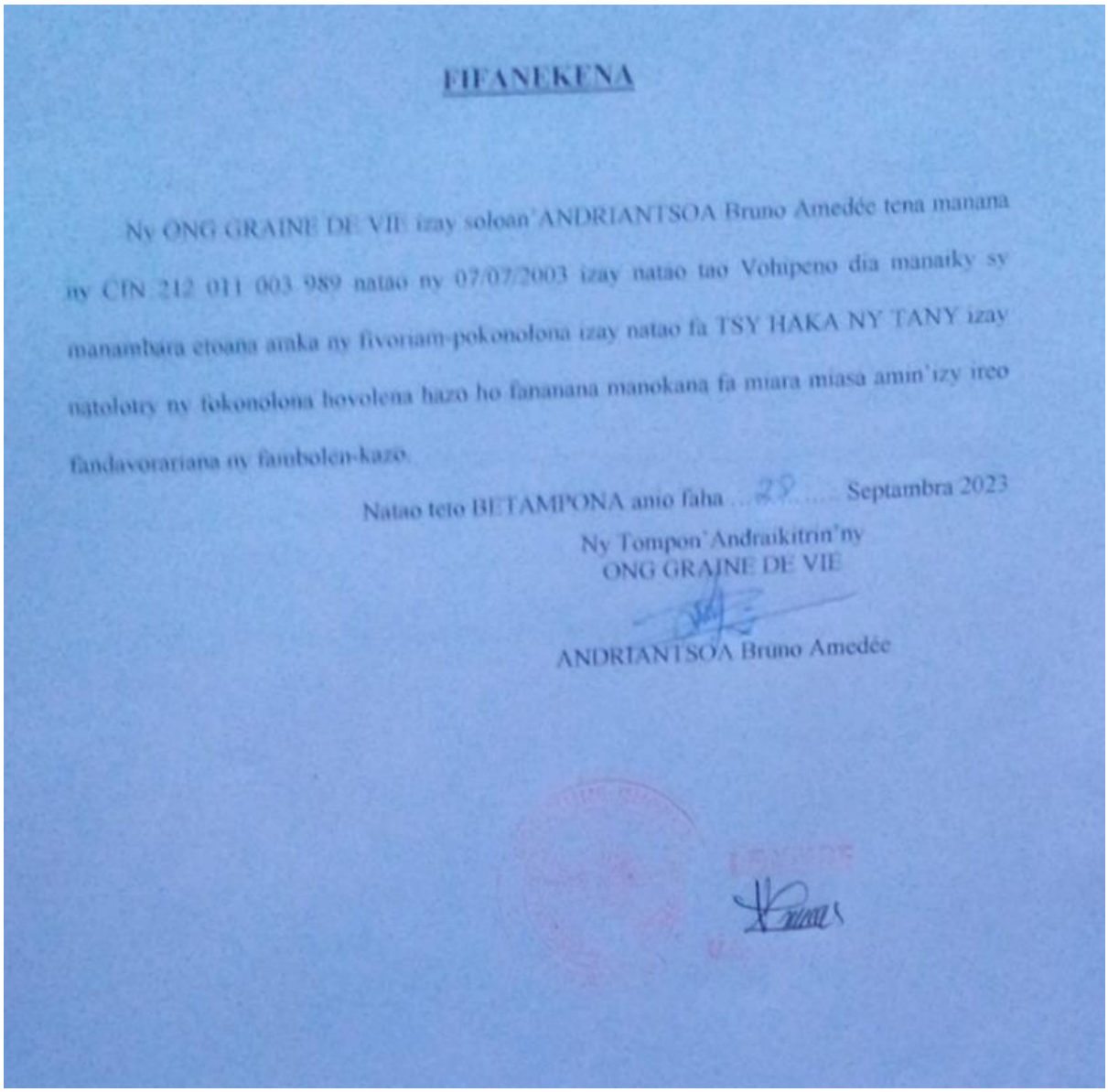





Annex 5 – Initial FPIC

See below

Example FPIC letters from Manakara landowners



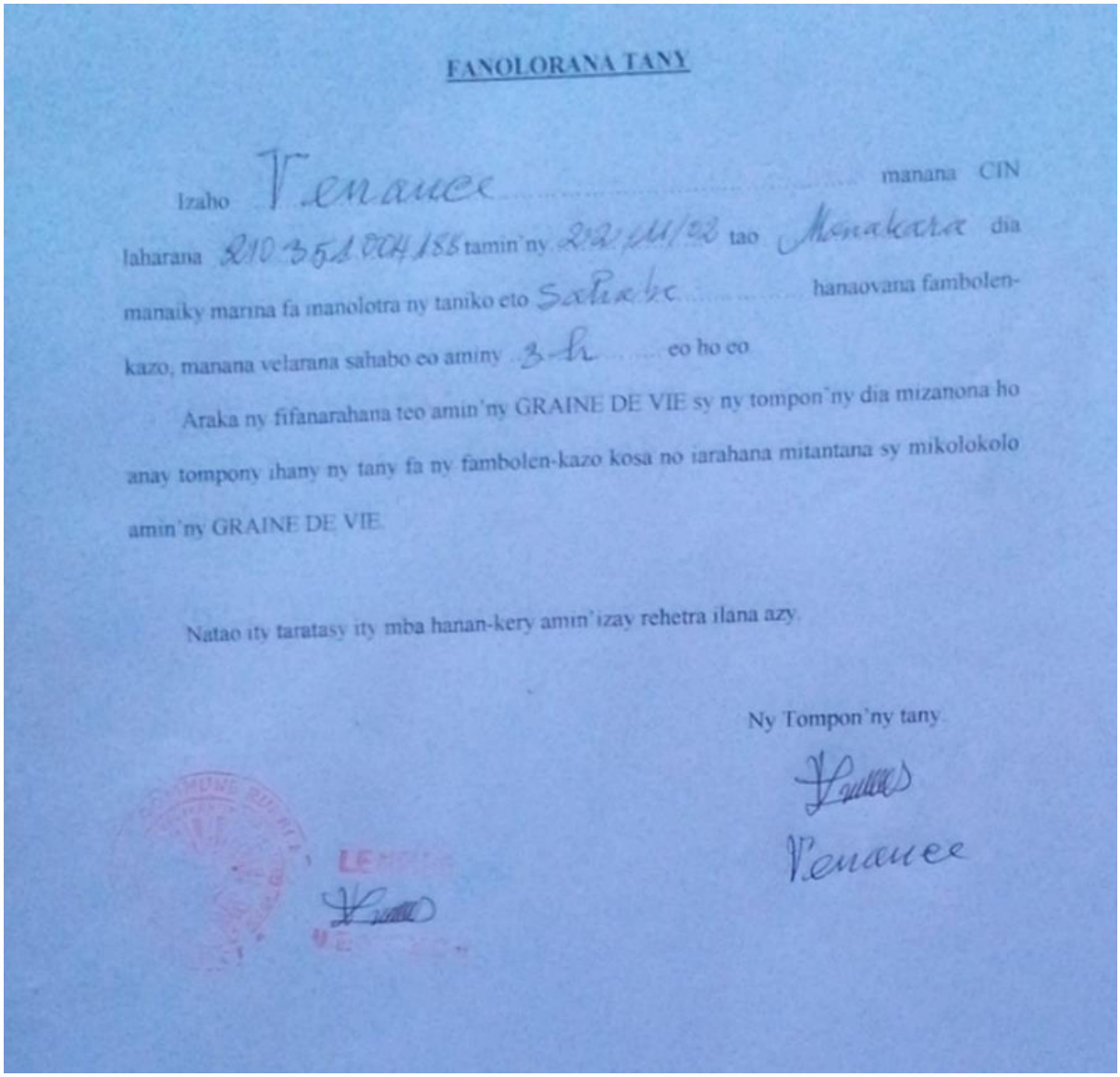
FIFANEKENA

Ny ONG GRAINE DE VIE izay soloan'ANDRIANTSOA Bruno Amedée tena manana ny CIN 212 011 003 989 natao ny 07/07/2003 izay natao tao Vohipeno dia manaiky sy manambara etoana araka ny fivoriam-pokonolona izay natao fa TSY HAKA NY TANY izay natolotry ny fokonolona hovolena hazo ho fananana manokana fa miara miasa amin'izy ireo fandavorariana ny fanbolen-kazo.

Natao teto BETAMPONA anio faha ...29..... Septambra 2023

Ny Tompon'Andraikitrin'ny
ONG GRAINE DE VIE

ANDRIANTSOA Bruno Amedée



FANOLORANA TANY

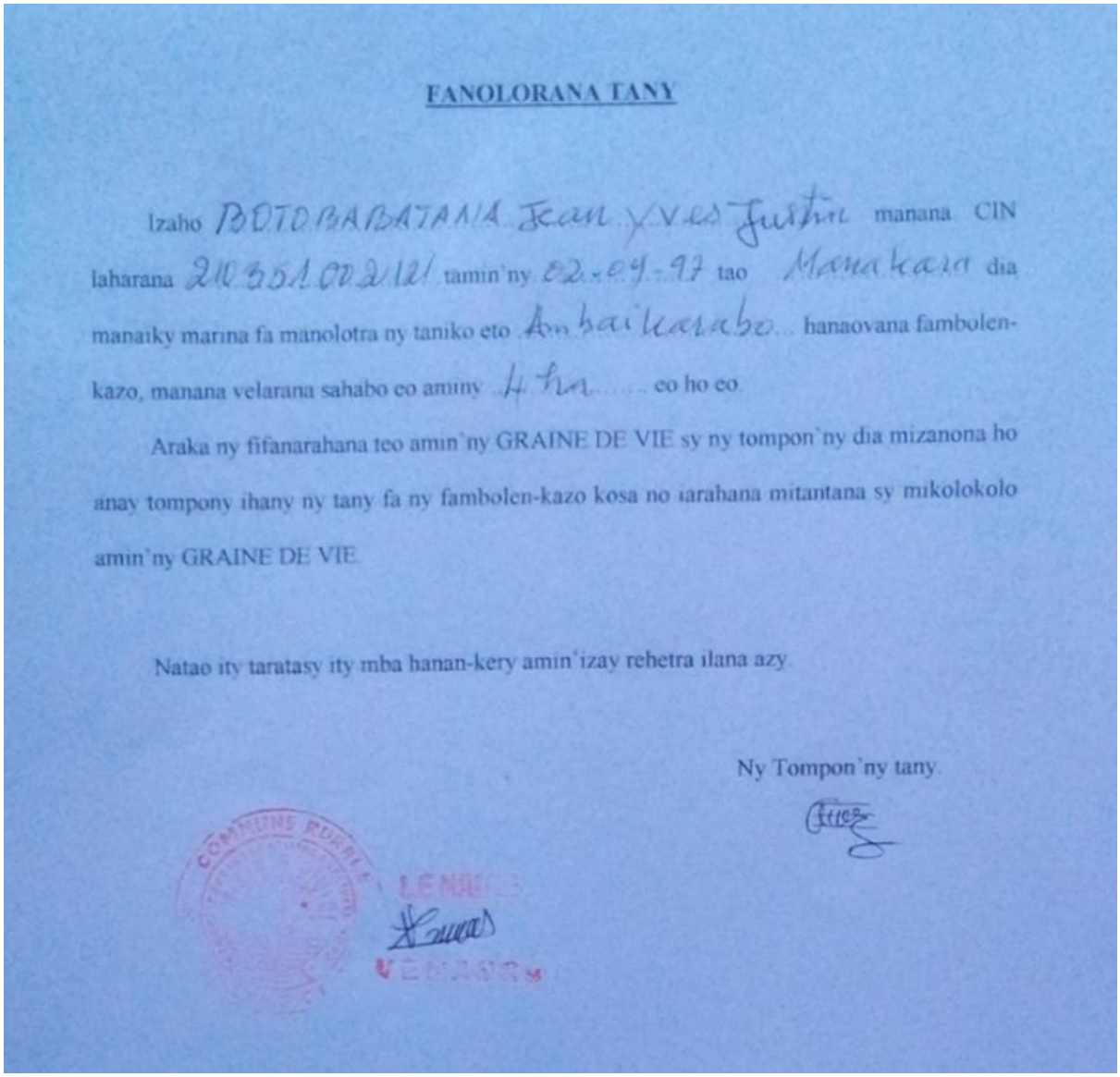
Izaho Venance manana CIN laharana 210 351 004 155 tamin'ny 2/2/11/92 tao Menakara dia manaiky marina fa manolotra ny taniko eto Sahabe hanaovana fambolen-kazo, manana velarana sahabo eo aminy 3 ha eo ho eo.

Araka ny fifanarahana teo amin'ny GRAINE DE VIE sy ny tompon'ny dia mizanona ho anay tompony ihany ny tany fa ny fambolen-kazo kosa no tarahana mitantana sy mikolokolo amin'ny GRAINE DE VIE.

Natao ity taratasy ity mba hanan-kery amin'izay rehetra ilana azy.

Ny Tompon'ny tany

Venance



FANOLORANA TANY

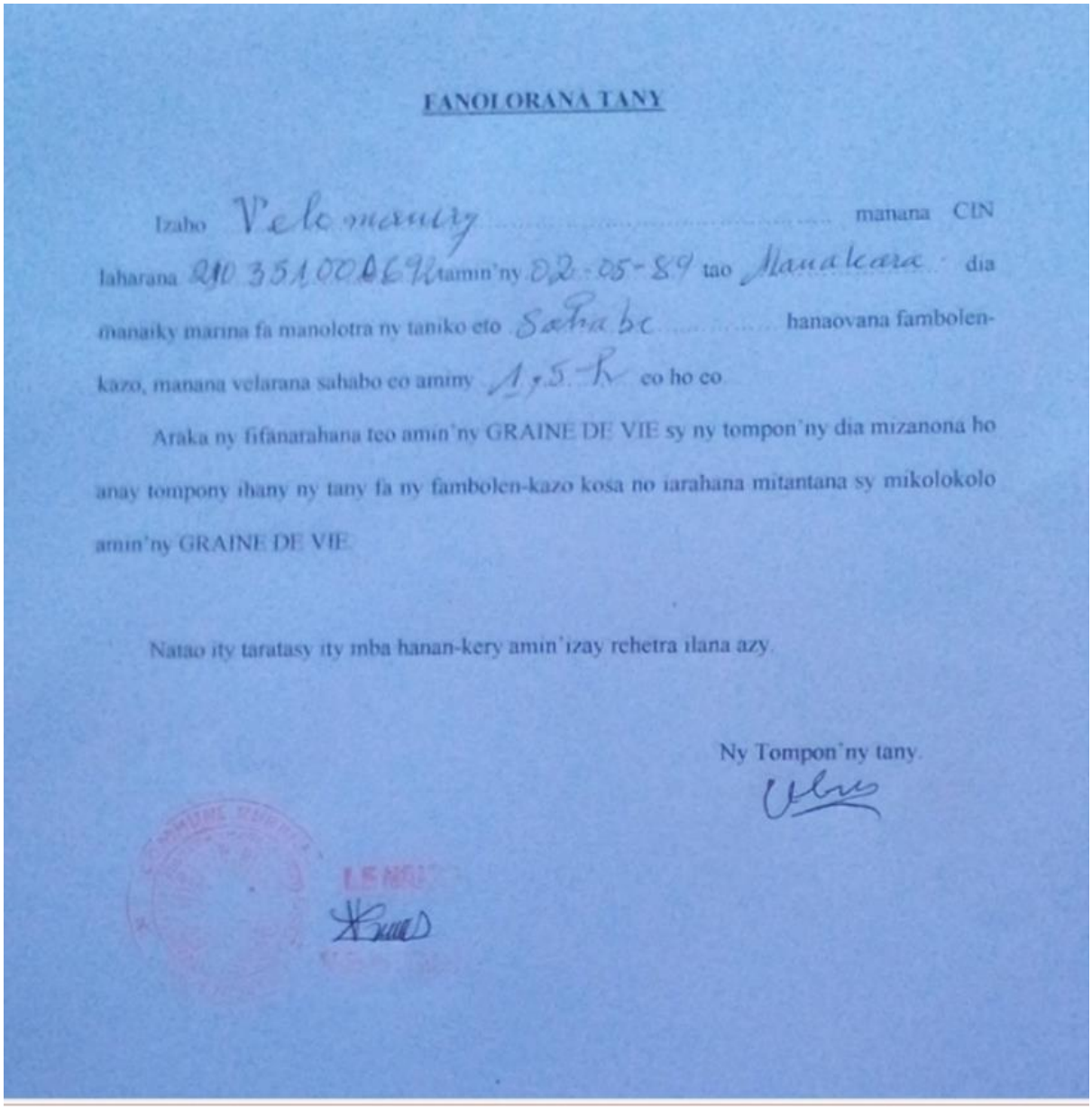
Izaho BOTOBABATANA Jean Yves Justin manana CIN laharana 210351002121 tamin'ny 02-04-97 tao Manakara dia manaiky marina fa manolotra ny taniko eto Ambaikarabo hanaovana fambolen-kazo, manana velarana sahabo eo aminy 4 ha eo ho eo.

Araka ny fifanarahana teo amin'ny GRAINE DE VIE sy ny tompon'ny dia mizanona ho anay tompony ihany ny tany fa ny fambolen-kazo kosa no iarahana mitantana sy mikolokolo amin'ny GRAINE DE VIE.

Natao ity taratasy ity mba hanan-kery amin'izay rehetra ilana azy.

Ny Tompon'ny tany.

COMMUNE RURALE



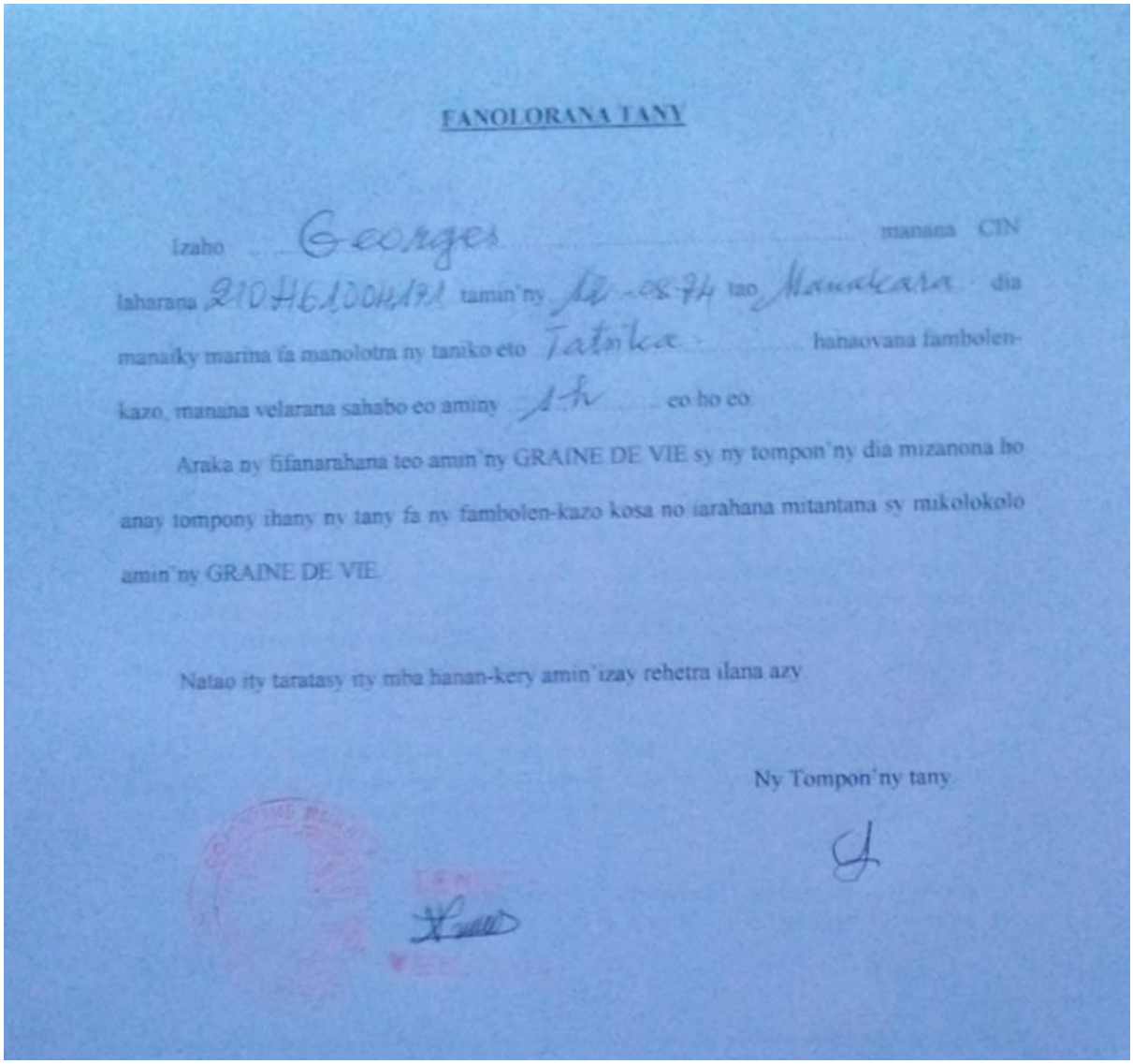
FANOLORANA TANY

Izaho Velomanitry manana CIN laharana 210 351 006 692 tamin'ny 02-05-89 tao Manakara dia manaiky marina fa manolotra ny taniko eto Sahabe hanaovana fambolen-kazo, manana velarana sahabo eo aminy 1,5 R eo ho eo.

Araka ny fifanarahana teo amin'ny GRAINE DE VIE sy ny tompon'ny dia mizanona ho anay tompony ihany ny tany fa ny fambolen-kazo kosa no iarahana mitantana sy mikolokolo amin'ny GRAINE DE VIE.

Natao ity taratasy ity mba hanan-kery amin'izay rehetra ilana azy.

Ny Tompon'ny tany.



FANOLORANA TANY

Izaho Georges manana CIN laharana 210HE100H191 tamin'ny 12-08-74 tao Mandcara dia manaiky marina fa manolotra ny taniko eto Tatsika hahaovana fambolen-kazo, manana velarana sahabo eo aminy 1 h eo ho eo.

