



# Payments for ecosystem services as a mean to adapt to climate change in Madagascar

Madagascar is well-known for its rich biodiversity and wealth of endemic species. It is expected that Madagascar will suffer especially from drought in climate change scenarios. Reforestation is listed among the priorities of the National Adaptation Plan of Action (NAPA). Through payment for ecosystem services (PES) this type of approach fits in different adaptation strategies: increasing soil resilience, food security as well as migration corridors for the species and alternative income for the communities. To attain those objectives the project is running activities such as forest re-creation with nurseries and plantation, awareness raising on the importance of forests and the reintroduction of traditional agricultural practices.

This article also gives an overview of the methodology used to implement a payment for ecosystem services scheme.

*Keywords: payment for ecosystem services, reforestation, Madagascar, tree nursery, biodiversity, climate change*

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Foreste per Sempre (FpS) is a Non-Governmental Organization (NGO), which operates for the defence, conservation and restoration of natural ecosystems and biodiversity worldwide (Europe, Latin America, Africa).



## INTRODUCTION

Projections indicate mean temperature increases of 1.1–2.6°C throughout the island with greatest warming in the south and least along the coast and in the north (Communication Nationale Initiale, Madagascar, 2008). These spatial characteristics have important biological implications because the south is already the driest region and the highly fragmented eastern forest is vulnerable to drying (Lee et al., 2008).

Because of its geographic position and geological origin, Madagascar boasts one of the richest biological diversities in the world, which reflects one of the highest rate of endemism (80% of endemic Malagasy species) and an incredible variety of forest ecosystems. Forests cover 22.6% of the national territory and generate approximately 20% of the GDP (energy, food, medicines, construction materials, etc.).

Biodiversity distribution, species and population are vulnerable to increased extreme events such as droughts and cyclones leading to soil erosion. Health conditions (due to an increase of pests and insect-borne diseases), access to water and related primary needs are expected to be under negative pressure due to expected climate change. These will consequently have an impact on the overall national productivity and the cost of life, increase socio-cultural and boundaries conflicts, threaten agricultural activities, encourage change of activities and favour migration towards urban areas or areas where there is better access to water. Adaptation strategies should take into account biodiversity vulnerability and recurrent poverty and provide activities increasing diverse ecosystem resilience with community benefits.

The government is looking into forestry projects to increase the afforestation rate and double the area devoted to forests (from 22.6% of the national territory to 50%, 17'000'000 ha target) by 2030 for meeting GHG emissions reduction needs but also for the supply of raw materials and the conservation of the national ecological balance like the water regulating service. To reach this objective the actual rate of reforestation (4000-5000 hectares per year) will need to be increased. Reforestation and avoided deforestation actively contribute to climate regulation, mainly in terms of carbon sequestration but also for watershed protection and flood regulation, pests' regulation, reduced soil erosion and avoided desertification. This type of intervention is also accounted as a very important measure to adapt to future climate change impacts. The economic, social and cultural services provided by the forests especially to the indigenous communities are also contemplated as part of the contribution of ecosystems to the livelihoods and wellbeing of the local communities.

The National Adaptation Plan of Action (NAPA) of Madagascar identified two priority adaptation strategies related to the forest sector: i) reforestation of rural areas with their specific reforestation plans based on locally appropriate species (priority n°8, estimated projects costs: 74,250 USD) and ii) promoting the transfer of forest management to local communities (n°9, estimated cost 94,980 USD). The NAPA also sees the reforestation as one of the key instruments to fight against soil degradation caused by climatic changes and by the use of non sustainable agricultural practice (such as tavy, the traditional slash-and-burn agriculture). In this context the work of NGOs like Foreste per Sempre (FpS) is of great support for the efforts undertaken at the national level, especially for those related to the decentralization of the management of ecosystems to the local communities (GELOSE/GCF legislation<sup>1</sup>) and to the need for training these same groups on more sustainable alternatives to the tavy. FpS activities are also compliant with other priorities of the Malagasy NAPA such as improvement of water management devices, intensification of crop production, and mobilization of necessary resources to prevent and control disease vectors.

## Project areas contexts and location specific vulnerabilities

### Mahasoa Project

<sup>1</sup> In 1996 the Malagasy government, facing high rates of deforestation and inefficient forestry practices, enacted a new community-based natural resource management policy known as GELOSE (Gestion Locale Sécurisée) applicable to forests, pastures, wildlife, and water (law No.96 - 025). In 1997, the law was incorporated into the new national forestry policy (Law 97 - 107 and Decree 97 - 1200). In 2000 the Contractual Forest Management (Gestion Contractualisée des Forêts or GCF) policy (No. 2001 - 122) was enacted for simplifying the contractual agreements between the parties involved under the GELOSE (USAID, 2007).

