Environmental and Social Impact Assessment

and

Environmental and Social Management Plan

28 June 2024

CEPF Grant 115419

Association Vahatra

Protecting Threatened Trees through Ecological Restoration at Ambohitantely, Madagascar

Ambohitantely, Madagascar

Grant Summary

1. Association Vahatra
2. Protecting Threatened Trees through Ecological Restoration at Ambohitantely, Madagascar
3. 115419
4. US$ 88,450
5. July 2024-June 2026
6. Madagascar
7. Summary of the project

Context and justification

Since 2021, six active and three passive forest ecological restoration plots have been put in place by Association Vahatra in the Ambohitantely Special Reserve, a zone with relict montane moist evergreen forests between 1500 and 1700 m. This project is conducted in direct collaboration with Madagascar National Parks, the protected area manager, and people from local communities surrounding the reserve. For each plot, a planting design was established respecting the configuration of the reference habitat within the remaining natural forest of the site. These plots, all which fall on the inside of extensive firebreaks, are the subject of an annual activity of filling-in new plantings of different tree species. With this stepwise system, the integration of threatened trees into these plots is well aligned with the concept of ecological restoration as practiced by Vahatra and constitutes a better way to safeguard these species and protect/recreate their forest habitat. Another important aspect is the creation of forested corridors to reconnect forest fragments.

The new restoration plots, which are the focus of this current grant request, have been designed to reflect the habitats of 19 threatened (as defined by IUCN's Redlist) trees, and promoting a planting design that favors the successful growth of these species. This approach, as well as the infrastructure and devices already in place (germination and first stages of growth in a tree nursery, use of compost and cow manure, firebreaks, and eradication of invasive species), guarantee a better survival rate of planted trees, and the reinforcement of habitat protection and the effective involvement of populations coming from neighboring villages. Within the restoration plots, the health of individual young trees are closely monitored, including the impacts of parasitic and harmful pests. For these reasons, our ecological restoration project at Ambohitantely advances well and aims at high success rates of replanted trees rapid growth, in light of locally poor soils. Further, using an experimental design, this ecological restoration project provides the opportunity to understand the growth process of these threatened trees based on climatic factors and environmental conditions.

Conservation status and knowledge level of threatened trees in Ambohitantely

In total, 19 species of threatened trees are known to occur in the 5600 ha Ambohitantely Special Reserve, of which only 18% of the protected surface area retains former relatively intact and more extensive natural forest.

Current status of projet

For several years, Vahatra has been assisting Madagascar National Parks in donating fire-fighting equipment, establishing and regularly maintaining

firebreaks around the Ambohitantely Special Reserve, which are primordial to safeguard the remaining natural forests. These collaborative efforts are ongoing and each year different activities have been advanced. For example, monitoring fires observed outside the reserve and the implementation of an alert system through designated fire observation points are among the initiatives being undertaken.

All biological, cartographic, and functional data gathered during our research in the reserve are analyzed by Vahatra scientists to accurately define the restoration areas. An ecological restoration action plan is subsequently executed. The southern block of the reserve, where Association Vahatra works, has been subdivided into several plots for ecological restoration, defined by the floristic and physiognomic characteristics of the local vegetation, topography, and distance from the forest edge. All of these areas are surrounded by a continuous firebreak that protects them from wild fires. Outside of the 19 threatened species associated with the project presented here, 38 other native species have been employed to date for restoring degraded forest habitats. Two distinct methods are adopted: 1) active restoration with young trees grown in the nursery and some new and highly efficient silviculture techniques and 2) passive restoration that involves the clearing of invasive vegetation at the forest edge, which provides the means for the viable seed bank in the soil to germinate.

Vahatra's initiatives generate over 200 person-days of work per month, resulting in significant economic benefits for the local population. Women are involved in potting, composting, and planting, while men using shovels and machetes undertake tasks such as digging, eradicating invasive species, and the properly maintaining the plots.

Objectives

Vahatra's activities at Ambohitantely have been supported since 2021 by "Save the Rainforest" (Sweden), and the project is in its third funding phase. The reason this NGO has financed three different phases is a direct reflection on their satisfaction with the results obtained to date, which have considerably surpassed the original expectations. The basic objectives of the project have expanded in line with Vahatra's progress and now include, as presented herein, the propagation, conservation, and protection of threatened trees.