Araka ny fifanarahana teo amin'ny GRAINE DE VIE sy ny tompon'ny dia mizanona ho anay tompony ihany ny tany fa ny fambolen-kazo kosa no tarahana mitantana sy mikolokolo amin'ny GRAINE DE VIE.

Natao ity taratasy ity mba hanan-kery amin'izay rehetra ilana azy.

Ny Tompon'ny tany

Translation:

ACCORD LAND AGREEMENT

I, the undersigned, Venance bearing CIN n° 210351004188 made on 22/11/2022 in Manakara hereby accept and offer my land located in Sahabe for a reforestation project. The land covers an area of approximately 03 ha.

Following our partnership agreement with the NGO Graine de Vie, the land will remain our property but the reforestation project will be managed together with Graine de Vie.

The following agreement has been made for all intents and purposes.

The landowner

The NGO GRAINE DE VIE represented by ANDRIANTSOA BRUNO Amédée bearing CIN n°212 011 003 989 made on 07/07/2023 in Vohipeno hereby accepts and affirms that following the meeting held with the local community, the project does not intend to take the land nor use the land donated by the villagers for reforestation activities for other purposes.

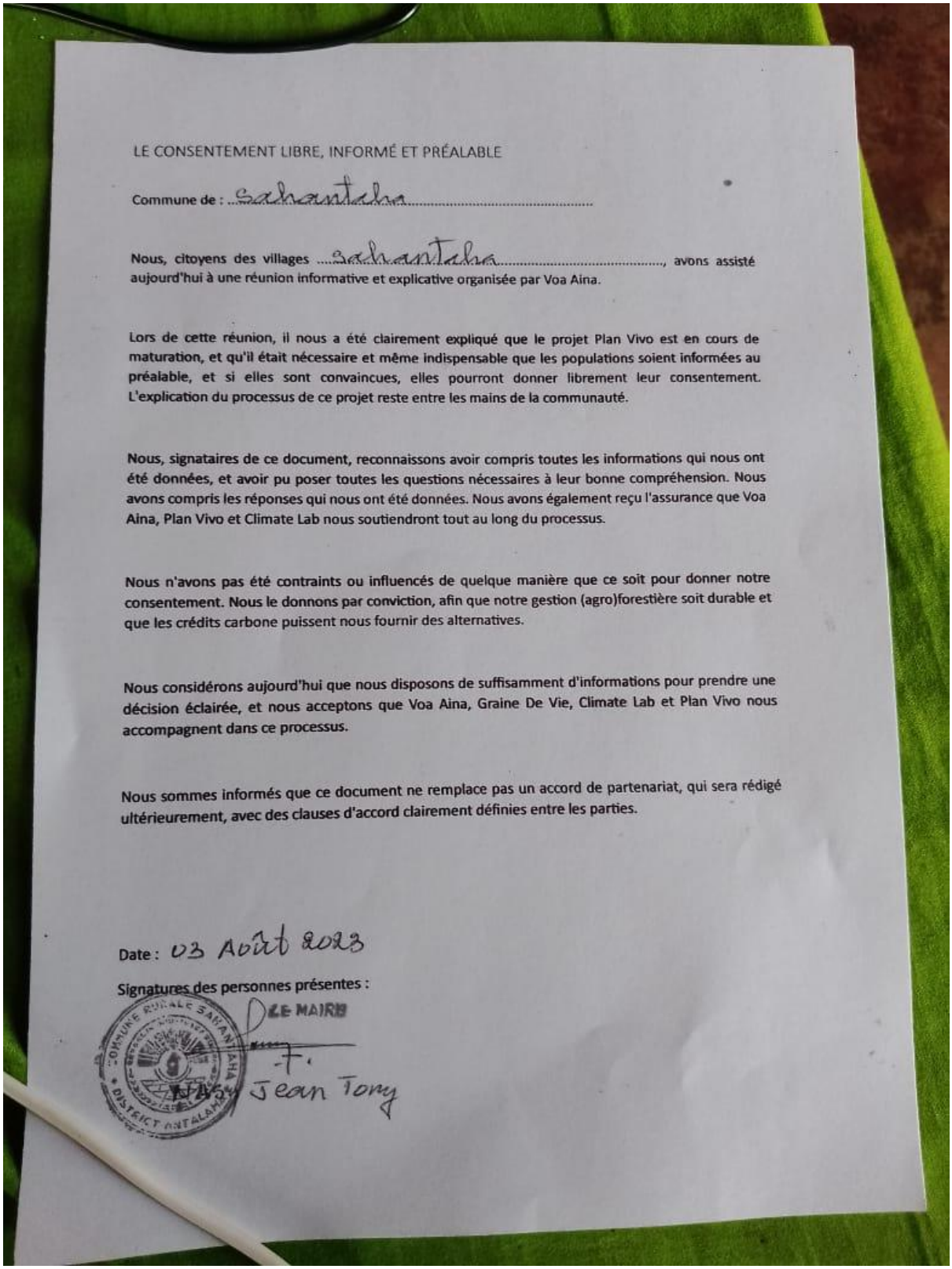
The project will be a close collaboration with the community, leading to a common goal of successful reforestation and quality results.

Betampona, September 28, 2023

Graine de Vie NGO Manager

ANDRIANTSOA Bruno Amédée

Example FPIC letters of Andasibe and Betampona



LE CONSENTEMENT LIBRE, INFORMÉ ET PRÉALABLE

Commune de : Sahantaha

Nous, citoyens des villages ....Sahantaha...., avons assisté aujourd'hui à une réunion informative et explicative organisée par Voa Aina.

Lors de cette réunion, il nous a été clairement expliqué que le projet Plan Vivo est en cours de maturation, et qu'il était nécessaire et même indispensable que les populations soient informées au préalable, et si elles sont convaincues, elles pourront donner librement leur consentement. L'explication du processus de ce projet reste entre les mains de la communauté.

Nous, signataires de ce document, reconnaissons avoir compris toutes les informations qui nous ont été données, et avoir pu poser toutes les questions nécessaires à leur bonne compréhension. Nous avons compris les réponses qui nous ont été données. Nous avons également reçu l'assurance que Voa Aina, Plan Vivo et Climate Lab nous soutiendront tout au long du processus.

Nous n'avons pas été contraints ou influencés de quelque manière que ce soit pour donner notre consentement. Nous le donnons par conviction, afin que notre gestion (agro)forestière soit durable et que les crédits carbone puissent nous fournir des alternatives.

Nous considérons aujourd'hui que nous disposons de suffisamment d'informations pour prendre une décision éclairée, et nous acceptons que Voa Aina, Graine De Vie, Climate Lab et Plan Vivo nous accompagnent dans ce processus.

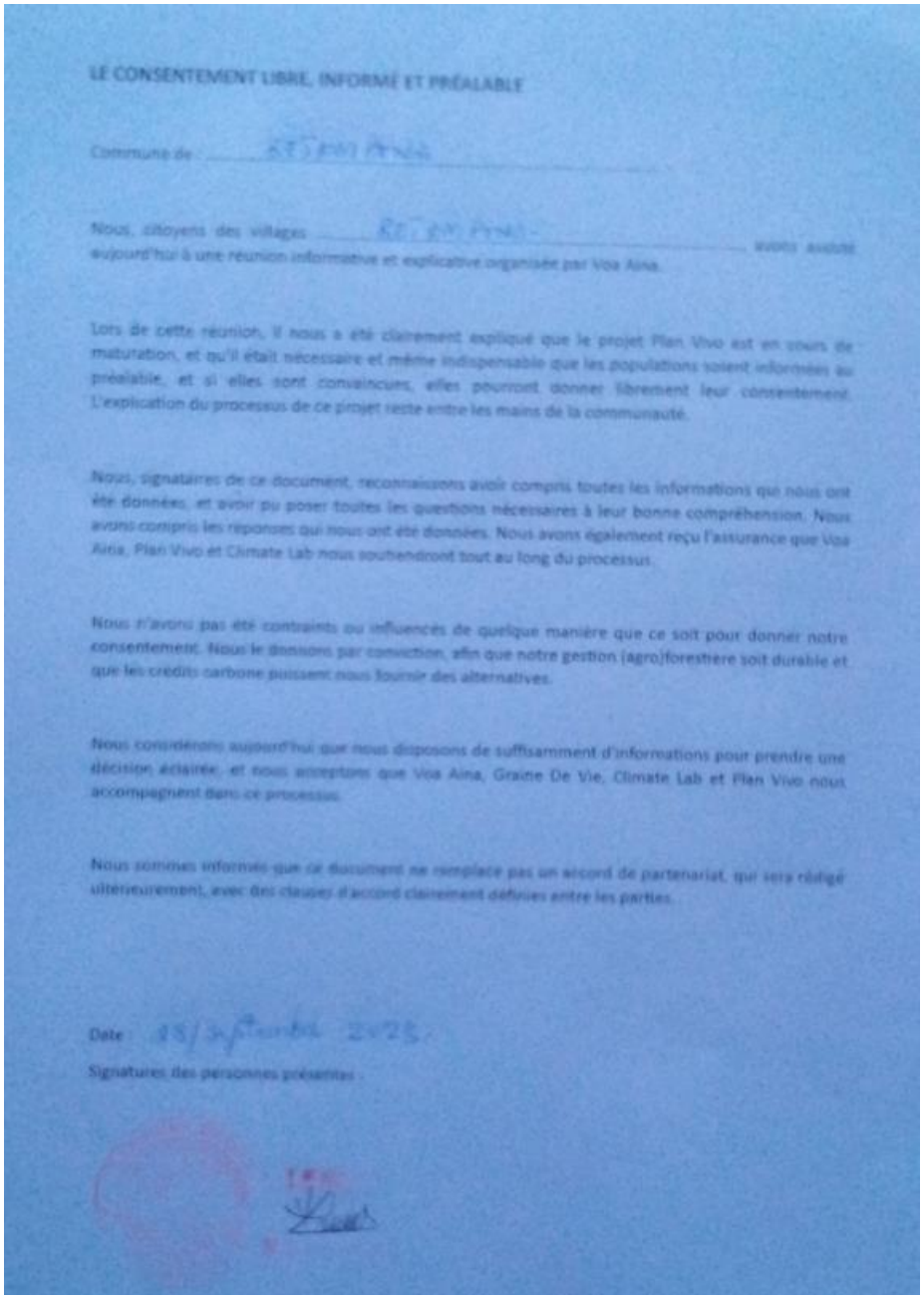
Nous sommes informés que ce document ne remplace pas un accord de partenariat, qui sera rédigé ultérieurement, avec des clauses d'accord clairement définies entre les parties.

Date : 03 Août 2023

Signatures des personnes présentes :

LE MAIRE

Jean Tony



LE CONSENTEMENT LIBRE, INFORMÉ ET PRÉALABLE

Commune de : [illegible]

Nous, citoyens des villages [illegible] avons assisté aujourd'hui à une réunion informative et explicative organisée par Voa Aina.

Lors de cette réunion, il nous a été clairement expliqué que le projet Plan Vivo est en cours de maturation, et qu'il était nécessaire et même indispensable que les populations soient informées au préalable, et si elles sont convaincues, elles pourront donner librement leur consentement. L'explication du processus de ce projet reste entre les mains de la communauté.

Nous, signataires de ce document, reconnaissons avoir compris toutes les informations qui nous ont été données, et avoir pu poser toutes les questions nécessaires à leur bonne compréhension. Nous avons compris les réponses qui nous ont été données. Nous avons également reçu l'assurance que Voa Aina, Plan Vivo et Climate Lab nous soutiendront tout au long du processus.

Nous n'avons pas été contraints ou influencés de quelque manière que ce soit pour donner notre consentement. Nous le donnons par conviction, afin que notre gestion (agro)forestière soit durable et que les crédits carbone puissent nous fournir des alternatives.

Nous considérons aujourd'hui que nous disposons de suffisamment d'informations pour prendre une décision éclairée, et nous acceptons que Voa Aina, Graine De Vie, Climate Lab et Plan Vivo nous accompagnent dans ce processus.

Nous sommes informés que ce document ne remplace pas un accord de partenariat, qui sera rédigé ultérieurement, avec des clauses d'accord clairement définies entre les parties.

Date : [illegible]

Signatures des personnes présentes :

TRANSLATION : FREE, INFORMED AND PRIOR CONSENT

Commune de : .....

We, the citizens of the villages ....., today attended an informative and explanatory meeting organized by Voa Aina.

At this meeting, it was clearly explained to us that the Plan Vivo project is in the process of maturing, and that it was necessary and even essential for the populations to be informed beforehand, and if they are convinced, they will be able to freely give their consent. The explanation of the process of this project remains in the hands of the community.

We, the signatories of this document, acknowledge that we have understood all the information given to us, and that we have been able to ask all the questions necessary for a proper understanding. We have understood the answers we have been given. We have also been assured that Voa Aina, Plan Vivo and Climate Lab will support us throughout the process.

We have not been coerced or influenced in any way to give our consent. We give it out of conviction, so that our (agro)forestry management is sustainable and carbon credits can provide us with alternatives.

We consider today that we have sufficient information to make an informed decision, and we accept that Voa Aina, Graine De Vie, Climate Lab and Plan Vivo accompany us in this process.

We are informed that this document does not replace a partnership agreement, which will be drawn up at a later date, with clearly defined agreement clauses between the parties.

Date :

Signature of the mayor

Annex 6 – Carbon Calculations Spreadsheet

For the details of the calculations for the Carbon Baseline summary and other tables summarising carbon benefits, we refer to the Excel files attached (Annex 6a and 6b) and to Annexes 7 (a and b).

Annex 7a – Technical Specifications

We use the template below to provide a technical specification for each project intervention. Different technical specifications are developed:

- The Mangrove Restoration Planting Specifications (Annex 7.a) are based on the PM001 methodology: Forestry Carbon Benefit Assessment Methodology. The Specifications are only valid for the mangrove restoration planting. We do not use the SHAMBA model.
- The Agroforestry Planting Specifications are detailed in Annex 7b. These are based on the PM001. We do not use the SHAMBA model.

Project Intervention:	Mangrove Restoration Planting
Version:	2.0
Date Approved:	Approved with PDD
Methodology:	PM001 Forestry Carbon Benefit Assessment Methodology
Modules/Tools:	PU001: Estimation of baseline and project GHG removals by carbon pools in Plan Vivo projects
Certificate Type(s):	fPVCs, rPVCs and vPVCs

Applicability conditions

This technical specification applies only to the mangrove project zone.

For this partim, we use the CDM methodology AR-AM0014 A/R Large-scale Methodology (Afforestation and reforestation of degraded mangrove habitats Version 3.0), that applies to afforestation and reforestation (A/R) project activities implemented in degraded mangrove habitats. The methodology allows afforestation and reforestation of wetland that constitutes degraded mangrove habitat. The methodology allows use of mangrove species and non-mangrove species but in case of more than 10 per cent area being covered by planting of non-mangrove species it prohibits changes in the hydrology of the project area (quod non in casu). The methodology restricts the extent of soil disturbance in the project to be no more than 10 per cent. Project activities applying this methodology may choose to exclude or include accounting of any of the carbon pools of dead wood and soil organic carbon, but cannot include the litter carbon pool.

The methodology is applicable under the following conditions:

a) The land subject to the project activity is degraded mangrove habitat;
b) More than 90 per cent of the project area is planted with mangrove species. If more than 10 per cent of the project area is planted with non-mangrove species then the project activity does not lead to alteration of hydrology of the project area and hydrology of connected up-gradient and down-gradient wetland area;
c) Soil disturbance attributable to the project activity does not cover more than 10 per cent of the total area.

It should be noted that a degraded mangrove habitat is defined as wetlands where, in their natural state, mangrove vegetation can grow and have soil or sediment that is usually water-logged with water that is saline or brackish, and that were subjected to impacts resulting in decrease of forest cover. Soil disturbance is defined as any activity that results in a decrease in soil organic carbon (SOC), for example ploughing, ripping, scarification, digging of pits and trenches, stump removal, etc.

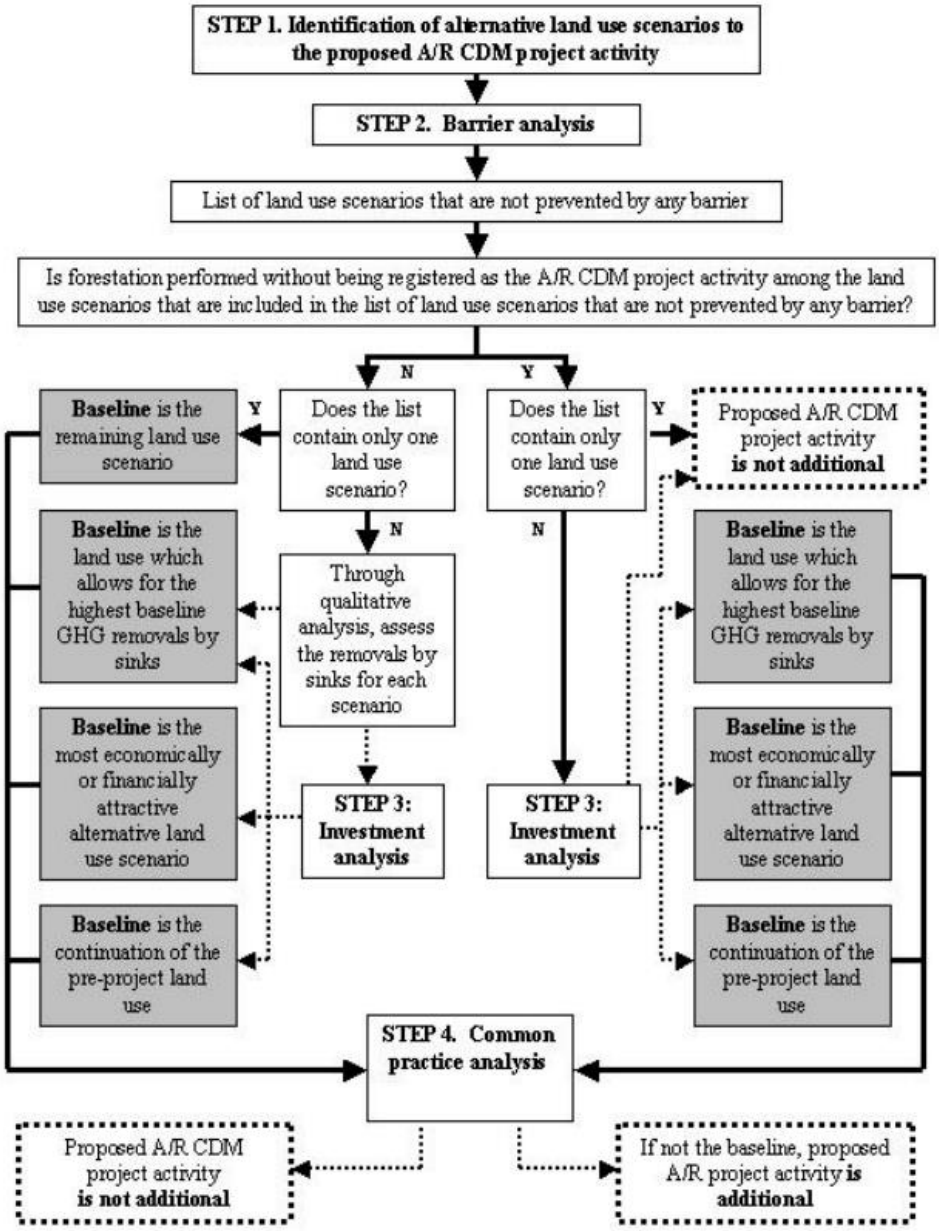
Additional applicability conditions are:

(i) The mangrove should always be assessed, replenished and rehabilitated after passage of a cyclone ("regarnissage").
(ii) All project zones must be located in the intertidal zone but behind barrier reefs (or zones with low-intensity wave activity).
(iii) Access routes and routing of zebu during ebb tide must be agreed during village meetings in every project zone. A legal DINA (bylaw at village level) must be available.
(iv) The project zones must only be located in the Antsiranana province.

Additionality

Below we describe the most likely land use scenario in the absence of project interventions and the additionality of the project interventions using AR-TOOL02 v1.0: "Combined tool to identify the baseline scenario and demonstrate additionality in A/R CDM project activities".

We follow the following steps:



STEP 0. Preliminary screening based on the starting date of the A/R project activity

The starting date of the activity was 1 January 2022. By then, the incentive from the plan vivo project was seriously considered in the decision to proceed with the project activity: at that month, the baseline measurement campaign was organized.

STEP 1. Identification of alternative land use scenarios to the proposed A/R project activity

Sub-step 1a. Identify credible alternative land use scenarios to the proposed project activity

Based on the socioecological survey (see §3.3.1), we identify the following land use scenarios to be credible:

• Continuation of the pre-project coastline;

• Mangrove plantation within the project boundary performed without being registered as a plan vivo certified project activity;

Sub-step 1b. Consistency of credible alternative land use scenarios with enforced mandatory applicable laws and regulations

Both alternative land use scenarios are in compliance with mandatory legislation and regulations taking into account the their enforcement in the region or country.

STEP 2. Barrier analysis

Sub-step 2a. Identification of barriers that would prevent the implementation of at least one alternative land use scenarios

No financial, technical, institutional nor social barriers would plausibly hamper the continuation of the status quo. This scenario requires no investments, technical knowledge nor legal efforts: mangroves within the project area boundaries disappeared before (see further). However, mangrove plantation without extra funding that follows from plan vivo certification is not a plausible scenario, given the significant amount of funding required and the lack of governmental or other mangrove nurseries in the areas.

Sub-step 2b. Elimination of land use scenarios that are prevented by the identified barriers

We eliminate the scenario of planting without extra plan vivo funding, since it is not a plausible future land cover scenario.

Sub-step 2c. Determination of baseline scenario (if allowed by the barrier analysis)

Planting without being registered as a plan vivo project is not included in the list of land use scenarios that are not prevented by any barrier. Consequently, only one land use scenario remains (perpetuation of the status quo), so according to the tool, this scenario is the baseline scenario. We continue with Step 4: Common practice test.

STEP 4. Common practice analysis

There are no similar previous or ongoing planting activities in or near the project zones, not even remotely similar to this proposed plan vivo project. Consequently, the plan vivo project activity is not the baseline scenario and, hence, it is additional.

Finally, below we present a summary of the basic barriers the project activities are to overcome.

Additionality table of the combined Project – Plan Vivo effort.		
Barrier group	**Baseline scenario**	**Additionality of the combined Project – Plan Vivo effort**
Financial	- Limited funds - Other priorities - Limited community credit availabilities	Start-up capital secured by Graine De Vie; payment scheme supported by Plan Vivo
Technical	Mangroves disappeared after 2004. Technical knowledge on mangrove service valorization is still limited. Thus, to strengthen the existing efforts, there is ample opportunity for projects focusing on the development of fishery associations.	Academic input of environmental scientists; skilled local coordinator; training for local communities; focus on (socio-economic) fishery valorization.
Institutional, social	- "Top-down approach", although room is given for local initiatives - Climate policies (e.g. REDD+) rather large-scale instead of community-based - Transferring only responsibilities, not rights, to the local communities	- Bottom-up approach with first consultation round, continued workshops and benefits for fishery communities - Rewarding for implementation results - Local communities are not the problem, they are the solution for the environmental issues

Project activities

The objective is to plant propagules with the involvement of the entire community in the planting and reinforcement of the mangrove against the waves coming from the sea. The mangrove rehabilitation project steps and activities are described below.

Establishing mangrove nurseries: Mangrove nurseries ("pépinières de mangrove ») are established near the project zones. The nurseries contain a mixture of endemic mangrove species (approximately 5000 to 10,000 per nursery) including Avicennia marina, Xylocarpus granatum, Rhizophora mucronata, Bruguieria gymnorhiza, Ceriops tagal, Lumnitzera racemosa and Sonneratia alba.

Mangrove planting (at sea but behind the barrier reef). The mangrove seedlings are planted near the coast but in the intertidal zone, in line with their natural zonation. A barrier reef is present, to protect against the actions of the waves.

We follow a cycle of approximately 18 months in total:

a. The first planting phase starts close to the current coastline, with a planting density of approximately 1000 seedlings/ha (Avicennia).

b. During the second cycle, after approximately 6 months, Xylocarpus (ca. 1000 seedlings/ha) and Lumnitzera (1000 seedlings/ha) are planted just seawards of the Avicennia.

c. Rhizophora is planted during a third phase, after another 6 months, at a density of 1000 seedlings/ha.

d. The last planting phase, after about 18 months in total, consists mainly of Sonneratia (at 1000 seedlings/ha). The total amount of seedlings planted thus equals ca. 5000 per ha.

Figure 1: Fishing community of Andasibe, Sava, with project zone indicated in yellow.

Mangrove regarnissage. After 2 years, the mangrove health is monitored and regularly maintained with enrichment planting ("phase of regarnissage"). Regarnissage can be done using seedlings from the nurseries, but also using the direct sowing technique (at a 1x1m grid) if sufficient mangrove mud is present. After a total period of approximately 5 years, a naturalized mangrove ecosystem is restored. The area of restoration extends about 50m seawards (in reference to the former coastline) nearby the fishing village, towards about 100m seawards further from the village. The above-mentioned rehabilitation methodology was successfully tested by Graine De Vie at Cap Est since 2011. To date, this mangrove provides evidence for the efficacity of the methodology.

Involve fishing associations. The mangroves are planted and protected by members of the nearby fishing associations. Female members of the associations have a key role during planting. The role of

the associations is not only to engage in ecosystem rehabilitation, but also to guard the mangrove during and after establishment. This is performed by a "petit comité pour la surveillance » under a rotation system. Besides, a natural mangrove ecosystem provides a habitat for species such as small fish, crabs and shrimps. These are often caught by fishermen, and cleaned and sold by fisherwomen. The project will also support the associations with trainings on sustainable fishery practices and marketing of their products.

Activate community re-investments. There are many socio-ecological challenges that could be supported by the plan vivo re-investments at the decision of the communities. Examples are to improve fishing materials, to improve children's access to school, to improve access to local fishing markets, etc.

Carbon benefits

Crediting Period

The project start date was 1 May 2022. The period of time over which the climate benefits will be quantified will be 30 years. This is an estimation of the period during which a stable state of (mangrove) ecosystem carbon can be reached under a certain type of management. Indeed, there will be a slowdown in carbon storage after climax vegetation will be reached, reasonably comparable to the state of a 30-years old forest. The project period is in line with the duration stated by the United Nations Framework Convention on Climate Change (30 years) (UNFCCC, 2003). The start of seedling planting in the project zones is the year 2022. A project period of 30 years is thus applicable because this is the timeframe during which a stable mangrove ecosystem can be reached under proper mangrove management.

Carbon Pools and Emission Sources

Below, we list the carbon pools and emission sources included in the estimation of carbon benefits with the justification for any excluded carbon pools or emission sources.

Carbon pools and emissions sources that are included or excluded in the quantification.		
Pools or emission sources	**Type of pool or emission source**	**Included?**
Carbon pools	Soil organic carbon	No: soil organic carbon is not included until an approved method or tool becomes available
	Above-ground biomass	Yes: above-ground biomass is a major pool for carbon sequestration in mangroves, to be considered for mangrove planting
	Below-ground biomass	Yes: this a potentially significant pool to be considered for mangrove planting
	Non-tree biomass	No: Non-tree biomass and grasses are not included as carbon pools in the above-ground biomass estimations
	Dead wood and litter	No: conservatively excluded
	Wood products	No: conservatively excluded

Emission sources	Grassland cutting and burning of woody biomass	No: Grassland cutting and burning is not common and is explicitly excluded in the project zones
	Project gasoline use	No: the effect is negligible, as the project participants dominantly use zebu and motorbikes.

Baseline Emissions/Removals

All project zones are currently located in the intertidal area, but behind the barrier reef. The mangrove seedlings are planted near the coast but in the intertidal zone, and in line with their natural zonation. Nevertheless, to better understand baseline conditions, the coastal changes of a focus zone near Andasibe was followed from 2016 till 2022 using Sentinel high-resolution satellite imagery (False Color Composites).

We thus analysed Sentinel-2 derived False Color Composites of the Andasibe mangrove in Madagascar between 2016 and 2022 (Google Earth Engine, 2023). Spectral band 8 of the Multispectral Imager (MSI) delivers the chlorophyll-reflecting central wavelength of 842 nm (Visible and Near Infrared, VNIR), suitable for mapping shorelines and biomass content, as well as at detecting vegetation changes.

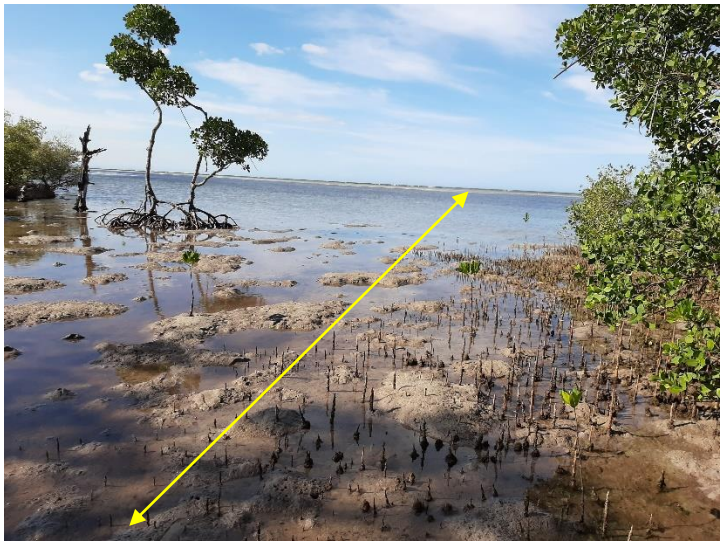


Figure 2: Viewpoint of the same area, Andasibe, Sava, with project zone indicated in yellow.

As demonstrated by the images below, the coastline has not significantly changed over the past years. The northeastern mangroves have indeed completely vanished after 2004 (source: interviews during Social Survey, 2022). A succession of cyclones Hary (2000), Hudah (2002) and Gafilo (2004) had inflicted major damage to the mangrove ecosystems of the northern coasts.

The forest area on the other hand shows little signs of change over the past decade. We can notice the same dry spots on the map where the density of the trees reduced. The coastal forest is also relatively degraded, which could be linked with the absence of the mangroves since 2004 (which normally provides the protection against cyclones).

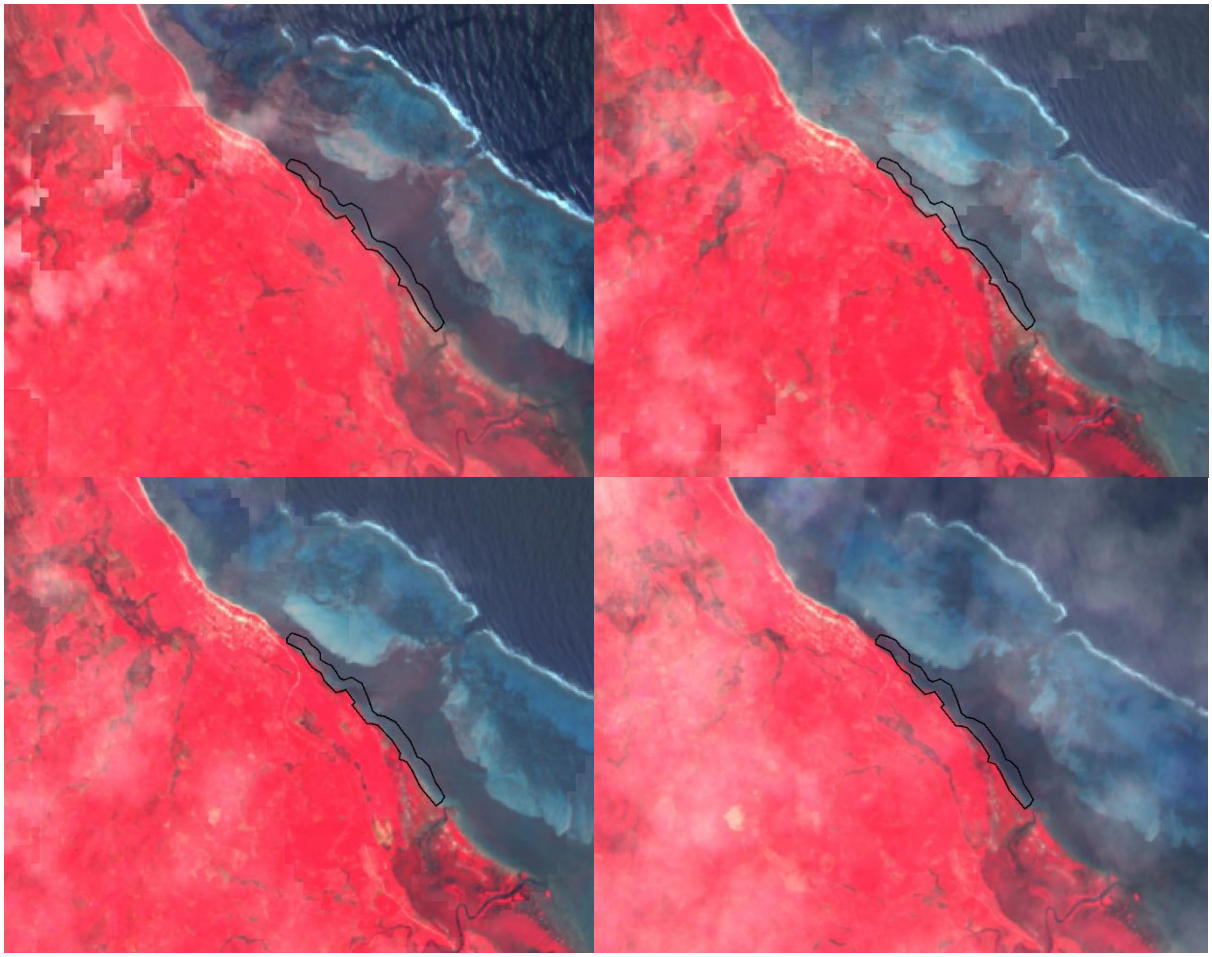


Figure 3: Sentinel-2 derived False Color Composites of Andasibe Mangrove in Madagascar between 2016 (top left), 2018 (top right), 2020 (bottom left) and 2022 (bottom right). The project zone is delimited by a black line on the satellite derived image.

Overall, the spatiotemporal analysis shows that there is no mangrove vegetation left in Andasibe nor is there any significant intertidal vegetation change in the period 2016-2022. The baseline state of the project area consist of shallow sea (intertidal zone behind barrier reef). The degraded status of the nearby coastal forest testifies to a generally degraded coastal landscape. The time series of satellite images show a relatively stable coastal landscape over the past decade, or: ΔC BSL $t0 \rightarrow t30 = 0$.

This is corroborated by Module PU001, requiring "no change in woody biomass carbon stocks if the conditions in AR-TOOL14 v4.2 section 5 are met" (§5.1.2). AR-TOOL14 vs 4.2 states in section 5 that changes in carbon stocks in trees and shrubs in the baseline may be accounted as zero ($\Delta C = 0$) for those lands for which the project participants can demonstrate, through documentary evidence or through participatory rural appraisal (PRA), that one or more of the following indicators apply (applicable indicators are underlined):

(a) Observed reduction in topsoil depth (e.g. as shown by root exposure, presence of pedestals, exposed sub-soil horizons);

(b) Presence of gully, sheet or rill erosion; or landslides, or other forms of mass movement erosion;

(c) Presence of plant species locally known to be indicators of infertile land;

(d) Land comprises of bare sand dunes, or other bare lands;

(e) Land contains contaminated soils, mine spoils, or highly alkaline or saline soils;

(f) Land is subjected to periodic cycles (e.g. slash-and-burn, or clearing-regrowing cycles after periodic cyclones) so that the biomass oscillates between a minimum and a maximum value in the baseline.

Finally, carbon stock in trees in the baseline are accounted as zero because the project zones are in the intertidal zone and devoid of trees – and all of the following conditions are met:

(a) The pre-project trees are neither harvested, nor cleared, nor removed throughout the crediting period of the project activity;

(b) The pre-project trees do not suffer mortality because of competition from trees planted in the project, or damage because of implementation of the project activity, at any time during the crediting period of the project activity;

(c) The pre-project trees are not inventoried along with the project trees in monitoring of carbon stocks but their continued existence, consistent with the baseline scenario, is monitored throughout the crediting period of the project activity.

Expected Project Emissions/Removals

The expected project emissions/removals are calculated using PU001, as this is applicable to mangroves and confirms the applicability of mangrove methodology AR-AM0014. Mangrove methodology AR-AM0014 sets forth the use of AR-TOOL14 "Estimation of carbon stocks and change in carbon stocks of trees and shrubs in A/R CDM project activities, Version 4.2".

Every 5 years, the project will perform a direct estimation of change by re-measurement of the mangrove sample plots within the project area (see §Monitoring), in line with AR-TOOL14 §6.2.

However, at project start, expected project removals in woody mangrove biomass can be estimated through the modelling of mangrove tree growth development following the procedures in AR-TOOL14 v4.2 Section 8.2. That method is used for ex-ante estimation (initial projection) of carbon stock in mangrove tree biomass. We use our field data of the Adjacent Mature Reference Area (AMRA) to predict the growth of mangrove trees and the development of the tree stand over 30 years. The sampling strategy at AMRA was based on 8 inventory plots of 100m² along transect lines for the above ground biomass measurement within the mature mangrove just nearby the project area (see §Monitoring) in the Eastern Cape - the villages of Andasibe, Ambodirafia and Sahanjahana.

The table below shows the dominant species identified in the mature sample plots. Local mangrove species include, as expected: Rhizophora mucronate, Sonneratia alba, Bruguiera gymnorhisa, Avicennia marina, Ceriops tagal, Limnitzeria racemose and Xylocarpus granatum.

Table 1: Classification of the mature mangrove species in AMRA.

FAMILY	**SPECIES**	**VERNACULAR NAME**
RHIZOPHORACEAE	*Rhizophora mucronata*	*HONKO LAHY*
SONNERATIACEAE	*Sonneratia alba*	*FARAFITRA*

RHIZOPHORACEAE	*Bruguiera gymnorhisa*	*TSITOLOMINA*
AVICENIACEAE	*Avicennia marina*	*AFIAFY*
RHIZOPHORACEAE	*Ceriops tagal*	*HONKO VAVY*
COMBRETACEAE	*Limnitzeria racemosa*	*LOVINJO*
MELIACEAE	*Xylocarpus granatum*	*ANTALAOTRA*

Table 2 summarizes the basis site characteristics of the sample plots. As shown by the basic site characteristics, the species Rhizophora mucronata is found in each of the reference sites and Limnitzeria racemosa is encountered in only one plot (MG – AND II). Plots MG-AND II and MG-SAH I have the highest variance and standard deviation while plots MG-AND I have the lowest variance.

Table 2: Basic characteristic of the mature survey plots

QUADRA	**MG-AND I**	**MG-AND II**	**MG-AMB I**	**MG-AMB II**	**MG-AMB III**	**MG-SAH I**	**MG-SAH II**	**MG-SAH III**
coordinates (WGS84)	15.112210°S 050.400214°E	15.127266° S 050.407824 °E	015,277201 °S 050,473162 °E	15,278035° S 050,472661 °E	15.127266° S 050.407824 °E	15,313379° S 050,474804 °E	15.313433° S 050.475118 °E	15.313560°S 050.475337°E
area (m²)	100	100	100	100	100	100	100	100
Entoptic pressure	Medium	Medium	Weak	Weak	Weak	Weak	Medium	Medium
Dominant species	*Bruguiera gymnorhisa*	*Ceriops tagal*	*Rhizophora mucronata*	*Rhizophora mucronata*	*Rhizophora mucronata*	*Ceriops tagal*	*Rhizophora mucronata*	*Rhizophora mucronata*
Distance from village	Close	Far	Close	Close	Close	Far	Far	Far

We subsequently present:

- The floristics list of species present in the AMRA mangrove plots;
- The abundance of AMRA mangrove individuals;
- Species abundance per AMRA plot;
- Jaccard Similarity Index per AMRA plot;
- Demographic structure of species per AMRA plot.

Table 3: Floristic list of species present in the mature survey plots (1: Presence; 0: Absence)

Family	**Species**	**Vernacular name**	**MG-AND I**	**MG-AND II**	**MG-AMB I**	**MG-AMB II**	**MG-AMB III**	**MG-SAH I**	**MG-SAH II**	**MG-SAH III**
RHIZOPHORACEAE	*Rhizophora mucronata*	*HONKO LAHY*	1	1	1	1	1	1	1	1
SONNERATIACEAE	*Sonneratia alba*	*FARAFITRA*	1	0	1	1	0	0	1	1
RHIZOPHORACEAE	*Bruguiera gymnorhisa*	*TSITOLOMINA*	1	1	1	1	0	1	1	1
AVICENIACEAE	*Avicennia marina*	*AFIAFY*	1	0	0	0	1	0	1	0
RHIZOPHORACEAE	*Ceriops tagal*	*HONKO VAVY*	0	1	1	1	0	1	1	1
COMBRETACEAE	*Limnitzeria racemosa*	*LOVINJO*	0	1	0	0	0	0	0	0
MELIACEAE	*Xylocarpus granatum*	*ANTALAOTRA*	0	1	0	0	0	1	1	0

Table 4: Abundance of mangrove individuals in the AMRA survey plots

SPECIES	**MG-AND I**	**MG-AND II**	**MG-AMB I**	**MG-AMB II**	**MG-AMB III**	**MG-SAH I**	**MG-SAH II**	**MG-SAH III**
Rhizophora mucronata	28	54	116	161	67	165	162	154
Sonneratia alba	19	0	1	1	0	0	1	2
Bruguiera gymnorhisa	32	63	15	9	0	6	67	37
Avicennia marina	1	0	0	0	2	0	1	0
Ceriops tagal	0	428	3	1	0	684	93	47
Limnitzeria racemosa	0	11	0	0	0	0	0	0
Xylocarpus granatum	0	6	0	0	0	2	3	0
Sum	80	562	135	172	69	857	327	240
Average	11.4	80.3	19.3	24.6	9.9	122.4	46.7	34.3
Standard deviation	14.5	155.5	42.9	60.2	25.2	255.0	63.4	56.4

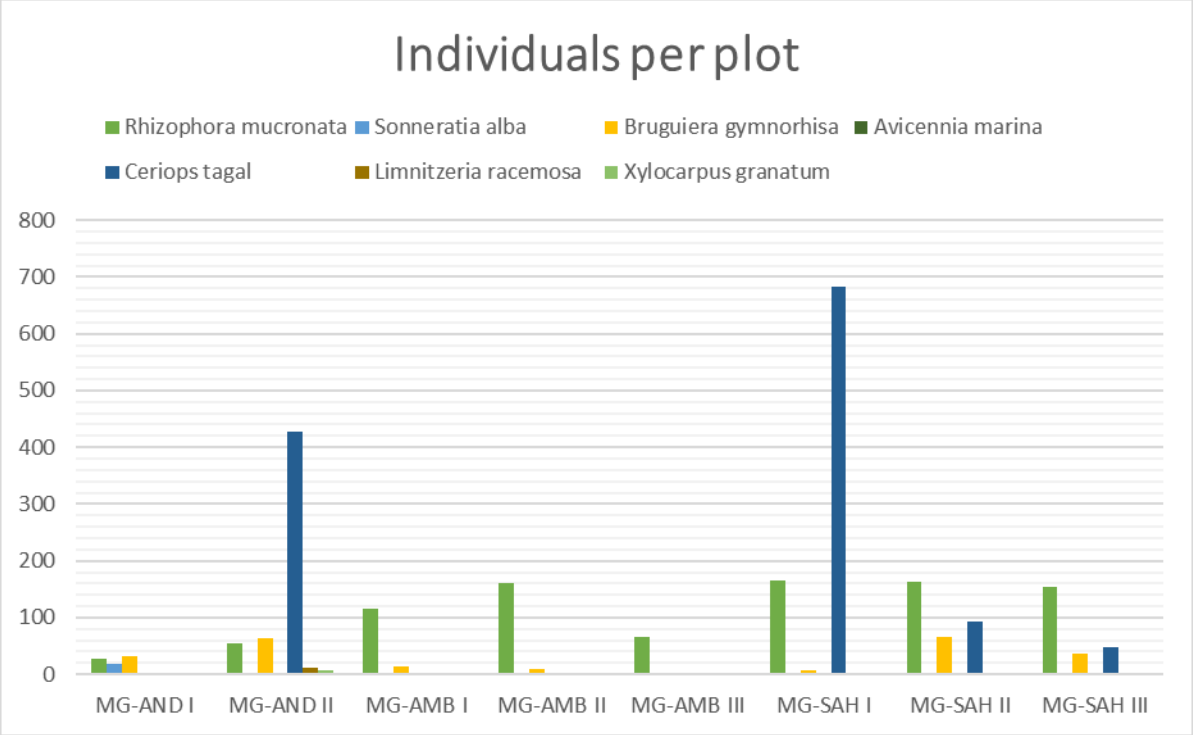


Figure 4: Species Presence and Abundances in the different AMRA plots

Table 5: Jaccard similarity index of the AMRA survey plots

	MG-AND I	**MG-AND II**	**MG-AMB I**	**MG-AMB II**	**MG-AMB III**	**MG-SAH I**	**MG-SAH II**	**MG-SAH III**
MG-AND I								
MG-AND II	28.57							
MG-AMB I	75.00	33.33						
MG-AMB II	80.00	66.67	100.00					
MG-AMB III	50.00	16.67	20.00	20.00				
MG-SAH I	40.00	60.00	60.00	60.00	20.00			
MG-SAH II	66.67	57.14	66.67	66.67	33.33	50.00		
MG-SAH III	60.00	50.00	100.00	100.00	20.00	60.00	66.67	

The table above shows that plots MG-AMB I, MG-AMB II and MG-SAH III are the most similar to each other. By contrast, plots MG-AMB III and MG-SAH I are rather dissimilar. Finally, it is noted that the species *Ceriops tagal* has the highest regeneration rate among all species. By contrast, the species *Avicennia marina* has the lowest rate of regeneration.