To this end, the project presented here aims with locally threatened and endemic tree species to put into practice the skills and knowledge of the Vahatra staff in the fields of reforestation, specifically ecological restoration, and at the same time seeking to understand the phenology and ecology of threatened trees and their reproductive processes within their natural forest environment. In specific terms, the objectives are:

O1: Gathering scientific data on threatened tree species: Acquiring a comprehensive understanding of the ecological characteristics and requirements of the threatened tree species within the Ambohitantely Special Reserve.

O2: Conservation of target tree species: Implementing tangible actions to protect and preserve populations of focal species.

O3: Involving local communities in the protection and conservation of threatened trees: Raising awareness and actively engaging local communities in

safeguarding **threatened** trees by educating them about their ecological importance and encouraging their participation in conservation efforts.

Seed collection

The data from phenological monitoring, specifically the quantity of seeds produced by each species will determine the need to store seeds for the next planting. If trees of the 19 species involved in this project produce a substantial number of fertile individuals during each season, the project should be able to meet its goal of producing about 1000 young plants annually. We set the minimum of 12 of the 19 species will be the subject of this project and with the hope that it will be all 19 species. In all cases, if seeds are unavailable for certain species, we will augment the production of those with available seeds and seedling production will remain at 19,000 trees. In the case that seed availability becomes a limiting factor, this may result in deploying a team to gather seeds from areas outside the reserve or establishing collaboration with the manager of the Anjozorobe-Angavo protected area, a forest block historically connected to Ambohitantely. Furthermore, this approach provides a clear method to manage genetic diversity among individuals of the same species.

In both scenarios, Vahatra has proactively planned the manner of drying, processing, and storing seeds, which will help anticipate any ecological or climatic challenges that could disrupt the reproductive cycle of parent trees and impede the smooth progress of the ecological restoration project. Consequently, the techniques employed by the Silo National des Graines Forestières (SNGF) are replicated at Ambohitantely and tailored to utilize the available resources, ensuring optimal management of our seed bank.

Modeling species distributions

Jacquis A. Tahinarivony, the project manager, is a botanist and geomatics expert who previously modeled as part of his doctoral thesis several plant species, characteristic of habitats on the Ampasindava Peninsula in northwestern. This approach enabled him to identify potential conservation areas and ultimately led to the establishment of the new protected area. The same techniques and methods will be used to generate environmental or predictive variables, based on the digitization of topographic data to create a digital terrain model with a resolution of 25 x 25 m, more precise than that of Shuttle Radar Topography Mission or SRTM (90 x 90 m) for local or regional studies. This digital terrain model is then processed to generate variables such as slope, aspect, sunlight exposure, and solar radiation. Variables such as temperature are derived from the above analyses and processing of thermal bands from satellite data. For precipitation, available satellite images are collected and analyzed to create cloud/no-cloud masks in order to calculate average rainfall between the wet and dry seasons. In this regard, cloud cover is used as a proxy for precipitation.

To model species distribution, the Biomod 2 package will be used and this offers a variety of statistical models for species distribution modeling and ensemble. The selected results are those provided by the most performant models. These results describe the potential distribution areas of each species and allow the project to better plan its ecological restoration design by comparing or overlaying potential distribution maps with vegetation cover maps.

The results of all these different approaches will be presented in scientific articles highlighting the importance of using scientific data for planning conservation and

protection activities for threatened species. Further, a seminar will be presented at Vahatra in Antananarivo towards the end of the final year of the project to members of different scientific community and civil society engaged in different aspects of reforestation and ecological restoration of forested zones on the island.

8. Document Prepared on June 27, 2024

9. **Legal and regulatory framework**:

In order to collect seeds of native trees in protected areas of Madagascar, a permit is needed from the national authorities. The regulation is the same for endangered and non-endangered, as define by the IUCN Redlist, trees. Association Vahatra has permits to conduct such work that need to be renewed every six months.

The law regulating the exploitation of forest products, including seeds of tree seeds, is decree n° 98-782 of August 18 1998. Scans of permits issued by the Minister of Environment and Sustainable Development, will be included in reports to CEPF.

10. **Status of area to be impacted:**

The Ambohitantely Special Reserve (MDG-169) represents a montane forest relic, a habitat that was formerly widespread in the Malagasy Central Highlands. This vegetational type is one of the most endangered on the island.