Table 6: Demographic structure of the mature mangrove species

		Rhizoph. m.	*Son. alba*	*Brug. gymn.*	*Avic. marina*	*Ceri. tagal*	*Limnt. rac.*	*Xyloc. gran.*
MG-AND I	Seed.	9	13	10	1	0	0	0
	Reg.	19	6	22	0	0	0	0
	Reg. r.	211.1	46.2	220	0	0	0	0
MG-AND II	Seed.	32	0	31	0	19	11	4
	Reg.	22	0	32	0	409	0	2
	Reg. rate	68.8	0	103.2	0	2152.6	0	50
MG-AMB I	Seed.	59	1	11	0	2	0	0
	Reg.	57	0	4	0	1	0	0
	Reg. rate	96.6	0	36.4	0	50	0	0
MG-AMB II	Seed.	38	1	6	0	1	0	0
	Reg.	123	0	3	0	0	0	0
	Reg. rate	323.7	0	50	0	0	0	0
MG-AMB III	Seed.	66	0	0	2	0	0	0
	Reg.	1	0	0	0	0	0	0
	Reg. rate	1.5	0	0	0	0	0	0
MG-SAH I	Seed.	37	0	0	0	32	0	0
	Reg.	128	0	6	0	652	0	2
	Reg. rate	345.9	0	0	0	2037.5	0	0
MG-SAH II	Seed.	107	1	7	0	6	0	1
	Reg.	55	0	60	1	87	0	2
	Reg. rate	51.4	0	857.1	0	1450	0	200
MG-SAH III	Seed.	100	2	11	0	6	0	0
	Reg.	54	0	26	0	41	0	0
	Reg. rate	54	0	236.4	0	683.3	0	0

Next, based on the calculations specified in the monitoring section, the above-ground and below-ground biomass of all AMRA plots can be expressed and summed to obtain woody biomass in tC/ha in all plots.

Plot	AGB (kg per plot)	AGB (tC per plot)	AGB (tC/ha)	BGB (tC/ha)	Woody biomass (tC/ha)
MG-AND I	2137.97	1.18	117.59	128.17	245.76
MG-AND II	5528.03	3.04	304.04	331.40	635.44
MG-AMB I	4097.17	2.25	225.34	245.62	470.96
MG-AMB II	3963.97	2.18	218.02	237.64	455.66
MG-AMB III	3587.18	1.97	197.29	215.05	412.34
MG-SAH I	2935.66	1.61	161.46	175.99	337.45
MG-SAH II	1411.99	0.78	77.66	84.65	162.31
MG-SAH III	4871.90	2.68	267.95	292.07	560.02
Average	**3380.28**	**1.86**	**185.92 (±70.3)**	**202.65 (±76.63)**	**388.57 (±146.93)**

Woody biomass in the adjacent mature reference areas is on average 388.57 tC/ha (±146.93 tC/ha). Note that also soil organic carbon analysis was performed at the FOFIFA Laboratoire de Pédologie (Ampandrianomby). Average SOC in the AMRA samples is 10.71%. In comparison, an indicative sample taken at a highly degraded mangrove near Cap Est had a SOC content of 3.68%.

Excluding SOC from the calculations, and based a molar conversion factor of 3.67, we calculate the woody carbon storage in the AMRA at 1426 ± 539 tCO2e/ha.

Potential Leakage

Leakage may be defined as a reduction in carbon stocks or increase in greenhouse gas emissions outside a project area, as a result of project activities. In Andasibe, it could be possible that, because of the restoration of the project zone, zebu herders will create new passages to the sea and pass with zebu (cattle) during ebb tide.

Based on AR-TOOL15-2.0, leakage emission attributable to the displacement of grazing activities under the following conditions is considered insignificant and hence accounted as zero (applicable conditions are underlined):

(a) Animals are displaced to existing grazing land and the total number of animals in the receiving grazing land (displaced and existing) does not exceed the carrying capacity of the grazing land;

(b) Animals are displaced to existing non-grazing grassland and the total number of animals displaced does not exceed the carrying capacity of the receiving grassland;

(c) Animals are displaced to cropland that has been abandoned within the last five years;

(d) Animals are displaced to forested lands, and no clearance of trees, or decrease in crown cover of trees and shrubs, occurs due to the displaced animals;

(e) Animals are displaced to zero-grazing system.

Above conditions are safeguarded as applicability conditions: access routes and routing of zebu during ebb tide must be agreed during village meetings in every project zone. A legal DINA (bylaw at village level) must be available as evidence, and state that zebu can be displaced towards existing grazing lands. A statement of a government official must accompany the DINA and confirm the location of the grazing lands to where cattle can be displaced (e.g. an area in line with the plan communal de développement), as well as the fact that these grazing lands are not under significant pressure.

Because of the former, and because observations of leakage are included in the annual monitoring targets (see §4), the leakage risk from displaced grazing is insignificant.

Uncertainty

AR-Tool14 states in §8.2: "Ex-ante estimation (projection) of carbon stock in tree biomass is not subjected to uncertainty control, although the project participants should use the best available data and models that apply to the project site and the tree species". It is therefore not necessary to control for estimation as described in PU005.

Furthermore, a comparison of our results with publications in SCI-ranked scientific journals indicates that our carbon estimations remain conservative. As Donato et al. (2011) show, carbon storage of mangroves studied across the Indo-Pacific averaged 1023 tC/ha, the bulk (49%–98%) of which was stored in organic-rich sediments. In mangroves of western Micronesia (Yap and Palau), carbon storage varied from 479 (seaward) to 1385 (landward) tC/ha, of which 70% was stored in sediment (Kauffman et al., 2011). By comparison, our estimations are lower (388.6 tC/ha) and more in line with the regional study of Jones et al. (2014) who estimate mature mangroves in Northern Madagascar have an average total carbon storage of 593.0 tC/ha (±47.1), though including SOC. Indeed, mangroves are extremely productive, with biomass production rates similar to tropical humid forests while most of the carbon is stored below-ground. The presence of dead roots serves as a nutrient conserving mechanism and rapid sediment accretion is responsible for accumulation of soil organic carbon.

For comparison, we list some carbon sequestration data of mangroves across the globe (Alongi, 2012).

Area	Dominant species	Age (years)	Total (tC/ha)	AGB (tC/ha)	BGB + soil (tC/ha)	Roots/AGB (tC/ha)	Roots (tC/ha)	Soil (tC/ha)	Soil depth (cm)
Peninsular Malaysia	*Rhizophora apiculata*	80	2205	312	1893	NA	NA	NA	3800
		18	1117	193	924	NA	NA	NA	4000
		5	479	87	392	NA	NA	NA	2800
Southern Vietnam	*Rhizophora apiculata*	6	1179	54	1125	NA	NA	NA	3400
		20	979	72	907	NA	NA	NA	2750
		35	1904	153	1752	NA	NA	NA	3600
Southern China	*Kandelia candel*	NA	619	64	555	2.0	130	425	1850
		NA	391	43	348	2.2	94	254	1900
		NA	332	7	325	1.1	8	317	1175
Indonesia	*Avicennia marina*	NA	437	24	413	NA	NA	NA	80
	Rhizophora stylosa	NA	703	19	684	NA	NA	NA	62

	Sonneratia caseolaris	NA	654	28	626	NA	NA	NA	1450
Southern Thailand	*R. apiculata*	25	808	138	670	1.0	142	528	1900
	R. apiculata	5	579	20	559	2.9	57	502	800
	Ceriops decandra	3	600	29	571	4.4	127	444	1000
Western Australia	*R. stylosa*	NA	863	115	621	1.1	127	621	1500
	A. marina	NA	662	55	515	1.7	92	515	775
Queens-land, Australia	*R. stylosa*	NA	2139	297	1842	1.1	312	1530	3500

Expected Carbon Benefits

We summarize the expected carbon benefits in the Tables below.

Expected Carbon Benefits Summary

Project Intervention	**Initial woody carbon stock (tCO2e/ha)**	**Baseline Emissions (t CO_2e/ ha)**	**Project Emission (t CO_2e/ha)**	**Leakage Emissions (t CO_2e/ha)**	**Carbon Benefit (t CO_2e/ha)**
Mangrove Restoration Planting	0	0	-1426 tCO2e/ha	0%	-1426 tCO2e/ha

Plan Vivo Certificate Potential

Project Intervention	**Carbon Benefit (t CO_2e/ha)**	**Project Area (ha)**	**Total Carbon Benefit (t CO_2e)**	**Risk Buffer (t CO_2e/ha)**	**Achievement Reserve**	**Uncertainty Buffer**	**Potential PVCs (t CO_2e)**
Mangrove Restoration Planting	-1426	14.1	-20 107	20%	10%	0%	14 075
TOTAL	-1426	14.1	-20 107	20%	10%	0%	14 075

Monitoring

1. Biomass survey

Aboveground mangrove biomass inventories were carried out in the AMRA, using 8 sample plots of 100 m². GPS coordinates (in WGS-84) of all plots were taken. The parameters measured in each plot include:

(i) Floristic parameters:
- Scientific name of each individual present in the plots: family, genus and species;
- Vernacular name of each individual: local name of each individual;
- Numerical abundance: total number of individuals present in each plot.

(ii) Dendrometric parameters:
- DBH or breast height diameter for adult plants;
- Maximum height.

(iii) Biological type:

After, the classification of Raukiaer (1905) on Phanerophytes:

- Mesophanerophyte: plant at height between 8 to 30m
- Microphanerophyte: plant at height between 2 to 8m
- Nanophanerophyte: plant at height between 0.5 to 2m

(iv) Regeneration rate:

According to Rollet (1979), natural regeneration is the set of processes by which plants multiply without silvicultural intervention. The study of regeneration makes it possible to know the rate and potential of regeneration of each species studied. The purpose here is to know the demographic structure of individuals and the regeneration rate of each species. This is to distinguish between mature individuals, i.e. those that are able to reproduce (IUCN, 2001). For mangroves the following maturity boundaries are used:

- Seedling: d< 2.5cm
- Young plant: 2.5cm ≤ d < 6cm
- Adult: d ≥ 6cm

The regeneration rate (TR) is expressed as the percentage ratio of regeneration individuals (n) to seed individuals (N). The regeneration rate was obtained by the following Rothe (1964) formula:

$$TR(\%) = (ni/N) \times 100$$

With:

ni: regenerated individual

N: Seed individual

TR: regeneration rate

According to Rothe (1964):

- A regeneration rate of less than 100% indicates that the species has a regeneration problem.
- A regeneration rate between 100% and 1000% indicates average or good regeneration.
- A regeneration rate of more than 1000% indicates that the species has a high potential for regeneration.

Beside general statistical characteristics (sum, mean, variance, standard deviation), also the Jaccard similarity index is calculated. The Jaccard similarity index makes it possible to compare two sites; thus assessing the resemblance between these by establishing the relationship between the common species and specific to each survey.

$$IJaccard = \frac{Nc}{(N1 + N2)}\ x\ 100$$

With:

Nc: Number of taxa common to situation 1 and 2

N1 and N2: Number of taxa present in 1 and 2 respectively

$I_{Jaccard}$: Jaccard similarity coefficient, expressed in percent

2. Above-ground biomass

According to the AR-TOOL14-4.2, the allometric equation applied to a tree species must be preferably selected from existing data applicable to the local situation (e.g. represented by similar ecological conditions). Thus, we preferably used the allometric equations based on Jones et al. (2014) for calculating above-ground mangrove biomass in Northern Malagasy mangroves (Table 7). Based on these allometric equations, above-ground carbon content can be estimated per tree and per plot as 0.55 × AGBM (FAO, 2017; Winrock, 1997).

Table 7: Allometric equations from Jones et al. (2014) for Above-ground mangrove biomass (B); dbh refers to diameter at breast height; D represents diameter; H stands for height; p = wood density.

Species	Allometric equation	Wood density
Avicennia marina	$B = 0.1848 \times dbh^{2.3524}$	0.661
Bruguiera gymnorrhiza (leaves)	$B = 0.0679 \times dbh^{1.4914}$	0.741
Bruguiera gymnorrhiza (stem)	$B = 0.464 \times (dbh^2 \times H)^{0.94275} \times p$	0.741
Ceriops tagal (dbh 2–18 cm)	$B = 10^{-0.7247} \times dbh^{2.3379}$	0.803
Ceriops tagal (dbh 18–25 cm)	$B = 10^{-0.494} \times dbh^{2.056}$	0.803
Heritiera littoralis (leaves)	$B = 0.0679 \times dbh^{1.4914}$	1.074
Heritiera littoralis (stem)	$B = 0.464 \times (dbh^2 \times H)^{0.94275} \times p$	1.074
Lumnitzera racemosa	$B = 0.0214 \times (dbh^2 \times H)^{1.05655} \times p$	0.565
Rhizophora mucronata (leaves)	$B = 0.0139 \times D^{2.1072}$	0.867
Rhizophora mucronata (root)	$B = 0.0068 \times dbh^{3.1353}$	0.867
Rhizophora mucronata (stem)	$B = 0.0311 \times (dbh^2 \times H)^{1.00741} \times p$	0.867
Sonneratia alba	$B = 0.0825 \times (dbh^2 \times H)^{0.89966} \times p$	0.78
Xylocarpus granatum	$B = 0.0830 \times (dbh^2 \times H)^{0.89806} \times p$	0.7

3. Below-ground biomass

According to the AR-TOOL14-4.2, root-shoot ratios must be applied for estimating below-ground biomass. We use the root-shoot ratio calibrated for tidal marshes, developed by Mokany et al. (2006).

4. Re-measurement of the sample plots over time

Every 5 years, the project will perform a direct estimation of change by measurement of 43 fixed survey plots of 100 m² within the project areas, in line with AR-TOOL14 §6.2, to re-calibrate the sequestration rates. The minimum number of survey plots required is calculated using the Winrock Sample Plot Calculator.

Annex 7b – Technical Specifications

Project Intervention:	Voa Aina: (agro)forestry intervention
Version:	2.0
Date Approved:	Approved with PDD
Methodology:	PM001 Agriculture and Forestry Carbon Benefit Assessment Methodology
Modules/Tools:	Module PU001
Certificate Type(s):	fPVCs, rPVCs, vPVCs

Applicability conditions

This technical specification focusses on the Voa Aina agroforestry interventions. It includes woodland planting and orchards with mixed native or naturalized tree species. Agroforestry interventions provide numerous ecosystem services and benefits for smallholder farmers. The woodland technique may also be employed on degraded land, where it can help to rehabilitate the land in the long run.

The project follows a strict checklist containing the project applicability conditions when considering a potential project area. All project areas must meet these requirements, while the checklist can also be used when identifying candidate plots for expanding the project.

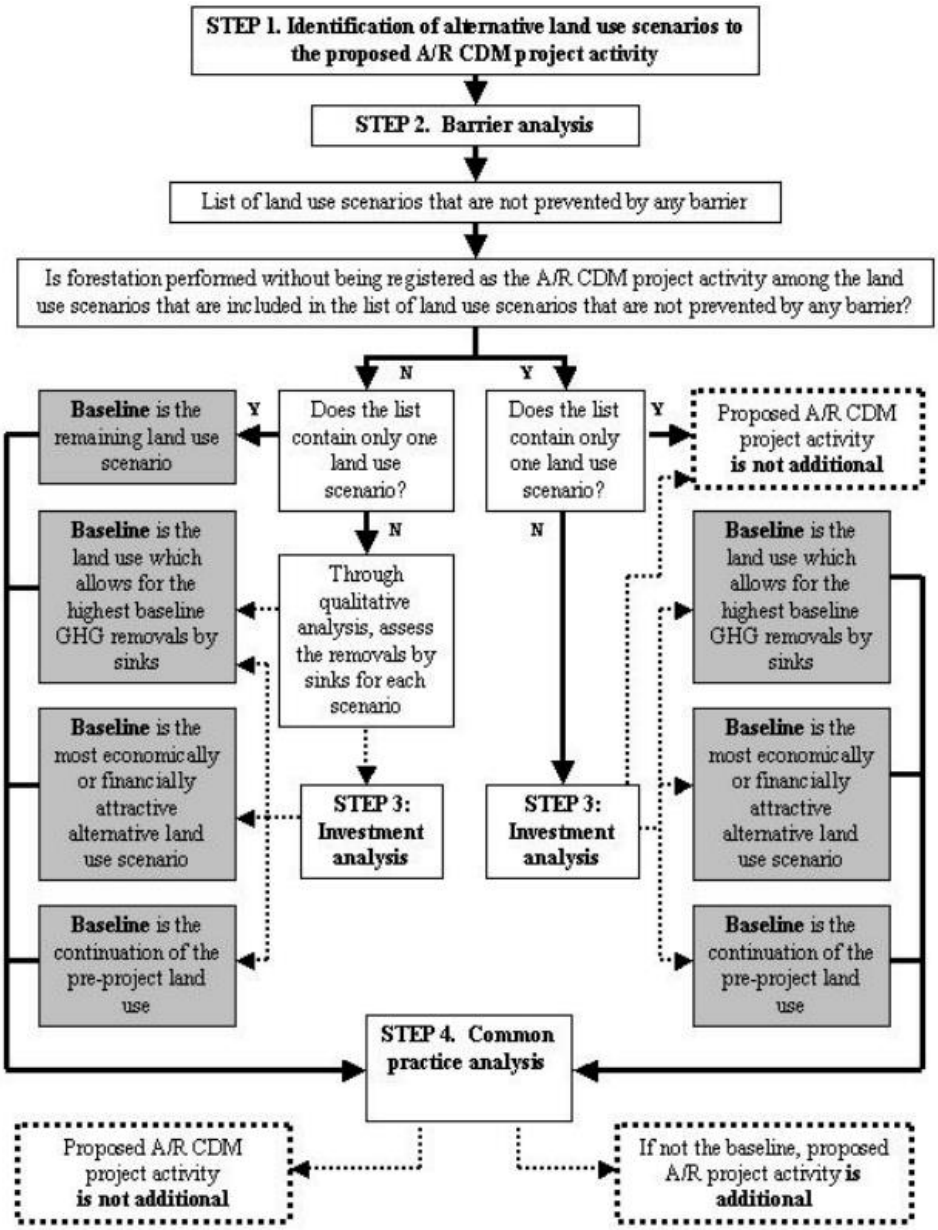
The applicability conditions are:

1. Project areas can only be located on plots of grasslands largely devoid of trees, with signs of bare soil, sheet or rill erosion; or on private lands that are largely devoid of trees where slash-and-burn was practiced before ('tavy'). For each application, areas already covered with trees will be left out of the project.
2. Plantings must have firebreaks when relevant.
3. Plantings cannot be located on existing woodlands, nor on important or designated grazing lands.
4. Interested project participants require proof of land ownership that is consistent with the legislation (e.g. in the form of land title, purchase agreement, proof of inheritance, confirmation by the mayor, customary ownership or other).
5. The project woodland nurseries must provide extra fruit or supplemental trees and distribute these free of charge.
6. Where relevant, a bylaw at village level (or government official statement) must be available as evidence that cattle can be displaced towards existing grazing lands that are not over pressured.
7. Observations of cyclones, wildfire occurrence, overgrazing, tree cutting and charcoaling in and around the project areas must be reported by project staff and discussed during the yearly meetings with the communities.

Additionality

Below we describe the most likely land use scenario in the absence of project interventions and the additionality of the project interventions using AR-TOOL02 v1.0: "Combined tool to identify the baseline scenario and demonstrate additionality in A/R project activities".

We follow the following steps:



STEP 0. Preliminary screening based on the starting date of the project activity

The starting year of the activity was 1 January 2022. By then, the incentive from the planned project was seriously considered in the decision to proceed with the project activity.

STEP 1. Identification of alternative land use scenarios to the proposed project activity

Sub-step 1a. Identify credible alternative land use scenarios to the proposed project activity

Based on the socioecological survey (see §3.3.1), we identify the following land use scenarios to be credible:

• Continuation of the pre-project “cropland or bushy grassland scenario” consisting of grassland with bushes and occasional trees, but largely devoid of trees. The bushy grassland is a land use under periodic burning (but without cropping nor fertilizer application);

• Agroforestation (woodland and orchards planting) on the plots within the project boundaries without being registered as a plan vivo project activity;

Sub-step 1b. Consistency of credible alternative land use scenarios with enforced mandatory applicable laws and regulations

Both alternative land use scenarios are in compliance with mandatory legislation and regulations taking into account their enforcement in Madagascar. Continuation of the status quo is in agreement with laws and regulations, while spontaneous tree planting is obviously a land cover type that is allowed by applicable regulations on private lands.

STEP 2. Barrier analysis

Sub-step 2a. Identification of barriers that would prevent the implementation of at least one alternative land use scenarios

No financial, technical, institutional nor social barriers would plausibly hamper the continuation of the status quo. Continuation of the current landscape scenario requires no investments, technical knowledge nor legal efforts: croplands would remain croplands and grasslands would remain regularly affected by fires (see further). However, agroforestation without extra funding is not a plausible scenario, given the significant amount of funding required and the lack of nurseries in the area.

Sub-step 2b. Elimination of land use scenarios that are prevented by the identified barriers

We eliminate the scenario of agroforestation without extra funding, since it is not a plausible future land cover scenario, given the lack of antecedents, the significant amount of funding required and the lack of nurseries in the area. We refer to the financial plan (Annex 16).

Sub-step 2c. Determination of baseline scenario (if allowed by the barrier analysis)

Agroforestation without being registered as a plan vivo project is not included in the list of land use scenarios that are not prevented by any barrier. Consequently, only one land use scenario remains ("continuation of the status quo land use"), so according to the tool, this scenario is the baseline scenario. We continue with Step 4: Common practice test.

STEP 4. Common practice analysis

There are no similar previous or ongoing agroforestation activities in or near the project zones, not even remotely similar to this proposed plan vivo registered project. Consequently, the plan vivo project activity is not the baseline scenario and, hence, it is additional. The "continuation of the status quo land use" becomes the baseline scenario.

Finally, below we present a summary of the basic barriers the project activities are to overcome.

Table 1: Main barriers for the project activities to overcome.

Agroforestry	**Main Barriers**	**Activities to Overcome Barriers**
Financial	- Very limited farmer cash income to buy seedlings - Limited credit availabilities - Very few other nurseries or governmental nurseries available	- Free distribution of seedlings - High-quality nurseries established by Voa Aina, producing high-quality seedlings - Smart use of scarce lands (optimal combination of crops, fruits, trees)
Technical	- Focus on exotics introduced by colonizer: Eucalyptus spp. and Pinus spp. - Few trainings on agroforestry; expensive technical consultants	Academic input of environmental scientists; skilled local coordinator team; free technical training for farmers; fruit production becomes possible*.
Institutional/Social	- "Top-down approach", although room is given for local initiatives - Climate policies (e.g. REDD+) large-scale instead of small-scale - Transferring only responsibilities, not rights, to the local communities	- Bottom-up approach with consultation rounds, continued workshops and benefits from agroforestry - Rewarding for implementation results - Local communities are not the problem, they are the solution for the environmental issues
*Further additionality and spill-over effects of the project may include increased blue/green water availability for crops close or downstream to the project areas, erosion control, limited timber production and fruit production.		

Project activities

Agroforestry interventions include woodland planting and orchard planting with mixed native or naturalized species.

Woodland planting (case in point: Manakara/Betampona/Mananjary project area)

The following activities are carried out (in chronological order):

1. Establishing new nurseries: Four nurseries have been established near the project zones. Every year, 80k seedlings are raised (~20k per nursery), of which 40k are planted in the project zones. Species include mainly (i) Intsia bijuga (hintsina), (ii) Canarium madagascariensis (arami), and (iii) Calophyllum inophyllum (forahofa) (but also some Mantalise, Mandahifu, Mandrorofo Ramy, Kaya, Albisia and Manalisia). Every year, another 40k fruit trees are distributed for free in the four surrounding villages and/or these can be interplanted with the woody seedlings. These seedlings benefit the four surrounding communities, by providing fruits and covering daily needs (e.g. heating, construction, fences).

2. Establishing firebreaks. The Manakara project initially protects and restores 200 to 323 hectare of highly degraded ecosystem areas, to be scaled up towards ~1000 ha later. The project actively creates effective firebreaks where necessary, in close consultation with the communities of the nearby villages. The firebreaks have a width of 5 to 15m.

3. Woodland planting in the project zone. Planting of trees is done on individual or community fields, after a project agreement is made. Through tree planting and/or direct sowing, up to 1000 trees are planted per hectare. The survival rate for planted seedlings is about 65% after 6 months. The survival rate for direct sowing is about 45% after 6 months. After the first year, one assumes a longer-term mortality rate of 0.5% per year. In any case, the project aims at a final stand density of >400 trees/ha. To achieve the stand density target, “regarnissage”/replenishment planting is performed in the years after planting (when relevant and after survival rate counting). The nursery employees and community members are helping with protecting and observing the project zone. Their role is mainly to engage with the nearby communities. Note that no pruning nor wood harvesting of the project trees is foreseen during the project period.

4. Supplemental trees raising. The nurseries involved also provide extra seedlings (or equivalent), not to plant within the project zone but to distribute for free to the communities. These seedlings can be planted in specifically designated zones, allowing for use after ~4 years (cutting, charcoal). Obviously, these trees are excluded from the carbon benefit calculations below. Nevertheless, the distribution additionally reduces general pressure on the woodlands.

5. Activate ecosystem co-benefits. Woodland establishment is important to improve the natural water cycle supplying water access for all the nearby villages and thus also for agricultural production. The project will provide trainings on sustainable water management practices (e.g. water wells as socioenvironmental reinvestments). Besides, the project will monitor biodiversity in a quantitative way, including key flora species, using the Shannon diversity index.

6. Involve the surrounding communities. The local communities will be involved in each step of the project and are activated in the project as co-designers, daily labourers to collect the seeds, potting, maintaining the nurseries, creating and maintaining firebreaks, and planting trees. Herders and charcoal producers are integrated into the community meetings and trainings to strengthen sustainable grazing and charcoal practices as alternatives on the longer term.

Figure 1: Nursery of Vohipeno (project zone Manakara). Note that these tree seedlings are strong enough to be collected for planting activities: they do not need shading constructions anymore at this stage.

Orchard planting

The orchard planting activities are summarized below (in chronological order):

1. Establishing nurseries for naturalized trees. Nurseries are established with on average 50% of their seedlings being naturalized fruit species (the other half endemic forest species such as Intsia, Canarium and Calophyllum). The nurseries thus contain approximately 5000 fruit trees per nursery. Grains can be derived from organic waste or from nearby orchards.

2. Free seedling distribution. After occasional radio broadcasts and community meetings, interested households can pick up 50 up to 400 seedlings to plant at their agricultural fields. Generally, people come from a radius of about 20km from the nursery. These tree seedlings are distributed free of charge and on a voluntary basis, with the aim to support agroforestry practices by smallholder farmers. Tree species that work well with agricultural crops are chosen. The dominant crops are rice, maize and manioc, but smallholders also commonly cultivate vegetables, coffee, cacao and vanilla.

3. Tree planting. Planting of trees is done on the individual fields, after an individual project agreement is made. All farmers can receive free agroforestry training. The estimated survival rate is 65% after the first six months after planting, and a longer-term mortality rate of 0.5% the years thereafter. The activity includes the planting of a mixture of non-fruit species (mainly Intsia bijuga, Canarium madagascariense, Calophyllum inophyllum); and fruit species such as mango (Mangifera indica), avocado (Persea americana); occasionally also lemon (Citrus limon), medlar (Mespilus germanica) and jambolana (Eugenia cumini). The final stem density target is 400 trees/ha (roughly one tree every 5 m), which allows the continuation of crop production on the field. Note that no pruning nor wood harvesting of the project trees is foreseen during the project period.

4. Aftercare. Free training on aftercare management is provided. Weeding is a common aftercare technique, while “regarnissage” is performed the next rainy season(s) (when relevant and after survival rate counting), in order to replace underperforming seedlings. Deadwood is generally removed. There is a low risk of fire occurrence in the cropping zones, as these zones are generally close to the village and agriculturally important, but firebreaks must be installed when relevant. Finally, farmers are encouraged to use organic fertilizer and organic pesticides for disease control. The project also provides free training to participants to protect trees from drought through mulching and micro-irrigation.

Carbon benefits

Crediting Period

This is an intervention based on a 30-year registration period. Direct payments will be made to the participants during the first 20 years of the project period, in line with the achievement of the milestone targets. This will allow to cover the early costs of planting the seedlings and taking care of these during the first years. Meanwhile, the payments also support the participating smallholders with cash to meet their direct livelihood needs. After 20 years, smallholders will also benefit from the non-timber forest production, for instance mango, avocados, the bark and leaves of the Intsia used in traditional medicines, the fruits and resins from the Canarium, the Calophyllum oil etc.

After 30 years, when the stand reaches maturity, sustainable forest management may become possible. Trees can be pruned. Natural regeneration and “regarnissage” will then resupply the stand density to ensure the equilibrium.

Carbon Pools and Emission Sources

These technical specifications are developed using Module PU001. We include the following carbon pools (Table 2):

Table 2. Carbon pools included in the calculations.

Carbon pool	Included?	Justification/Explanation
Above-ground woody biomass	Yes	This is a potentially significant pool and is considered for tree planting and agroforestry activities
Below-ground woody biomass	Yes	This is a potentially significant pool and is considered for tree planting and agroforestry activities
Non-tree biomass	No	Although not explicitly included in the accounting, crop residues are modelled and included as an input to the soil organic carbon pool where appropriate
Dead wood	No	Although not explicitly included in the accounting, dead wood is modelled and included as an input to the soil organic carbon pool where appropriate
Litter	No	Although not explicitly included in the accounting, tree litter inputs are modelled and included as an input to the soil organic carbon pool where appropriate
Soil organic carbon	No	This is a major pool affected by tree planting, agroforestry and agricultural activities
Wood products	No	Wood products are not accounted for, and are conservatively excluded

This intervention is targeting plots that are currently largely devoid of trees. It is assumed that the current woody biomass stock on the plots would remain static under both the baseline scenario and under the project intervention scenario. Indeed, given among others the lack of nurseries in the region, it is highly unlikely that smallholders would independently plant trees on their plots without extra project support.

Baseline Emissions/Removals

Currently, the project areas are largely devoid of trees (Figure 2). Without improved management and seedling planting, we can reasonably expect a stable system where future carbon sequestration will be very limited.

The general tree cover trend in Eastern Madagascar is indeed worrying. It is beyond doubt that vegetation cover decline has been significant over the past years and decades across the Eastern agro-ecological belt of Madagascar. Studies identify a clear reduction in tree cover and tree species diversity over the years, setting in motion processes of severe erosion and soil (fertility) loss. Zaehringer et al. (2015) find that over the last two decades, “the speed of forest loss increased, the total area of upland rice production remained almost stable, and the area of irrigated rice fields slightly increased”. Their findings confirm a significant trend of land use intensification, while deforestation through shifting cultivation is still on the rise. Interestingly, “deforestation mostly affects the small forest fragments interspersed in the agricultural mosaic and is slowly leading to a homogenization of the landscape” (Zaehringer et al., 2015).

Besides, Brown et al. (2015) predict a sharp decline in biodiversity on the eastern escarpments and high elevation ecosystems. The forecast for Eastern Madagascar’s plant diversity is worrying: “regional diversity will continue to decrease in response to the combined effects of climate and land

cover change, with habitats such as ericoid thickets and eastern lowland and sub-humid forests particularly vulnerable into the future".

Figure 2: Illustrations of baseline conditions at Manakara project areas

Focussing on the project areas, one can expect the change in carbon stock in the project zones to be stable in the baseline scenario, under continued or even increasing hydroclimatic pressures. Photographs testify to the stable status in 2022. Without active nurseries, distribution of seedlings, investment funding, planting and training on management techniques, we can expect a stable baseline where future carbon stocks will not increase. Indeed, it is highly unlikely that farmers would independently plant trees on the plots without nurseries or without extra project support. Overall, we can reasonably assume that there is no change in carbon stock in the baseline scenario as compared to the initial carbon stock: $\Delta C_{baseline} = 0$.

In more standardized terms, Plan Vivo Module PU001 (applicable for Agroforestry) requires "no change in woody biomass carbon stocks if the conditions in AR-TOOL14 v4.2 section 5 are met" (§5.1.2). The AR-TOOL14 vs 4.2 states in section 5: "Changes in carbon stocks in trees and shrubs in

the baseline may be accounted as zero for those lands for which the project participants can demonstrate, through documentary evidence or through participatory rural appraisal (PRA), that one or more of the following indicators apply:

i. Observed reduction in topsoil depth (e.g. as shown by root exposure, presence of pedestals, exposed sub-soil horizons);
ii. Presence of gully, sheet or rill erosion; or landslides, or other forms of mass movement erosion;
iii. Presence of plant species locally known to be indicators of infertile land;
iv. Land comprises of bare sand dunes, or other bare lands;
v. Land contains contaminated soils, mine spoils, or highly alkaline or saline soils;
vi. Land is subjected to periodic cycles (e.g. slash-and-burn, or clearing regrowing cycles [or periodic burning]) so that the biomass oscillates between a minimum and a maximum value in the baseline."

We note that the above underlined conditions are valid and safeguarded as project applicability conditions.

We finally note that following AR-TOOL14 v4.2 section 5, carbon stock in trees in the baseline can be accounted as zero if all of the following conditions are met:

a) The pre-project trees are neither harvested, nor cleared, nor removed throughout the registration period of the project activity;
b) The pre-project trees will not suffer mortality because of competition from trees planted in the project, or damage because of implementation of the project activity, at any time during the registration period of the project activity;
c) The pre-project trees are not inventoried along with the project trees in monitoring of carbon stocks but their continued existence, consistent with this baseline scenario, will be monitored throughout the crediting period of the project activity.

Expected Project Emissions/Removals

Expected changes in carbon are calculated based on PU001 through AR-TOOL14: Estimation of carbon stocks and change in carbon stocks of trees and shrubs in A/R CDM project activities, Version 4.2.

At project start, expected project removals in woody biomass must be estimated through the modelling of tree growth development following the procedures in AR-TOOL14 v4.2 Section 8.2. That method is used for ex-ante estimation (initial projection) of carbon stock in tree biomass. One must develop a fitting growth model to predict the growth of trees and the development of the tree stand over time. To develop the growth model, DBH growth curves of the main species involved were measured in the field (field survey Tanambaon' I John ou Ankiakantely).

The Tanambaon'i john Restoration Plots have been restored by Graine de Vie in collaboration with the rural commune of Sahantaha and the active participation of local communities since and after 2012. The aim was to restore the shreds of the forests linking the two communes of Ampohibe and Sahantaha formed by several small plots. Thus, a growth monitoring mission was organized in Tanambaon'i John in October 2023 to find out the survival rate and growth rate of the seedlings placed in the ground. This report presents the results of the mission. The objective of the mission

was to know the survival rate and growth of plants in each plot of each species of plants in order to be able to calibrate regional DBH growth curves.

The method was to measure the total height and DBH of mature plants in the restoration plot and to measure the total height of the seedlings of each species placed underground. It consists of placing a 10x10m plot at random and measuring the living seedlings in each plot and each species put underground. In total, 217 trees were measured to calibrate the DBH – age curve per specie.

The restoration plots at Tanambaon'i John are characterized by the presence of small hills generally carpeted with vegetation following the slopes. Seedlings were planted each year in the open areas to fill the plots with fast-growing or native species. To this end, the plots are scattered according to the places likely to be restored. The plants usually grow at the beginning of the rainy season if they have fallen into the somewhat fertile part of the soil. Other seedlings that are placed on more arid soils seem to struggle to grow and require more intervention to succeed. Here are the results of monitoring in the restoration plots at Tanambaon'i John.

Seedlings

Since 2021, Graine de vie has focused its activities on two species: Intsia bijuga and Calophyllum inophyllum. Therefore, the monitoring of young plants is mainly focused on these two species.

Intsia bijuga:

Counting and surveying was done by randomly placing a 10x10 plot in the planting plot. For intsia, the three-year survival rate is 90%. The plants grow at an average of 5.7cm per year. For each reforestation campaign, dead seedlings are replaced by seedlings and then activity continues in the non-wooded areas.

The exponential projection of Intsia height shows that young plants grow at 5 cm per year, so it is difficult to estimate the time to mature. In fact, there are several factors that interfere such as the fertility of the soil, the passage of fire, zebu grazing.

Calophyllum inophyllum:

For Foraha, the survival rate was 82.67%. It grows faster than Intsia at a rate of 14cm per year. This species does not tolerate arid environments with sandy-rocky soils. Some parts of the plot have very poor soils with the presence of pebbles.

The exponential projection of Foraha's height shows that young plants normally grow at 14cm per year, so in only a few years time, they are already starting to develop flowers if the protection of the plot is ensured.

Mature Trees

Acacia sp: (50.343391; -15.081154)

Placed right at the entrance to the restoration plot, the acacia trees planted in 2013 are already of exploitable size in 2023. In 11 years, they already have an average height of 13.76m. Out of 37 individuals measured, the correlation coefficient between height and DBH was 0.78. That is, the higher the plant grows, the bigger the trunk. The acacia is perfectly suited to the restoration field at Tanamban'i John with its average growth of 1.21m per year and average DBH growth of 2.23 cm/yr.

Mangifera indica sp: (50.341146; -15.081667)

Measurements were made on 25 mature individuals. This species has an average height of 12.17m, but it has a large DBH with a Height-DBH correlation coefficient of 0.69. Having reached a certain height, the mango trees do not heighten much more, but they take on a bigger horizontal dimension by their larger DBH.

Annual growth was on average 1.1m, which seemed somewhat higher in the places at the top of the hills. Average DBH growth was 3.48 cm/yr.

Callophyllum inophyllum (Foraha): (50.339094; -15.082715)

Foraha or Callophyllum inophyllum usually grows near the coastline by the sea. However, this plant is also able to adapt to the poor environment in the interior of the land, such as Tanambaon'i John. The annual growth was measured at 0.74m. This plant is resistant to the passage of fire, just like the Acacia. Planted in 2020, this is a fast-growing plant and its DBH is correlated with height (coefficient 0.73). Average DBH growth was 1.37 cm/yr. For reasons of conservativeness, this is also considered the maximum ex ante growth rate.

Canarium madagascariense and Intsia Bijuga: (50.332346; -15.080790)

The Intsia planted in 2013 already have an average height of 3.49m with an average growth of 0.27m per year. The plot of Intsia is placed on less fertile soil as a result of the passage of fire almost every year, whose unadapted plants do not grow much. This species from the valley is not at all adapted to this somewhat arid environment. Average DBH growth was 0.60 cm/yr.

Next, AGB per tree was modelled. To model AGB, BNC REDD+ Madagascar (2018) advises to use the following allometric equation, developed by Vieilledent et al. (2012):

$$AGB = e^{-1.948+1.969\times ln(DBH)+0.66\times ln(H)+0.828\times ln(\rho)}$$

With:

AGB : Above-Ground Biomass per tree estimated, in tdm/ha

ρ : Wood density

DBH : Diameter at Breist Height (DBH): tree diameter at 1.30m above the soil

H: Estimated height of the tree

The height of the tree is to be modelled with the equation of Vieilledent et al. (2012):

$$H = 12.120 - (12.120 - 1.3)e^{0.052 \times DBH}$$

With:

H: Estimated height of the tree

DBH : Diameter at Breist Height (DBH): tree diameter at 1.30m above the soil

Wood densities can be determined from the global database of wood densities compiled by Chave et al. (2009). Based on the allometric equation above, above-ground carbon content was estimated per tree as 0.55 × AGBM (FAO, 2017; Winrock, 1997).

Finally, for estimating below ground biomass of dense humid forest, the BNC REDD+ Madagascar (2017) reports on the estimations for BGB using root-shoot ratios developed by Mokany et al. (2006). For reasons of conservativeness, we here use the lowest root-shoot ratio of the Mokany table: BGB is estimated to account for 0.20 of the total AGB (in line with Santantonio et al, 1997).

We refer to Annex 6 for the calculation sheet of the Expected Project Emissions/Removals.

Potential Leakage

Leakage is defined as a reduction in carbon stocks or increase in greenhouse gas emissions outside the project area, as a result of project activities. On the croplands, cropping agriculture can continue as before. Yet, the main potential source of agroforestry leakage would clearly come from displaced grazing, i.e. burning pressure displaced towards other nearby areas because grazing is no longer possible inside the project areas.

This technical specification uses AR-TOOL15 version 2.0 to estimate leakage significance: A/R Methodological tool – Estimation of the increase in GHG emissions attributable to displacement of pre-project agricultural activities in A/R CDM project activity. The tool states under §10: “Leakage emission attributable to the displacement of grazing activities under the following conditions is considered insignificant and hence accounted as zero (applicable conditions are underlined):

a) Animals are displaced to existing grazing land and the total number of animals in the receiving grazing land (displaced and existing) does not exceed the carrying capacity of the grazing land;
b) Animals are displaced to existing non-grazing grassland and the total number of animals displaced does not exceed the carrying capacity of the receiving grassland;
c) Animals are displaced to cropland that has been abandoned within the last five years;
d) Animals are displaced to forested lands, and no clearance of trees, or decrease in crown cover of trees and shrubs, occurs due to the displaced animals;
e) Animals are displaced to zero-grazing system.

Observations of leakage are discussed during the annual community meetings and included in the annual monitoring targets (see §4) and the current project areas cannot be important or designated grazing lands. A statement of a government official must be made to confirm the location of the grazing lands to where cattle can be displaced (e.g. an area in line with the plan communal de développement), as well as the fact that these grazing lands are not under significant pressure.

The project nurseries must also provide extra trees and distribute these free of charge.

Above conditions are safeguarded as applicability conditions: the leakage risk from displaced grazing is insignificant.