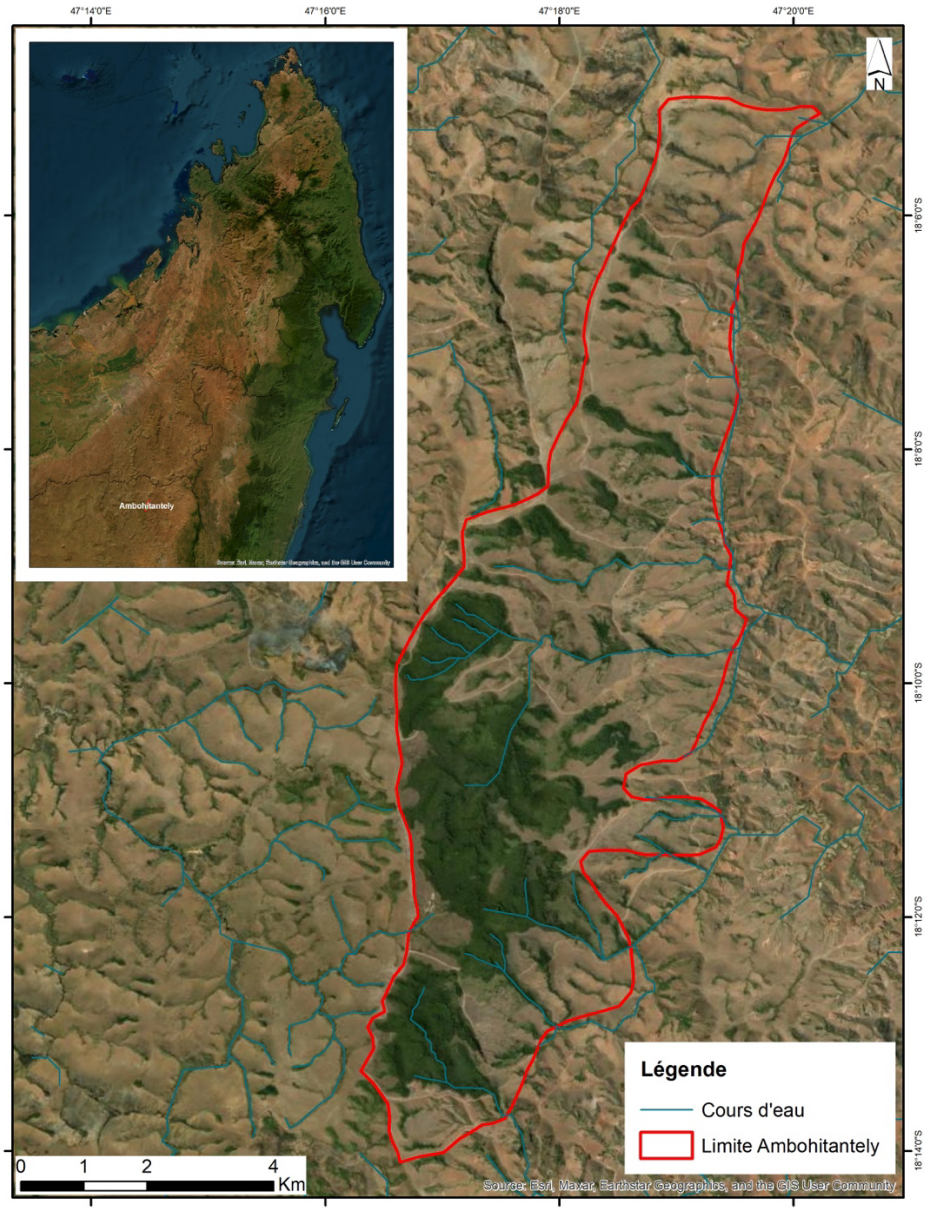
The Ambohitantely area falls under the Malagasy governmental administration of the Analamanga Region and Ankazobe District. This area is notably rural and the local people rely in part on agriculture for their livelihood – many individuals live a partially subsistence lifestyle. With the traditional production system and constraints imposed by climate and topography, the local agricultural activities rarely provide food self-sufficiency or reserve economy for a given rural household. Additionally, the cultivable land area, specifically valleys and foothills, is very limited, and in general the soils are not particularly productive. Further, fires often set by people spread across anthropogenic grasslands in the region and often enter into the dwindling forest areas, which leads to forest reduction and fragmentation and reduces wood resources needs by local people. These problems are further exacerbated by the recent intensification of regional insecurity associated with bandits (*dahalo* in Malagasy) that raid villages and steal livestock, further hindering economic and social development of the region.