Uncertainty

We refer to AR-Tool14, which states in §8.2: "Ex-ante estimation (projection) of carbon stock in tree biomass is not subjected to uncertainty control, although the project participants should use the best available data and models that apply to the project site and the tree species". It is therefore not necessary to control for uncertainty estimation as described in PU005.

Expected Carbon Benefits

We refer to the Tables below to summarize the Expected Carbon Benefits.

Expected Carbon Benefits Summary

Project Intervention	**Initial woody vegetative carbon stock* (tCO2e/ha)**	**Baseline Emissions* (t CO_2e/ ha)**	**Project Emission (t CO_2e/ha)**	**Leakage Emissions (t CO_2e/ha)**	**Carbon Benefit (t CO_2e/ha)**
Woodland planting	0	0	-402	0%	-402
Orchard	0	0	-348	0%	-348

**Based on AR-TOOL14 v4.2 section 5*

Plan Vivo Certificate Potential

Project Inter-vention	**Carbon Benefit (tCO_2e/ha)**	**Project Area (ha)**	**Total Carbon Benefit (t CO_2e)**	**Risk Buffer (tCO_2 e /ha)**	**Leakage Buffer (tCO2e /ha)**	**Achievement reserve (tCO2e /ha)**	**Uncertainty buffer**	**Pot. PVCs (t CO_2e)**
Woodland planting	-402	323	129 846	20%	0%	10%	-	90 892
Orchard	-348	10	3480	20%	0%	10%	-	2436
TOTAL	-375	333	133 326	20%	0%	10%	-	93 328

Monitoring

The project will rigorously keep track of the performance of each survey plot over time (see Annex 13.3, E1). Each smallholder plot has a project agreement with a plan vivo map, along with a monitoring scheme specifying the performance-based milestones.

Milestone-based monitoring scheme for each smallholder plot:

Time of measurement (yr)	**Performance-based milestone**	**Method of measurement**
0 (within one year of planting)	At least 50% ofthe planned number of trees is planted and protected against burning when relevant	Physical counting of *all* new trees planted (while counting all existing trees too)
1	100% of the planned number of trees planted and protected against burning when relevant	Physical counting of *all* new trees planted
3	At least 65% of the planted trees surviving	Physical counting of *all* the surviving trees
5	An average DBH of at least 3cm	DBH measurements, based on a representative sample of at least 10% of the trees concerned
7	Average DBH of at least 4cm	DBH measurements, based on a representative sample of at least 10% of the trees concerned
10	An average DBH of at least 6cm	DBH measurements, based on a representative sample of at least 10% of the trees concerned

It is important to note that all project plots are visited by project staff or by a community liaison officer in the years specified in the Monitoring Table.

At the first three milestone checks, all planted trees are observed (to count the number planted and the survival rate). At the last three milestone checks, diameter at breast height is measured for every project plot at a representative subpopulation of that plot (subpopulation equal to 10% of the total

planted trees in the project plot). The subpopulation of 10% of the planted trees is sampled during linear transect walks crossing the project plot and recording every tree encountered (until the 10% target is obtained). Alongside DBH measurements, species, number of trees and health status are recorded as well.

Successful evaluation is determined by a combination of on the ground technician judgement and in-office data analysis. If both the technicians and the data suggest that the producer has met the target, full payment is received every year. If the target has not been met but the threshold is achieved, partial payment is made and corrective actions are implemented. If the threshold is not met, payments are withheld until targets are reached the following year. In accordance with this technical specification, the majority of the producers will reach 100% planting after one year. If they miss the target, they will replant towards 100% capacity by the following year.

The project customized a QField application to oversee and manage the large amount of data that are generated.

The use of funds acquired from agroforestry plots will be divided into two broad categories. 40% will go to program operations and development whereas the remaining 60% will go into a separate Trust Fund. This fund is effectively a distinct account earmarked for payments to smallholder producers. These funds will be distributed periodically over a twenty-year period based on the milestones above. Prior to disbursement, the money will be kept in the trust fund and the interest will be used to cover the financial transaction fees of paying the producers. From the 60% partim smallholder farmers receive, minimum 10% is shared with the community as a Community Fund.

Annex 8 – Exclusion List

Activities	**Included in Project ('Yes' or 'No')**
Any project activities leading to or requiring the destruction [1] of critical habitat [2] or any forestry project which does not implement a plan for improvement and/or sustainable management.	N
Any activity which could be associated with the significant impairment of areas particularly worthy of protection of cultural heritage (without adequate compensation in accordance with international standards).	N
Trade in animals, plants or any natural products not complying with the provisions of the CITES/Washington convention [3].	N
Destructive fishing methods or drift net fishing with a net more than 2.5 km in length, explosives and/or poison.	N
Large-scale commercial logging operations for use in primary tropical moist forest.	N
Production or trade in wood or other forestry products other than from sustainably managed forests [4].	N
Exploitation of diamond mines and marketing of diamonds where the host country has not adhered to the Kimberley Process.	N
Activities involving harmful or exploitative forms of forced labour [5] or harmful child labour [6].	N
Projects that include involuntary physical displacement and/or forced eviction.	N
Production or activities that encroach on lands owned, or claimed or occupied by Indigenous Peoples, without full documented consent of such peoples.	N
Harmful and unsafe production, use, sale or trade of pharmaceuticals, ozone layer depleting substances [10], and other toxic [11] or dangerous materials such as asbestos or products containing PCB's [12], wildlife or products regulated under CITES, including all products that are banned or are being progressively phased out internationally	N
Production or trade of arms, ammunition, weaponry, controversial weapons, or components thereof (e.g., nuclear weapons and radioactive ammunition, biological and chemical weapons of mass destruction, cluster bombs, anti -personnel mines, enriched uranium).	N
Procurement and use of firearms.	N
Provision of finances to military institutions involved in conservation or security activities.	N
Production or trade of strong alcohol intended for human consumption or other alcoholic beverages (excluding beer and wine).	N
Production or trade of tobacco and other drugs	N
Gambling, gaming establishments, casinos or any equivalent enterprises and undertaking [10].	N
Any trade related to pornography or prostitution.	N
Production or trade in radioactive material. This does not apply to the procurement of medical equipment, quality control equipment or other application for which the radioactive source is insignificant and/or adequately shielded	N

Production or trade in unbound asbestos. This does not apply to the purchase or use of cement linings with bound asbestos and an asbestos content of less than 20%.	N
Production, trade, storage, or transport of significant volumes of hazardous chemicals, or commercial scale usage of hazardous chemicals. Hazardous chemicals include gasoline, kerosene, and other petroleum products.	N
Transboundary trade in wastes, except for those accepted by the Basel Convention and its underlying regulations [11].	N
Any activity leading to an irreversible modification or significant displacement of an element of culturally critical heritage [12].	N
Production and distribution, or investment in, media that are racist, antidemocratic or that advocate discrimination against a part of the population.	N
Projects involving the planting or introduction of invasive species	N
Projects that increase the dependency of primary participants and other stakeholders on fossil fuels.	N

Notes:

[1] Destruction means (1) the elimination or severe reduction in the integrity of a habitat/area caused by a major and long-term/prolonged change in land-use or water resources or (2) the modification of a habitat such that this habitat's ability to fulfil its function/ role is lost.

[2] The term critical habitat encompasses natural and modified habitats that deserve particular attention. This term includes (1) spaces with high biodiversity value as defined in the IUCN's classification criteria, including, in particular, habitats required for the survival of endangered species as defined by the IUCN's red list of threatened species or by any national legislation; (2) spaces with a particular importance for endemic species or whose geographical range is limited; (3) critical sites for the survival of migratory species; (4) spaces welcoming a significant number of individuals from congregatory species; (5) spaces presenting unique assemblages of species or containing species which are associated according to key evolution processes or which fulfil key ecosystem services; (6) and territories with socially, economically or culturally significant biodiversity for local communities. Primary forests or high conservation value forests must also be considered as critical habitats

[3] https://cites.org/eng/disc/text.php

[4] Sustainably managed forests are forests managed in a way that balances ecological, economic and socio-cultural needs.

[5] Forced labour means all work or service, not voluntarily performed, that is extracted from an individual under threat of force or penalty.

[6] Harmful child labour means the employment of children that is economically exploitive, or is likely to be hazardous to, or to interfere with, the child's education, or to be harmful to the child's health, or physical, mental, spiritual, moral, or social development. Employees must be at least 14 years of age, as defined in the ILO’s Declaration on the Fundamental Principles and Rights at Work (C138 – Minimum Age Convention, Article 2), unless local laws require compulsory school attendance or a minimum working age. In such circumstances, the highest age requirement must be used.

[7] Any chemical component which reacts with, and destroys, the stratospheric ozone layer leading to the formation of holes in this layer. The Montreal Protocol lists Ozone Depleting Substances (ODS), their reduction targets and deadlines for phasing them out

[8] Including substances included under the Rotterdam Convention, Stockholm Convention and WHO "Pharmaceuticals: Restrictions in Use and Availability".

[9] PCBs (polychlorinated biphenyls) are a group of highly toxic chemical products that may be found in oil-filled electrical transformers, capacitors and switchgear dating from 1950 to 1985.

[10] Any direct financing of these projects or activities involving them (for example, a hotel including a casino). Urban improvement plans which could subsequently incorporate such projects are not affected.

[11] Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their disposal (1989).

[12] "Critical cultural heritage" is considered as any heritage element recognised internationally or nationally as being of historical, social and/or cultural interest.

Annex 9 - Environmental and Social Screening Report

Topic	Risk Questions	Project Coordinator Response	Plan Vivo E&S comments	Project Coordinator Response
Vulnerable Groups	Are there vulnerable or disadvantaged groups or individuals, including people with disabilities (consider also landless groups, lower income groups less able to cope with livelihood shocks/ stresses) in the project area, and are their livelihood conditions well understood by the project?	There are lower income groups (e.g. groups of farmers with much less cows and/or less than 1ha of cropland), though their livelihood conditions are surveyed during PDD phase	No further comments	OK
	Is there a risk that project activities disproportionately affect vulnerable groups, due to their vulnerability status?	Possibly, if lower income groups would be underrepresented during decision-making events at community meetings	PIN states that *"Reforestation particularly on community lands often meant greater costs for poorer community members than for their better-off neighbours who were less dependent on access to village property on communal lands (Molnar et al., 2011; FAO, 19930)".* A t E&S risk assessment (PDD stage), project developers should assess whether lower income groups are likely to be adversely affected and underrepresented, and if needed, assess the project plans to ensure	Elaborated in the ESMP.

			representation in decision-making forums (or conduct parallel consultations), and to ensure that these groups are beneficiaries of the project's livelihood initiatives.	
	Is there a risk that the project discriminates against vulnerable groups, for example regarding access to project services or benefits and decision-making?	No	Insufficient evidence provided here – at PDD project developer should justify this. Consider if there is a risk related to exclusion due to the caste structure described in the PIN, and due to e.g. limited time availability due to labour commitments (particularly more vulnerable families)	No, vulnerable groups are included in the participatory consultations (§2.5 of the PDD).
Gender equality	Is there a risk of adverse gender impacts due to the project/ project activities, including for example discrimination or creation/exacerbation or perpetuation of gender-related inequalities?	Possibly, if a perpetuation of gender-related inequality occurs, e.g. when women would be underrepresented during decision-making events at community meetings.	As per PIN: "*communal reforestation may cause gender-based conflicts of interest. In most cases, women tended to be disfavoured*". Some example mitigation measures are included at the bottom of page 30. At E&S risk assessment (PDD stage), project developers should assess whether women are likely to be	Elaborated in the ESMP.

			underrepresented and/or adversely affected, and check if the proposed mitigation measures are sufficient.	
	Is there a risk that project activities will result in adverse impacts on the situation of women or girls, including their rights and livelihoods? Consider for example where access restrictions disproportionately affect women and girls due to their roles and positions in accessing environmental goods and services?	No	As per response above.	No, women are included in the participatory consultations and gender parity is stimulated during community meetings (§2.5 of the PDD)
	Is there a risk that project activities could cause or contribute to gender-based violence, including risks of sexual exploitation, sexual abuse or sexual harassment (SEAH)? Consider partner and collaborating partner organizations and policies they have in place. Please describe.	No	Suggest checks of partner policies during the E&S assessment.	No, project partners follow the Madagascar law and signed an ethical charter that is based on respecting the Charter of Fundamental Rights (ratified 7 December 2000)
Human Rights	Is there a risk that the project prevents peoples from fulfilling their economic or social rights, such as the right to life, the right to self-determination, cultural survival, health, work, water and adequate standard of living?	No	No further comments.	OK
	Is there a risk that the project prevents peoples from enjoying	Possibly, if vulnerable individuals would not be	At E&S risk assessment (PDD stage), project developers	Elaborated in the ESMP.

	their procedural rights, for example through exclusion of individuals or groups from participating in decisions affecting them?	present during decision-making by community meetings	should assess whether lower income groups are likely to be underrepresented if this is a risk.	
	Are you aware of any severe human rights violations linked to project partners in the last 5 years?	No	Would need a conversation to verify	No, project partners follow the Madagascar law and signed an ethical charter that is based on respecting the Charter of Fundamental Rights (ratified 7 December 2000)
Community, Health, Safety & Security	Is there a risk of exacerbating existing social and stakeholder conflicts through the implementation of project activities? Consider for example existing conflicts over land or natural resources, between communities and the state.	Possibly, given the social conflict with Dahalo and the perpetual discussion on the issue of fire between communities and State	At E&S risk assessment (PDD stage), project developers should assess the potential for exacerbating existing conflicts, and incorporate into ESMP if necessary. This includes the Dahalo, cattle theft (and role of fire in theft events), for example.	Elaborated in the ESMP.
	Does the project provide support (technical, material, financial) to law enforcement activities? Consider support to government agencies and to Community Rangers or members conducting monitoring and patrolling. If so, is there a risk that these activities will harm communities or personnel involved in monitoring and patrolling?	No	The project will hire 'Forest Rangers' (engagement, rather than patrolling, pg. 24), and work with Fishing Associations ('guard mangrove during establishment). While these are community monitors, rather than law enforcement per se, potential for conflict between Community Rangers/ Monitors and community/ other natural	No, the project does not work with law enforcers. Community monitoring structures are organized after participatory consultations (§2.5 of the PDD). In the event of (potential) safety and manage conflict, a community meeting is organized to resolve the issue, following the

			resource users. Risk assessment should understand similar set ups & challenges in the project area, and therefore propose a suitable approach to working with community rangers/ fishing associations to ensure their health & safety and manage conflicts.	grievance mechanism protocol (§3.16 of the PDD).
	Are there any other activities that could adversely affect community health and safety? Consider for example exacerbating human-wildlife conflict, affecting provisioning ecosystem services, and transmission of diseases.	No	No further comments	OK
Labour and working conditions	Is there a risk that the project, including project partners, would lead to working conditions for project workers[1] that are not aligned with national labour laws or the International Labor Organization's (ILO) Declaration on the Fundamental Principles and Rights at Work (discriminatory working conditions, lack of equal opportunity, lack of clear employment terms, failure to prevent harassment or	No risk, as the project will at all times align with national labour laws	Agree – risk assessment to check alignment between national labour laws and ILO core conventions	National labour laws are in line with ILO core conventions.

[1] Project workers include project coordinator staff, staff of other project partners, third party groups fulfilling core functions of the project, and community volunteers or contracted workers.

	exploitation, failure to ensure freedom of association etc.)?			
	Is there an occupational health and safety risk to project workers while completing project activities?	No	Note that project workers extend to Community Monitors and those community members providing a core function or service in the project, and not just those individuals employed by the coordinating body. H&S issues can relate to conflicts with community members/ natural resource users during engagement and monitoring/ guarding duties, fire management activities, etc. Assessing what the tasks will entail, ensuring adequate H&S during these activities is expected.	No, project partners follow the Madagascar law and signed an ethical charter that is based on respecting the Charter of Fundamental Rights (ratified 7 December 2000)
	Is there a risk that the project support or be linked to forced labour, harmful child labour, or any other damaging forms of labour?	No	Agree	No, project partners follow the Madagascar law and signed an ethical charter that is based on respecting the Charter of Fundamental Rights (ratified 7 December 2000)
Resource efficiency, pollution, wastes,	Is there a risk that project activities might lead to releasing pollutants to the environment, cause significant amounts of waste or hazardous waste or materials?	No risk, as no pollutants are used	No further comments	OK

chemicals and GHG emissions	Is there a risk that the project will lead to significant consumption of energy, water or other resources, or lead to significant increases of greenhouse gases?	No, project GHG emissions are negligible	No further comments	OK
Access restrictions and livelihoods	Will the project include activities that could restrict peoples' access to land or natural resources where they have recognised rights (customary, and legal). Consider projects that introduce new access restrictions (eg. creation of a community forest), reinforce existing access restrictions (eg. improve management effectiveness and patrolling of a community forest) , or alter the way that land and natural resource access restrictions are decided (eg. through introducing formal management such as co-management).	Possibly, given the perpetual discussion on the issue of fire (though the project is explicitly not anti-fire, but aims to introduce community-based fire management)	Good to see this considered in more detail at risk assessment stage in PDD. Assessment would include understanding whose access could be restricted by the various project interventions, and ensuring that there is a clear logical link between any identified costs & benefits / beneficiaries.	Elaborated in the ESMP.
	Is there a risk that the access restrictions introduced /reinforced/altered by the project will negatively affect peoples' livelihoods?	No, since there are no access restrictions	Note that introduction of restoration areas (mangrove, forest) that are monitored and guarded by community members, constitute access restrictions, if they affect fishing, grazing, and other natural resource use.	Elaborated in the ESMP.
	Have strategies to avoid, minimise and compensate for these negative	NA	To be decided.	See above.

	impacts been identified and planned?			
Cultural heritage	Is the Project Area officially designated or proposed as a cultural site, including international and national designations?	No	No further comments	OK
	Does the project site potentially include important physical cultural resources, including burial sites and monuments, or natural features or resources of cultural significance (eg. sacred sites and species, ceremonial areas) and is there risk that the project will negatively impact this cultural heritage?	No	No further comments	OK
	Is there a risk that the project will negatively impact intangible cultural heritage? Consider for example cultural practices, social and cultural norms in relation to land and natural resources.	No	Note that the PIN states ". The forest is an important sacred place for the villagers". Agreed that there is no obvious potential impacts on cultural heritage.	OK
Indigenous Peoples	Are there Indigenous Peoples[2] living within the Project Area, using the land or natural resources within the project area, or with claims to land or territory within the Project Area?	Yes, around the Manakara site, Antemoro may insist on their cultural traditions	E&S assessment to clarify if there are groups, such as the Antemoro, who would be categorised as Indigenous Peoples according to international standards. If so, project developer to	Elaborated in the ESMP.

[2] As per the IUCN Environmental and Social Management System, Indigenous Peoples include: "(i) peoples who identify themselves as "indigenous" in strict sense; (ii) tribal peoples whose social, cultural, and economic conditions distinguish them from other sections of the national community, and whose status is regulated wholly or partially by their own customs or traditions or by special laws or regulations; and (iii) traditional peoples not necessarily called indigenous or tribal but who share the same characteristics of social, cultural, and economic conditions that distinguish them from other sections of the national community, whose status is regulated wholly or partially by their own customs or traditions, and whose livelihoods are closely connected to ecosystems and their goods and services" (IUCN 2016).

			consider whether any E&S risks are associated with this.	
	Is there a risk that the project negatively affects Indigenous Peoples through economic displacement, negatively affects their rights (including right to FPIC), their self-determination, or any other social or cultural impacts?	No	To be clarified during the E&S assessment.	Elaborated in the ESMP.
	Is there a risk that there is inadequate consultation of Indigenous Peoples, and/or that the project does not seek the FPIC of Indigenous Peoples, for example leading to lack of benefits or inappropriate activities?	Possibly, if the Antemoro traditions and leadership would not be involved in the project	Agree – would need a conversation with the IPs	See above.
Biodiversity and sustainable use of natural resources	Is there a risk that project activities will cause adverse impacts on biodiversity (both in areas of high biodiversity value, and outside of these areas) or the functioning of ecosystems? Consider issues such as use of pesticides, construction, fencing, disturbance etc.	No	Agree	OK
	Is there a risk that the project will introduce non-native species or invasive species?	Possibly, since most fruit trees are not native to Madagascar (nevertheless these are “naturalized”)	Seems negligible then	OK
	Is there a risk that the project will lead to the unsustainable use of natural resources? Consider for example projects promoting value	No	Agree	OK

	chains and natural resource-based livelihoods.			
Land tenure and conflicts	Has the land tenure and use rights in the project area been assessed and understood?	Yes	No further comments	OK
	Is there a risk that project activities will exacerbate any existing land tenure conflicts, or lead to land tenure or use right conflicts?	Possibly, given the perpetual discussion on the issue of fire, e.g. as a protest against state authority	Based on information elsewhere in the PIN, there appears to be potential risk around land tenure given that some of the land is tenured to the MNP who would need to agree that communities can manage the land. This should be assessed within the E&S assessment, and appropriate risk mitigation actions should be identified if necessary.	Elaborated in the ESMP.
Risk of not accounting for climate change	Have trends in climate variability in the project areas been assessed and understood?	Yes	No further comments	OK
	Has the climate vulnerability of communities and particular social groups been assessed and understood?	Yes	No further comments	OK
	Is there a risk that climate variability and changes might influence the effectiveness of project activities (eg. undermine project-supported livelihood activities) or increase community exposure to climate variation and	Possibly, given the vulnerability of Manakara to cyclones	No further comments	Elaborated in the ESMP.

	hazards? Consider floods, droughts, wildfires, landslides, cyclones, etc.			
Other – eg. cumulative impacts	Is there a risk that the project will contribute cumulatively to existing environmental or social risks or impacts, for example through introducing new access restrictions in a landscape with existing restrictions and limited land availability?	No	No further comments	OK
	Are there any other environmental and social risks worthy of note that are not covered by the topics and questions above?	Possibly, there may be the risk of displacement of wood cutting towards adjacent areas (which will be addressed in the PDD as leakage risk)	This may pose a risk to biodiversity if activity is shifted to an area more sensitive to wood cutting. Please assess this during the PDD design stage and incorporate into the risk assessment (biodiversity section).	Displacement of wood cutting is countered by planting Acacia tree seedlings in designated zones (PDD, §3.5, §3.6).