The nearest villages to the Vahatra station at Ambohitantely are approximately 1.5 hours walking distance. The closest primary schools are in Firarazana (1.5 hours on foot) or Mahatsinjo (2.0 hours on foot) and the nearest secondary school is in Ankazobe (40 km). We estimate that within a 10 km radius, about 25% of the local adult population has attended primary school for at least a few years and these individuals have some literacy capacity, albeit low. This level of alphabetization applies to the people engaged by Vahatra and this situation notably complicates certain forms of employee–employer interactions. For example, when we built the biological station at Ambohitantely, the local construction workers refused for several different reasons,

mostly distrust of anything possibly connected to the central government, to have written and legal contracts. Our "contracts" with these individuals took a classical form based on honor and oral agreements. This is the manner such relations are still formed in rural Madagascar.

As implied above, the rural areas surrounding Ambohitantely is an economically disadvantaged portion of Madagascar. The average local wages for full-time workers in the non-agricultural sectors, the one that applies to people engaged by Association Vahatra, is lower than the national average of about 100,000 Malagasy Ariary (MGA) ($22.4 USD) per month. A local person engaged by Association Vahatra as a permanent employee gains 250,000 MGA ($56.5 USD) per month, making these jobs in an economic sense of considerable interest to local people. Further, approximately every four months, approximately 240 women and 320 men are employed on a short-term basis and compensated at a rate of 10,000 MGA ($2.5 USD) per day – these funds provide an important injection in the local economy. The reforestation and ecological restoration project of Association Vahatra has engaged a significant workforce for a range of different tasks. In addition, these people have acquired new skills, including compost production, which has important implications for their agricultural livelihoods.

To further emphasize the relation between employee–employer and the implications for advancing conservation in and around the protected area, the local people now understand the economic changes that have taken place within their households locally associated with the Vahatra project at Ambohitantely, whether engaged as permanent or part-time employees. In many ways, an important portion of the local population now equates forest conservation with economic growth. Local people through the traditional governance structure at the village level have expressed a clear interest in forest conservation, which includes the creation of local patrol groups or reinforcing the MNP patrol teams, and other aspects such as early fire warning and firefighting teams. In the context of another grant proposal Vahatra will be submitting for work at Ambohitantely, a budget line will be included to formalize these villager initiatives and create local civil society associations recognized by the national government directed at forest conservation activities.



11. **Baseline data**:

This EIA focuses on the risk that could result to endangered tree species during the phase of collecting seed and vegetal material.

In total, 19 species of threatened trees are known to occur in the 5600 ha Ambohitantely Special Reserve, of which only 18% of the protected surface area retains former relatively intact and more extensive natural forest. Several of these trees have limited geographic distributions within the reserve and at regional/national levels. For example, *Neocussonia capuroniana* (EN) is only documented in the Ambohitantely forest, while *Malagasia alticola* (EN), is also known from Tsaratanana, Tsiazompaniry, and Kalambatritra. These threatened trees

are represented in the world's herbaria by only a few collections and in many cases with imprecise geographical coordinates.

Regarding the spatial distribution of these 19 species, for example, *Pandanus spinifer* is confined to low-lying areas, such as marshes and bottomlands. In certain cases, different threatened tree species occur in the same microhabitats and share some common life history traits, simplifying large-scale restoration activities. Further, several species, including those we plan on growing and transplanting, are consumed and disseminated by local frugivorous animals (the vast majority endemic to Madagascar), including *Abrahamia turkii*, *Calophyllum drouhardii*, *Cryptocarya deabalta, C. coriaceae, C. macrocarpa, Neocussonia capuroniana*, and *Syzygium condensatum*. Concordantly, once these trees are producing fruits, one of our long-term monitoring strategies is to follow the recolonization of frugivorous animals in the plots and also in the intervention area of Vahatra, to better understand their role in seed dissemination

12. **Anticipated impacts and risks:**

Project implementation implies:

- Collecting seeds and vegetal materiel from endangered tree species, with risks:
    - to impact natural regeneration
    - to damage trees to collect seeds
- Setting up nurseries for reproduction of these species prior to reintroduction, with risk:
    - to establish a nursery in close proximity to a forested area that hosts threatened species.

Precautionary measures should be taken to prevent any impact on the wild population of endangered species. Measures should also be taken to ensure safety of staff and employees of the project during the implementation.

13. **Mitigation measures**:

For collection of seeds from endangered species:

- Each mature endangered species tree is labeled or has a unique identifier (ID). All phenological and ecological data for each tree are stored in a database, including information on the seeds collected. Seeds are collected from healthy specimens from large populations, distributed across different types of habitats.
- Fruit or seed collection activities are accompanied by an information sheet (Table below), making it possible to trace the origin of the seeds, the date of collection, the location and the quantity collected. Seeds are stored separately for each tree, to preserve quality and genetic diversity.
- Rational collection is also put in place to ensure the natural regeneration of species and the maintenance of their population in their natural habitat. For a fertile tree, the quantity of seeds collected does not exceed 60% of its total

production, unless the plant and/or its habitat is strongly threatened by fire or logging.

- All precautionary measures are taken not to damage the trees during the collection of seeds, most of which will be collected from the ground.
- The collection will take place on parcels of public land, with all required authorizations from the protected area management.

For the nurseries:

- The nurseries will be set up in degraded land (mostly anthropogenic grassland and in close proximity to the MNP housing complex and Association Vahatra biological station) with no impact on natural ecosystem.
- No pesticides will be used for the nurseries.

14. **Actions to ensure health and safety**: This section will describe actions that will be taken to ensure the health and safety of workers.

For safety measures:

- During the training for seed collecters, the project team will inform staff that climbing of trees to collect seeds is prohibited.

15. **Monitoring and evaluation**:

The monitoring will take place during all the seed collection campaign, using a monitoring sheet as presented below.

Fiche d'identité des graines

ID-Cible	Famille	Genre	Espèce	GPS	Date de collecte	Quantité collectée (Kg)	Num Photos	Num de collection

16. **Timeline and resources:**

The precautionary measures will be taken all along project, as necessary.
No specific financial resources are need for implementation.

17. **Permission of the landowner**:

Collection of seed will take place in the protected area with authorization of the managers ; nursery will be set up in a piece of land dedicated, identified with local communities and with their authorization.

18. **Participatory preparation**:

Association Vahatra is enthusiastically involved in a range of scientific endeavors and pedagogic and capacity building aspects for Malagasy graduate students and researchers, young university professionals, and conservation practioners. Other activities include the dissemination of information at different levels on Malagasy biodiversity that includes a publishing house that produces a technical journal known as *Malagasy Nature* (http://www.vahatra.mg/malagasynaturefr.html) and different series of technical and largely lay books on the islands protected areas and biodiversity (http://www.vahatra.mg/guidesfr.html). At different levels, the scientific members of Vahatra are regularly consulted by a range of different governmental and non-governmental organizations posing questions of the island's biodiversity, requests for advice on different decisions that need to be made by management authorities, participation in workshops and different presentations, and interventions in the national university system, as well as public lectures. All five scientific members of the organization have posts within the national university system ranging from lecturers to professors. The association is well known in different sectors on the island for a range of interventions to advance Malagasy science and the national scientific community.

In the context of this project, a range of different types of interactions will be engaged with external stakeholders. Foremost, is for people from the local communities, who will be employed as full-time and part-time workers and be a critical collaborator in the project and also obtain financial benefits advancing the local economy. Further, local communities will be an important participant in different pedagogic and information sharing aspects of this project as real stakeholders. The project will also help advance for Madagascar National Parks via financial and technical support the protection and conservation of the special reserve under their direction. A number of other organizations work on tree planting in and around the Ambohitantely protected area (e.g. Eden and Graine de Vie), and this project will help development increased discussion and more collaborative efforts between Vahatra/Madagascar National Parks/and these other organizations. Another external group that will be important stakeholders are organizations working on reforestation and forest conservation projects in other areas of Madagascar (e.g. Missouri Botanical Garden, Kew, Fanamby, Alamino, Ecovision, etc.) and to share the lessons learned mostly through site visits and different discussions and types of interactions. Finally, the Malagasy academic community will be an important stakeholder in this project, including university students being engaged to do research at the site and exchanges with different university departments (ESSA-Forêt, botany, and zoology).

19. **Disclosure**:

The impact assessment will be part of the document available on the CEPF web, and will be communicated through presentation to local stakeholders, at same time as presentation of the Grievance mechanism, explicated in the main proposal.