SECTION D: SCREENING REPORT (E&S REVIEWER TO COMPLETE)	
Name of E&S reviewer	***Caroline Stillman and Eva Schoof***
Date of E&S screening:	***27.07.22***
Project risk rating:	*Moderate* *This project has moderate risks associated with it, due to the potential presence of indigenous groups in the region, and engagement in fire control activities which could cause/exacerbate conflict with the state and other groups in the region (eg. cattle rustlers). Land tenure has been well documented and understood, however a risk still exists around the MNP having tenure over one project area. An additional risk element is that the project works in three quite different social contexts in three different areas.These risks could potentially be mitigated through known mitigation measures, including a stakeholder engagement plan and clear FPIC process.*

<table>
<tr><td>Principle risks and impacts</td><td>
<table>
<tr><th>E&S topic/ risk area</th><th>Likelihood (1-5)</th><th>Magnitude (1-5)</th><th>Significance (low, moderate, severe, high)</th></tr>
<tr><td>Vulnerable Groups</td><td>3</td><td>3</td><td>Moderate</td></tr>
<tr><td>Gender equality</td><td>3</td><td>2</td><td>Low</td></tr>
<tr><td>Human Rights</td><td>2</td><td>1</td><td>Low</td></tr>
<tr><td>Community, Health, Safety & Security</td><td>2</td><td>4</td><td>Moderate</td></tr>
<tr><td>Labour and working conditions</td><td>1</td><td>1</td><td>Low</td></tr>
<tr><td>Resource efficiency, pollution, wastes, chemicals and GHG emissions</td><td>1</td><td>1</td><td>Low</td></tr>
<tr><td>Access restrictions and livelihoods</td><td>2</td><td>4</td><td>Moderate</td></tr>
<tr><td>Cultural heritage</td><td>1</td><td>1</td><td>Low</td></tr>
<tr><td>Indigenous Peoples</td><td>2</td><td>2</td><td>Low</td></tr>
<tr><td>Biodiversity and sustainable use of natural resources</td><td>1</td><td>2</td><td>Low</td></tr>
<tr><td>Land tenure conflicts</td><td>3</td><td>3</td><td>Moderate</td></tr>
<tr><td>Risk of not accounting for climate change</td><td>3</td><td>3</td><td>Moderate</td></tr>
<tr><td>Other – eg. cumulative impacts</td><td>1</td><td>1</td><td>Low</td></tr>
</table>
</td></tr>
<tr><td>E&S assessment required</td><td>An E&S assessment, during development of the PDD, is required. Elements of this assessment are very likely to be included in the project design process, considering the high overlap between the issues identified above, and the Plan Vivo Standard requirements.

Areas of likely focus:
- Vulnerable groups and gender: project to assess potential costs and benefits, and how to ensure representation of vulnerable groups and women through the project design and development.
- Potential costs & benefits of access restrictions (in proposed restoration areas), making logical link between any restrictions/ costs and the proposed livelihood activities.
- Community Monitors/ Rangers: assess risk of conflicts with communities in comparable set ups
- Community health, safety and security: Risk of exacerbating conflict within region – social conflict with Dahalo, potential issue of fire between communities and State, and cattle thieves
- Indigenous peoples: clarifying status of Indigenous Peoples within the project area, and project should assess whether Antemoro customs may at any point be in conflict with project activities
- Risk of not accounting for climate change: Project should assess potential impacts of cyclones in Manakara or other vulnerable regions on proposed project activities</td></tr>
<tr><td>Likely safeguard plan required</td><td>ESMP section of PDD required. The project should take the following into account:</td></tr>
</table>

	- *Indigenous peoples - stakeholder engagement plan for engaging with Antemoro IPs, and FPIC plan* - *Vulnerable Groups – how to avoid elite capture* - *Gender equality – monitor involvement of women* - *Community safety – disputes over fire should be monitored* - *Access restrictions – consult community/FPIC based on fire restrictions* - *Land tenure conflicts – FPIC, stakeholder engagement* - *Climate change – monitor risks of cyclones*

Annex 10 – Environmental and Social Assessment Report

METHOD

In July/August 2023, communal meetings on risks were held in Andasibe (Sava) and Betampona (Manakara). Using the model below, the main risk areas were discussed and mitigation measures were decided in common. In Betampona, 36 people joined the risk sessions on 12 and 13 July; in Andasibe, 31 people joined the risk sessions on 7 and 8 August.

1. COMMUNITY-LEVEL RISK ASSESSMENT THROUGH COMMUNITY DISCUSSIONS

Key areas of risk (note: A = Andasibe, B = Betampona)	**Community discussion on the importance of risk?**	**Measures to reduce this risk?**
Vulnerable groups: How do you assess the potential costs and benefits of the project and how to ensure representation of vulnerable groups and the poor throughout project design and development? How to avoid benefit capture of the local elite?	A: It was mentioned that fishermen are very vulnerable. True aquaculture is not yet practised. B: It was not mentioned but deduced that the king could allocate land to individuals who can take more benefits of carbon.	A: It is crucial to include the fokolona and VOI/COBA ("small environmental committee") in the governance structure in decisions regarding the plan vivo revenues. Because they are not the elite (they are the fishermen and herders). B: In Betampona, carbon revenues should also be considered (in part) as a community fund (equitable benefit-sharing). Afterwards, the village general assembly (fokolona) will also meet regularly and participate in the decision-making process.
Women: How to assess the potential project costs and benefits for women, and to ensure women's representation throughout project design and development?	A&B: It was mentioned that there could be a risk that women cannot participate in decision-making and do not reap the benefits of the project.	A&B: Ensure that women participate in the popular assemblies. Target: 45% B: Women's priority is food security (cassava etc)

	B: We shouldn't just plant trees, women's priority is food security. Women have to feed the children. We don't eat trees: there has to be enough cassava.	
How to assess the potential costs and benefits of access restrictions (in proposed planting areas)? Risk of displaced pressure?	A: Zebu use the area at low tide as a route. The itinerary must be rerouted. B: There is no real agricultural activity in the grassy area, but sometimes grazing of very low intensity. This needs to be relocated.	A: We have a consensus between fishermen and herders on this point. This can be written in a DINA. B: The relocation must be done according to the *Plan Communale de Développement*, and towards an area where there is not much grazing pressure. The cantonal expert or the mayor can help to find it. It should also be noted that smallholders will of course remain the owners of their land.
How to assess the risk of conflict with neighbours and neighbouring communities?	A: The herders live in the neighbouring village. B: Jealousy between neighbors and neighboring villages is not inconceivable (as for example with the lichi fields).	A: A consensus is needed with the herders (DINA). B: As for neighbours: carbon revenues should also be considered (in part) as a community fund. Afterwards, the village general assembly (fokolona) will also meet regularly and participate in the decision-making process. As for the neighboring villages: they are really far away, it is too far-fetched to think that they would want to start a fire.
Community health and safety: How do you assess the risk of exacerbation of conflicts in the region: social or ethnic conflict, possibly fire issues between communities and the state, and cattle herders?	There are no ethnic conflicts. There are no Dahalo or national parks in the vicinity.	See: Vulnerable groups
Indigenous peoples: how to work with the Antemoro peoples in the project area, and how to assess the risk of conflict?	Perhaps the Antemoro traditions would not be respected.	The project must work closely with the king. Rites must also be respected, as well as the Ancestors and the Dead. For example, before large planting actions, a ceremony with rum must be organized.
Risk of not accounting for climate change: How to assess the potential impacts of extreme weather events on proposed activities?	A: Cyclones and floods can occur, with algae washing up on the shore and complicating the growth of the plants. B: Unpredictable cyclones and heavy rains can occur, as well as landslides and drought.	A: *Regarnissage* is necessary after the cyclone, and we can add wooden sticks with a small barrier to stop the algae during flooding, or clean afterwards. B. It is better to plant a little earlier. A *regarnissage* event is also necessary (in case of rain failure or cyclone passage).
How to assess fire risks?	A: The risk is low, but we need training from time to time. B: Fires are more related to tavy. But there is also the need for charcoal.	A: It is good to plan woodlands with combustible trees in the vicinity, for charcoal. B: Need for additional seedlings as fuel. Firewall if necessary.
Other risks proposed?	A&B: Late payment to the community or smallholders is	A&B: Clear and transparent communication is required on the scheduled payment dates.

	a risk, in that case we may lose interest.	B: We would like to produce more casava, and can the *pepinière* also provide vanilla, cloves, coffee and cinnamon?

2. COMMUNITY E&S RISK MANAGEMENT PLAN (ESMP)

E&S risks and impacts and mitigation measures					
Environmental and social risks and impacts[3]	**Mitigation measures[4]**	**Feasibility, effectiveness and sustainability**	**Costs**	**Implementation responsibility and schedule**	**Follow-up indicator?**
Vulnerable groups: How to protect vulnerable fishermen and avoid the dominance of a few individuals?	A: It is crucial **to include the VOI/COBA** as a governance structure in decisions regarding the plan vivo revenues. Because they are not the elite (they are the fishermen and herders). B: In Betampona, carbon revenues should also be considered (in part) as a **community fund** (equitable benefit-sharing). Afterwards, the village general assembly (Fokolona) will also meet regularly and participate in the decision-making process.	Establishment of a VOI in Andasibe necessary, but by now it is established. It is also quite a common social structure. The allocation of a Community Fund must be part of the agroforestry agreement (minimum 10%). That would be an easy solution.	No costs (meeting and bureaucracy) No costs (bureaucracy)	2023, GDV 2023, CL	P5, P16
Women: How to ensure women's representation throughout project design and development?	Try that women participate **>45% in people's assemblies** A planting density of 400 trees per hectare makes it possible to produce crops under the trees. We want a **food forest, not a woodlot**.	Target: 45% (that is quite ambitious in a rather patriarchal society) We should keep track of women's participation	No costs (behavioural change)	Annually, A&B	L2 P14

[3] For each row, include the different E&S risks and impacts that have been identified during the screening and assessment.
[4] Management measures will either be plans or protocols, or specific project activities. Where a management measure is a plan (eg. community engagement plan), the activities for this plan need to be included in the project design and budgeted for.

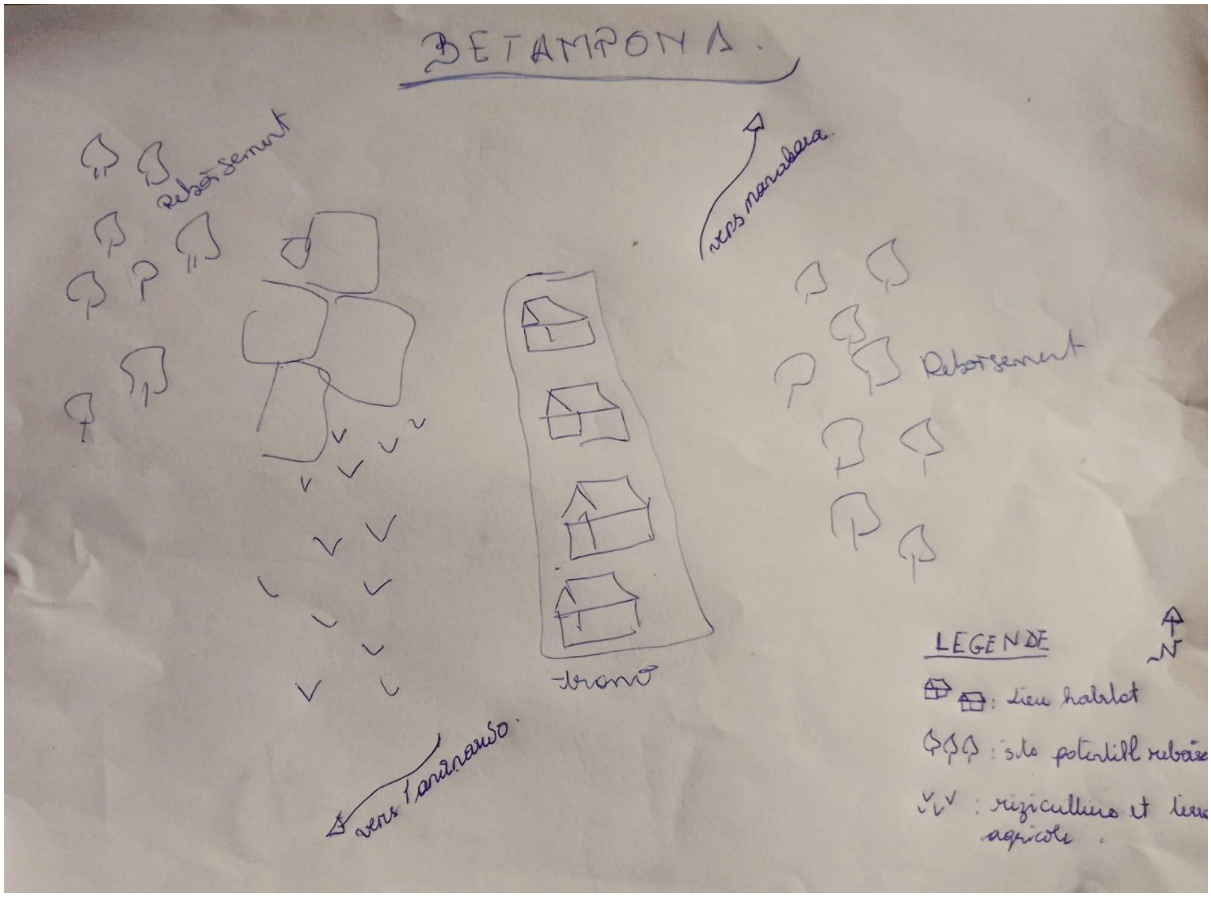
E&S risks and impacts and mitigation measures					
Environmental and social risks and impacts[3]	**Mitigation measures[4]**	**Feasibility, effectiveness and sustainability**	**Costs**	**Implementation responsibility and schedule**	**Follow-up indicator ?**
		during each meeting			
How to balance access restrictions (in proposed planting areas)?	A: We need a consensus between fishermen and herders on this. This can be written in **a DINA.** B: The grazing relocation must be done according to the *Plan Communale de Développement*, and in an area where there is currently not much grazing pressure. **The cantonal expert or the mayor** can help find it and declare it. We specify to all stakeholders that all property rights explicitly remain with the owner.	DINA in Andasibe. It is quite a common document. Required written declaration from the cantonal expert or mayor. The *Plan Communale de Développement* already exists.	No costs (meeting and bureaucracy) No costs (meeting and bureaucracy)	2023, A&B 2023, B	NA
Risk of conflict with neighbouring communities?	A: Fishermen-Herders Consensus (e.g. DINA). B: As for neighbours: carbon revenues should also be considered (in part) as a Community Fund. Afterwards, the village general assembly (Fokolona) will also meet regularly and participate in the decision-making process. As for the neighboring villages: they are really far away, it is too far-fetched to think that they would want to start a fire.	DINA in Andasibe (see above) The allocation of a Community Fund must be part of the agroforestry agreement. That would be an easy solution.	No costs (meeting and bureaucracy)	2023, A&B 2023, CL	P16
How to work with the Antemoro peoples in the project area, and how to assess the risk of conflict?	The project must work closely with the king of the Antemoro. Rites must also be respected, as well as Ancestors and the Dead. For example, for large planting actions, **a ceremony** with rum should be held.	Ceremony with rum (and rice meal) before any big planting action. This is already happening.	Food and beverage	Annually, GDV	NA
Risk of not accounting for climate change (cyclones, drought)	A: **Regarnissage** after the cyclone, and adding wooden sticks with a small barrier to stop algae during flooding	Frequent regarnissage, that is quite common.	Permanent nursery costs (about 0.5$ per tree)	Annually, GDV	P9

E&S risks and impacts and mitigation measures					
Environmental and social risks and impacts[3]	**Mitigation measures[4]**	**Feasibility, effectiveness and sustainability**	**Costs**	**Implementation responsibility and schedule**	**Follow-up indicator ?**
	B. It is better to **plant a little earlier**. A regarnissage event is also necessary (in case of rain failure or cyclone passage)				
Fire hazards	A: It is good to plant extra woodlands with **combustible trees** in the vicinity, for charcoal. B: Need for additional **seedlings** as fuel. Firewall if necessary.	Free distribution of additional seedlings (or other) – this is not difficult since GDV already operates the nurseries around.	Permanent nursery costs (about 0.5$ per tree)	2023-2024, GDV 2023-2024, GDV	C4
Other risks proposed: delay of payment	A&B: Clear and transparent communication is required on scheduled payment dates B: The *pepinière* can provide cloves, coffee and cinnamon. And training sessions are organized every year.	Clear communication around payment dates when issuing plan vivo credits is quite feasible + Free distribution of additional seedlings (cloves, coffee, cinnamon)	Permanent nursery costs (about 0.5$ per tree)	2024, CL 2024, GDV	NA
Safeguard Provisions					
Stakeholder Engagement & consultation	• About 2 to 3 subsequent *réunions villageoises* per project area, before project start • Annual *réunion villageoise* per community, during the next 30 years • Always work with fishermen associations in mangrove areas • Involve agricultural associations/cooperatives of smallholders where possible • Organize trainings on sustainable forest and	Feasible, since the project has experienced teams across the different project regions Sustainable on the long term (annually during 2022-2052)	No cost (no per diems during meetings)	Annually (2022-2052), GDV, A&B, CL	P5, P10

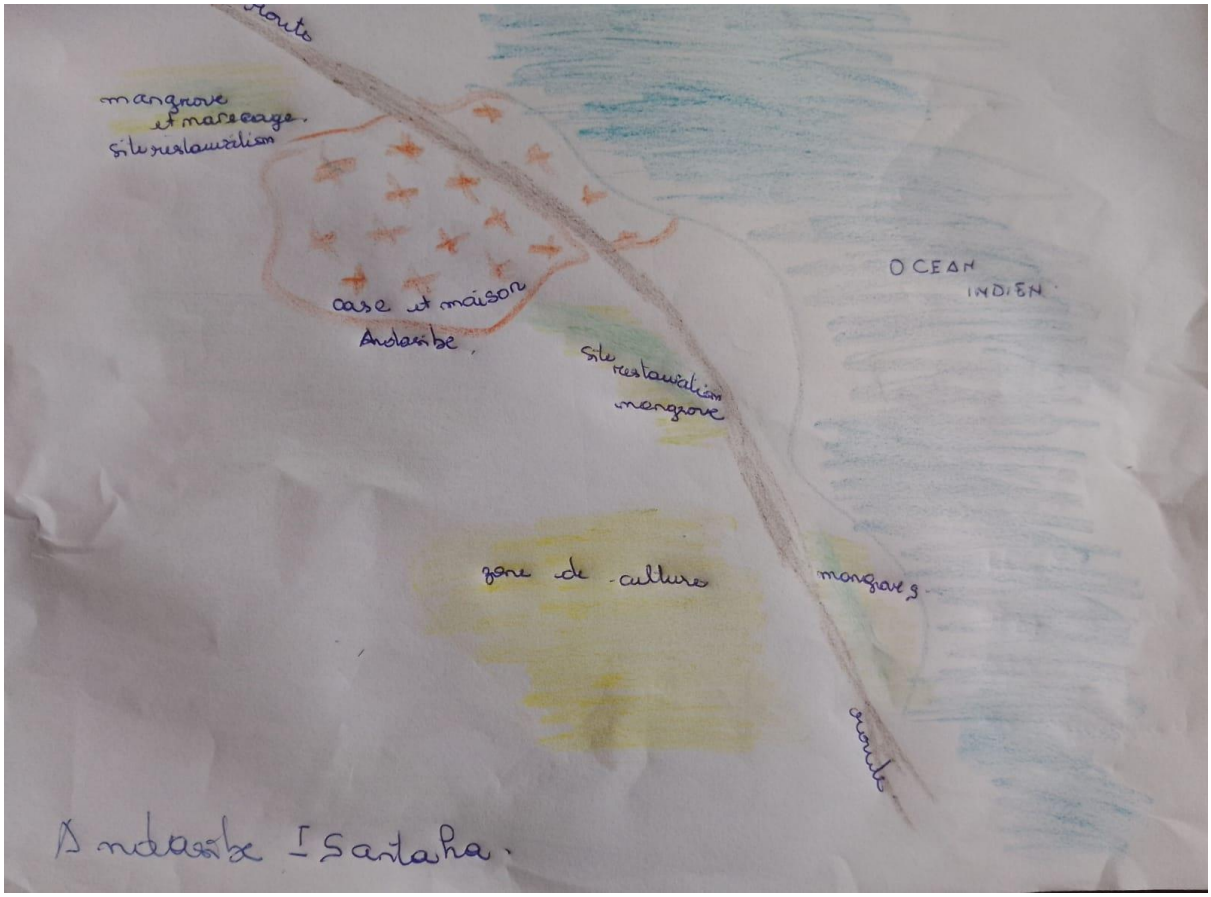
E&S risks and impacts and mitigation measures					
Environmental and social risks and impacts[3]	**Mitigation measures[4]**	**Feasibility, effectiveness and sustainability**	**Costs**	**Implementation responsibility and schedule**	**Follow-up indicator ?**
	water management in every village				
Grievance Redress Mechanism	• Complaint and suggestion book • Direct messages to project team, including annual *réunion villageoise* • Telephone communication with project team, with poster at townhall • Indirect message via king or mayor • Community satisfaction survey	See §3.17	No cost (no per diems during meetings)	Annually (2022-2052), GDV, A&B, CL	NA
Free Prior and Informed Consent	• About 2 to 3 subsequent *réunions villageoises* per project area, before project start • Annual *réunion villageoise* per community, during the next 30 years • Always work with fishermen associations in mangrove areas • Involve agricultural associations/cooperatives of smallholders where possible • Organize trainings on sustainable forest and water management in every village	Feasible, since the project has experienced teams across the different project regions Sustainable on the long term (annually during 2022-2052)	No cost (no per diems during meetings)	Annually (2022-2052), GDV, A&B, CL	P5, P10

Annex 11 – Land Management Plans

Examples below



Example individual plan vivo Betampona



Example communal plan vivo Andasibe

Annex 12 – Project Agreements

The project agreements have been made available to the Plan Vivo Foundation, and are available upon request

Annex 13 – Monitoring Plan

A13.1 Monitoring methods

1. Mangrove biomass survey

Aboveground mangrove biomass inventories were carried out in the AMRA, using 8 sample plots of 100 m². GPS coordinates (in WGS-84) of all plots were taken. The parameters measured in each plot include:

(v) Floristic parameters:
- Scientific name of each individual present in the plots: family, genus and species;
- Vernacular name of each individual: local name of each individual;
- Numerical abundance: total number of individuals present in each plot.

(vi) Dendrometric parameters:
- DBH or breast height diameter for adult plants;
- Maximum height.

(vii) Biological type:

After, the classification of Raukiaer (1905) on Phanerophytes:

- Mesophanerophyte: plant at height between 8 to 30m
- Microphanerophyte: plant at height between 2 to 8m
- Nanophanerophyte: plant at height between 0.5 to 2m

(viii) Regeneration rate:

According to Rollet (1979), natural regeneration is the set of processes by which plants multiply without silvicultural intervention. The study of regeneration makes it possible to know the rate and potential of regeneration of each species studied. The purpose here is to know the demographic structure of individuals and the regeneration rate of each species. This is to distinguish between mature individuals, i.e. those that are able to reproduce (IUCN, 2001). For mangroves the following maturity boundaries are used:

- Seedling: d< 2.5cm
- Young plant: 2.5cm ≤ d < 6cm
- Adult: d ≥ 6cm

The regeneration rate (TR) is expressed as the percentage ratio of regeneration individuals (n) to seed individuals (N). The regeneration rate was obtained by the following Rothe (1964) formula:

$$TR(\%) = (ni/N) \times 100$$

With:

ni: regenerated individual

N: Seed individual

TR: regeneration rate

According to Rothe (1964):

- A regeneration rate of less than 100% indicates that the species has a regeneration problem.
- A regeneration rate between 100% and 1000% indicates average or good regeneration.
- A regeneration rate of more than 1000% indicates that the species has a high potential for regeneration.

Beside general statistical characteristics (sum, mean, variance, standard deviation), also the Jaccard similarity index is calculated. The Jaccard similarity index makes it possible to compare two sites; thus assessing the resemblance between these by establishing the relationship between the common species and specific to each survey.

$$IJaccard = \frac{Nc}{(N1 + N2)}\ x\ 100$$

With:

Nc: Number of taxa common to situation 1 and 2

N1 and N2: Number of taxa present in 1 and 2 respectively

$I_{Jaccard}$: Jaccard similarity coefficient, expressed in percent

2. Above-ground mangrove biomass

According to the AR-TOOL14-4.2, the allometric equation applied to a tree species must be preferably selected from existing data applicable to the local situation (e.g. represented by similar ecological conditions). Thus, we preferably used the allometric equations based on Vieilledent et al. (2012) and Jones et al. (2014) for calculating above-ground biomass (Table 7). Based on these allometric equations, above-ground carbon content can be estimated per tree and per plot as 0.55 × AGBM (FAO, 2017; Winrock, 1997).

Table 13a: Allometric equations from Jones et al. (2014) for Above-ground mangrove biomass (B); dbh refers to diameter at breast height; D represents diameter; H stands for height; p = wood density.

Species	Allometric equation	Wood density
Avicennia marina	$B = 0.1848 \times dbh^{2.3524}$	0.661
Bruguiera gymnorrhiza (leaves)	$B = 0.0679 \times dbh^{1.4914}$	0.741
Bruguiera gymnorrhiza (stem)	$B = 0.464 \times (dbh^2 \times H)^{0.94275} \times p$	0.741
Ceriops tagal (dbh 2–18 cm)	$B = 10^{-0.7247} \times dbh^{2.3379}$	0.803
Ceriops tagal (dbh 18–25 cm)	$B = 10^{-0.494} \times dbh^{2.056}$	0.803
Heritiera littoralis (leaves)	$B = 0.0679 \times dbh^{1.4914}$	1.074
Heritiera littoralis (stem)	$B = 0.464 \times (dbh^2 \times H)^{0.94275} \times p$	1.074
Lumnitzera racemosa	$B = 0.0214 \times (dbh^2 \times H)^{1.05655} \times p$	0.565
Rhizophora mucronata (leaves)	$B = 0.0139 \times D^{2.1072}$	0.867
Rhizophora mucronata (root)	$B = 0.0068 \times dbh^{3.1353}$	0.867
Rhizophora mucronata (stem)	$B = 0.0311 \times (dbh^2 \times H)^{1.00741} \times p$	0.867
Sonneratia alba	$B = 0.0825 \times (dbh^2 \times H)^{0.89966} \times p$	0.78
Xylocarpus granatum	$B = 0.0830 \times (dbh^2 \times H)^{0.89806} \times p$	0.7

3. Below-ground biomass

According to the AR-TOOL14-4.2, root-shoot ratios must be applied for estimating below-ground biomass. We use the root-shoot ratio calibrated for tidal marshes, developed by Mokany et al. (2006).

4. Re-measurement of mangrove sample plots over time

Every 5 years, the project will perform a direct estimation of change by measurement of 43 fixed survey plots of 100 m² within the project areas, in line with AR-TOOL14 §6.2, to re-calibrate the sequestration rates. The minimum number of survey plots required is calculated using the Winrock Sample Plot Calculator.

5. Sampling smallholder agroforestry plots

The project will rigorously keep track of the performance of each project plot over time. Each plot has a project agreement with a plan vivo map, along with a monitoring scheme specifying the performance-based milestones.

Time of measurement (yr)	**Performance-based milestone**	**Method of measurement**
0 (within one year of planting)	At least 50% ofthe planned number of trees is planted and protected against burning when relevant	Physical counting of *all* new trees planted (while counting all existing trees too)
1	100% of the planned number of	Physical counting of *all* new trees planted

	trees planted and protected against burning when relevant	
3	At least 65% of the planted trees surviving	Physical counting of *all* the surviving trees
5	An average DBH of at least 3cm	DBH measurements, based on a representative sample of at least 10% of the trees concerned
7	Average DBH of at least 4cm	DBH measurements, based on a representative sample of at least 10% of the trees concerned
10	An average DBH of at least 6cm	DBH measurements, based on a representative sample of at least 10% of the trees concerned

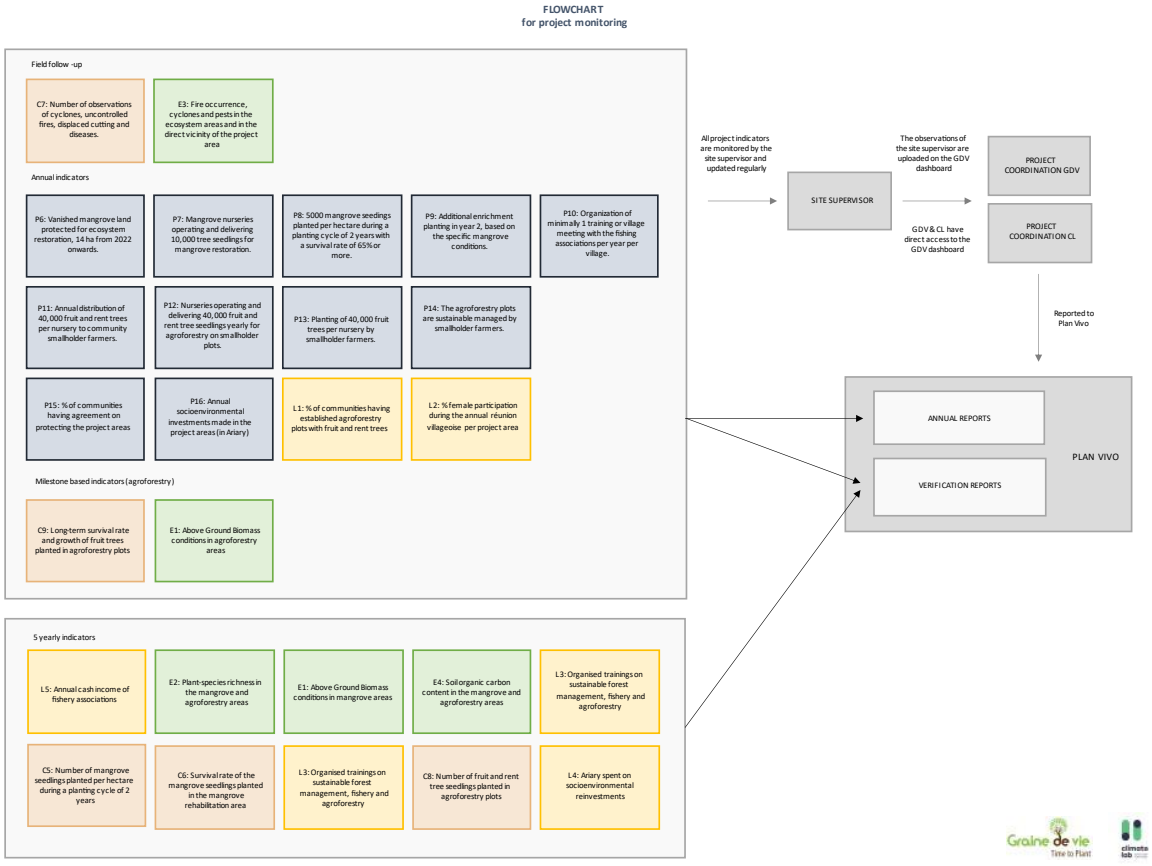
It is important to note that all project plots are visited by project staff or by a community liaison officer in the years specified in the Monitoring Table.

At the first three milestone checks, all planted trees are observed (to count the number planted and the survival rate). At the last three milestone checks, diameter at breast height is measured for every project plot at a representative subpopulation of that plot (subpopulation equal to 10% of the total planted trees in the project plot). The subpopulation of 10% of the planted trees is sampled during linear transect walks crossing the project plot and recording every tree encountered (until the 10% target is obtained). Alongside DBH measurements, species, number of trees and health status are recorded as well.

Successful evaluation is determined by a combination of on the ground technician judgement and in-office data analysis. If both the technicians and the data suggest that the producer has met the target, full payment is received every year. If the target has not been met but the threshold is achieved, partial payment is made and corrective actions are implemented. If the threshold is not met, payments are withheld until targets are reached the following year. In accordance with this technical specification, the majority of the producers will reach 100% planting after one year. If they miss the target, they will replant towards 100% capacity by the following year.

The project customized a QField application to oversee and manage the large amount of data that are generated.

Annex 13.2 Monitoring flowchart



Annex 13.3 Monitoring parameter list

Monitoring Parameter	Definition and unit	Method	Frequency	Means of Verification
P1	Project areas (ha) with agreement ensuring protection, from 2022 onwards	GPS delineation	To be updated annually	Legal agreement declaring the status of protection and photo report of firebreaks, Annual survival rates
P2	Number of tree seedlings (#) produced yearly per nursery for planting in the project areas.	Seedling counting in the nursery	To be checked annually	Annual tree seedlings produced per nursery

P3	Survival rate of planted trees (%)	Survival rate count	To be checked annually	Amount of tree seedlings planted or sown and survival rate per hectare
P4	Number of incidences of disturbance into the restored area (#)	Reporting disturbance events during community meeting	To be checked annually	Appointed responsible field supervisor per project area. Reported incidences of disturbance into the restored area
P5	Number of trainings or village meetings on sustainable forest and water management per year per village (#)	Training	To be checked annually	Number of trainings provided per village supported by meeting photographs.
P6	Area of intertidal zone (ha) protected for ecosystem restoration	GPS delineation	To be updated annually	Legal agreement declaring the status of protection. Annual Survival rates
P7	Number of mangrove seedlings nursed in mangrove nurseries (#)	Seedling counting in the nursery	To be checked annually	Annual mangrove seedlings produced per nursery
P8	Mangrove survival rate (%)	Survival rate count	To be checked annually	Number of mangrove seedlings planted or sown and survival rate per hectare.
P9	Number of additional mangrove seedlings planted in regarnissage (#)	Seedling counting during planting	To be checked annually	Number of mangrove seedlings planted in year 2 for “regarnissage” purposes.
P10	Number of trainings or village meetings with the fishing associations per year per village (#)	Training	To be checked annually	Number of trainings/meetings organized with the fishing associations per village supported by meeting photographs.
P11	Number of fruit and rent trees distributed per municipality (#)	Seedling counting in the nursery	To be checked annually	Number of fruit and rent trees distributed, supported by signed declarations and mini Plan Vivos.
P12	Number of fruit and rent trees planted per municipality on smallholder plots (#)	Seedling counting during planting	To be checked annually	Annual amount of fruit and rent tree seedlings produced per nursery.
P13	Survival rate of the fruit trees (%)	Survival rate count	To be checked annually	Amount of fruit and rent tree seedlings planted.

P14	Average stem density (trees/ha)	Survival rate count	To be checked annually	Agroforestry mini Plan Vivo maps and milestone-based payment scheme.
P15	Number of smallholders having agreement on protecting the project areas (#)	Document count	To be checked annually	Smallholder agreements on project areas
P16	Annual socioenvironmental investments made in the project areas (in Ariary)	Financial review	To be checked annually	Reports and contracts of socioenvironmental investments, photographic evidence
C1	Number of seedlings planted per hectare (#)	Seedling counting during planting	To be checked annually	Registration of tree seedlings leaving the nurseries for enrichment planting and coordination of planting activities by the project team
C2	Average DBH growth of trees planted (cm/yr)	DBH measurement with tape measure based on a representative sample of 10% of the trees in year 5, 7 and 10.	Year 5, 7 and 10	A dedicated monitoring team is specialized in this activity, to be reported per project plot
C3	Number of observations of uncontrolled fires and displaced cutting and charcoaling in and around the project zones (#)	Reporting disturbance events during community meeting	To be checked annually	Registration of observations made by project staff and/or mentioned during the yearly meeting with the community.
C4	Number and survival rate of supplemental tree seedlings planted by community members and/or in designated zones (# per municipality and %)	Seedling counting in the nursery and survival rate count	To be checked annually	Registration of extra tree seedlings leaving the nurseries for planting by community members and/or in designated zones where wood harvesting and charcoaling may be allowed.
C5	Number of mangrove seedlings planted per hectare during a planting cycle of 2 years (#)	Seedling counting during planting	To be checked annually	Registration of mangrove seedlings leaving the nurseries for enrichment planting in the mangrove rehabilitation areas and

				coordination of mangrove planting activities by the project team.
C6	DBH of mangroves planted (cm)	DBH measurement with tape measure in 100m² plots	To be resampled every 5 years in the same plots	Survey report of the DBH measurement of 43 fixed survey plots of 100 m² within the project areas
C7	Number of observations of cyclones, uncontrolled fires, displaced cutting and diseases (#)	Reporting disturbance events during community meeting	To be checked annually	Registration of observations made by project staff and/or mentioned during the yearly meeting with the community.
C8	Number of fruit and rent tree seedlings planted in agroforestry plots (#)	Seedling counting during planting	To be counted annually	Registration of fruit and rent tree seedlings leaving the nurseries for planting in agroforestry plots, supported by smallholder Plan Vivo maps.
C9	Average DBH growth of fruit trees planted (cm/yr)	DBH measurement with tape measure based on a representative sample of 10% of the trees in year 5, 7 and 10.	Year 5, 7 and 10	A dedicated monitoring team is specialized in this activity, to be reported per project plot
L1	Number of communities having established agroforestry plots with fruit and rent trees (%) and number of households enabled by the project (fishery/agroforestry) to meet their livelihoods threshold (#)	Participants count	To be checked annually	Reporting or photographs
L2	Female participation during the annual *réunion villageoise* per project area (%)	Head count	To be checked annually	Reporting and photographic evidence in Annual Report

L3	Number of trainings on sustainable tree management, fishery and agroforestry (#)	Training	To be checked annually	Reporting and photographic evidence of trainings in Annual Report
L4	Annual socioenvironmental investments made in the project areas (in Ariary)	Financial review	To be checked annually	Financial reporting in Annual Report
L5	Annual income of fishery associations, including cash income (in Ariary) and volumes of fish, shrimps and crabs caught (tons)	Financial review	To be reported every 5 years	Financial statements of the Efishery associations
L6	Volume of fruit produced (mango, avocado, lemon, medlar, plum, orange, jackfruit) by smallholder (tons), as well as the volume of rice, maize, manioc, vegetables, cacao, coffee and vanilla produced by the same smallholder (tons)	Social survey questionnaire	To be reported every 5 years	Five-yearly social questionnaire taken from subsample of smallholder participants
E1	Above Ground Biomass conditions in the restoration areas (tC/ha)	DBH measurement with tape measure in 100m² plots	To be resampled every 5 years in the same plots	Survey report of the DBH measurement of 43 fixed survey plots of 100 m² within the project areas
E2	Plant-species richness in the mangrove rehabilitation areas (index)	Shannon diversity index	To be resampled every 5 years in the same plots	Based on the vegetation survey, the total number of species in the community (richness S), as well as the proportion of species i relative to the total number of species (pi) can be calculated.
E3	Fire occurrence, cyclones and pests in the ecosystem areas and in the direct vicinity of the project area (# per year)	Reporting disturbance events during community meeting	To be checked annually	Observations of fire are reported in community meetings.
E4	Soil organic carbon content in the mangrove rehabilitation areas (tC/ha)	Walkley Black analysis on mixed soil sample per plot	To be resampled every 5 years in the same plots	Systematic soil organic carbon monitoring with mixed samples (see Annex 7a)

E5	Crab count per quadrant in the previously degraded mangrove areas as an indicator of ecosystem health (#/quadrant)	Counting crabs in six fixed 1x1 m quadrants across the project area (during 1-hour observation sessions)	To be resampled every 5 years in the same plots	Crab count report

Annex 14 – Project Database

- A. Admin
- B. Financing
- C. Land titles, rights and agreements
- D. Environmental
- E. Livelihood
- F. Government
- G. Plan Vivo documents
- H. Spatial data
- I. Media
- J. Monthly reports

Annex 15 – Letter of Approval

REPOBLIKAN'I MADAGASIKARA

Antananarivo, 23 SEPT 2024

SECRETARIAT GENERAL
BUREAU NATIONAL DES CHANGEMENTS CLIMATIQUES ET DE LA REDD+
AUTORITE NATIONALE DESIGNEE DU MECANISME DE DEVELOPPEMENT PROPRE

LE PRESIDENT DE L'AUTORITE NATIONALE DESIGNEE DU MECANISME DE DEVELOPPEMENT PROPRE

A

MONSIEUR FREDERIC DEBOUCHES
PRESIDENT DE GRAINE DE VIE

N°-24/MEDD/SG/BNCCREDD+/ ANDMDP

Objet : Lettre de non objection

Monsieur le Président,

Après la réception du Project Design Document du Projet PLAN VIVO **d' Agroforesterie et de restauration des mangroves** dans les zones Nord et Est de Madagascar que vous nous avez soumise, nous notons que le projet proposé vise à établir des agrosystemes resilients et soutenir des moyens de substance durable dans l' est de Madagascar .

Nous notons ainsi que le projet contribue au developpement durable du pays et s'aligne avec les objectifs de lutte contre le changement climatique à Madagascar. Nous n'avons donc aucune objection à ce que le projet soit mise en œuvre à Madagascar.

Il convient toutefois de noter que le projet doit se conformer à toutes les exigences nationales en matière de réglementation et/ou de planification et doit suivre les procedures en vigueur.

Veuillez agréer, Monsieur le Président l' expression de mes salutations distinguées.

RATOVONJANAHARY Lantonirina

Copie à:
- Madame le Coordonnateur du BNCCREDD+....." Pour information"

B.P 3948, Rue Toto RADOLA – Antaihavala, Antananarivo 101
Mail: ministere@environnement.mg / http://www.environnement.mg

Annex 16 – Financial Plan

See Excel in annex, available upon request

Annex 17: Practical information for foreign visitors

Glossary

Andrianony: Traditional king (or *roi* in French) of the Antemoro around Manakara

DINA: A written consensus between two competing groups; for instance, between fishermen and herders about cattle routes along the mangrove zone

DREDD: Direction Régionale de l'Environnement et du Développement Durable (Regional Environmental Agency)

Fanjakana: Institutional power of the State

Faritany mizakatena: Province of Madagascar

Fokonolona: Term for a village community (from foko, clan or ethnic group, and olona, person, human being) bringing together the members of one or more clans, living within a defined territory, during a village meeting

Fokontany: Smallest administrative unit in Madagascar, comprising one or several villages and holder regular *reunions villageoises* (or *reunions communautaires*)

Merina: Largest ethnic group in Madagascar, sometimes referred to as "highlanders" with mixed but predominantly Austronesian roots

MNP: Madagascar National Parks (agency managing the national parcs and reserves of the State)

Petit comité pour la surveillance : Also called *communauté de base* (COBA, VOI) : group of people responsible for a certain environmental management task

Sorabe: Sorabe is an alphabet based on Arabic, formerly used to transcribe the Antemoro Malagasy dialect

Tanety: Hillside or slopy area

Tanindrazana: Ancestors' land, referring to the place where one was born or where the ancestors are buried

Tarika: A tarika is an extended family, including all those with common ancestors (a shared tomb). Each tarika has a chief and the chiefs of different tarikas in a village form the leaders of the fokonolona

Tavy: Slash-and-burn agriculture

Zebu: Bos indicus or indicine cattle (humped cattle)

Short logistical note for foreign visitors

The project is happy to welcome foreign visitors (VVB, clients, stakeholders, visitors etc). Visitors should take the following travel information into account when planning their trip:

- The project area at Andasibe can only be reached from Antananarivo via Madagascar Airlines / Tsaradia. A short flight connects the capital with the airport of Sambava. Next, Andasibe is about 3 hours driving from Sambava (first using a section of the RN53 with asphalt, next via an unpaved road). The city of Antalaha has good-quality hotels.
- The project area at Manakara can only be reached from Antananarivo via a long drive along national road RN7 and RN12. The trip takes about 20 hours. Visitors are advised to spend the night at Antsirabe or Ranomafana.