Activities are based at the villages of Mahasoa and Manamby, in the region of Ihorombe (Southern Madagascar). Ihoisy is the main city in the region of Ihorombe. North of this town we find the Ihoisy river valley where the village of Mahasoa is based. The municipality of Mahasoa is surrounded on both sides by rocky hills for approximately 100 km, including an area of 1,500 m<sup>2</sup> and 22,000 people.

The economy of the village is based on traditional techniques for zebu breeding and on the cultivation of rice, manioc and local tubers. Due to diverse and complementary causes (deforestation, agricultural techniques such as the 'slash and burn' (tavy) techniques and climate change) soil erosion has dramatically increased in time. This, together with a great decrease of the water level of the adjacent river, has caused the loss of many hectares of land previously cultivated with rice and other cultures. The focus of this project is on: forest recreation, environmental and water balance and biodiversity conservation, ensuring water supply, providing for food security and education, improvement of local road system.

### **Ilena Project**

Fianarantsoa is the second widest city for dimensions and population. It is located in the South east of Madagascar and it's one of the poorest areas of the island. The Ilena village was built 7 km from the city with the intent to become an exclusive area for people affected by Leprosy. To date 400 people live there and, despite the disease has been eradicated, they are almost completely excluded from the social and economic life of the near neighbourhoods. In this area a key source of income was the sale of wood that has drastically decreased in time due to a massive deforestation that has led also to the disappearance of the local flora and fauna.

The activities carried forward by FpS have started in 2007 and the focus is on the improvement of the livelihoods of the inhabitants of Ilena through the restoration of the local ecosystems and agricultural land.

The main goals have been to:

- Reforest the area surrounding the village by converting the endemic species forests through the introduction of a PES program.
- Cultivate land with biological and sustainable practices for ensuring long term food security through a diet diversification and more advanced agricultural techniques. This would enable the inhabitants to benefit from additional economic revenue if the exceeding production of fruits and vegetables can be sold to the city market of Fianarantsoa.
- Cultivate algae for pharmaceutical purposes (i.e. Spirulina which is also a dietary supplement).
- Restructure local infrastructures (in particular the road system and the electric grid).
- Train part of the inhabitants of Ilena on reforestation practices and entrepreneurship techniques in order to enable them to carry forward all the activities independently with FpS only supervising.

### **Mahajanga Project**

Mahajanga is a city located on the delta of the river Betsiboka, on the Nord-west coast of Madagascar. The area is subject to great seasonal changes: long heavy dry season with high temperatures and rainy season.

The coast is of great interest for both naturalists and tourists.

Activities have started in March 2010 and will keep running until end 2011. The main focus is on:

- The reforestation of the selected area that will go under the payment for ecosystem services (PES) program.
- The restoration of local infrastructures that will ensure the maintenance of the reforested areas (fireguard alleys, wells, motorized equipment).
- Creation of a guest quarter for international volunteers and tourists as centre to start up the eco-tourism component of all the 3 projects in Madagascar.
- Reforestation of a small portion of the area with Eucalyptus for domestic use (wood coal).

## **Stakeholders**

**Local communities** have a key role; they are in fact entitled to both the benefits and many of the responsibilities for the implementation of these projects. In all three projects the revenues from the PES scheme are transferred to the local **Dioceses** while FpS facilitates the contractual agreements. In the Ilena project FpS collaborates with the Diocese of Fianarantsoa, in the Mahasoa project with the ECAR (Eglise Catholique Apostolique Romaine), the Diocese of Ihoisy in

collaboration with the religious mission of the Lazzaristi (San Vincenzo de' Paoli) of Mahasoa and in the Mahajanga project with the Salesians of 'Don Bosco' Mission.

Since a foreigner entity doesn't have the legal right to own land in Madagascar FpS has assigned the ownership of the projects and supervision of all activities to these religious groups, as unique juridical entities. The environmental services provided through the re/afforestation of the selected land are issued by the Dioceses but certified by the local **Ministry of Environment**. The **State of Madagascar** is the actual owner of the land, whose concession has been granted to the Dioceses. Public land in Madagascar is in fact fee tail property.

## **ADAPTATION STRATEGY n°1: REFORESTATION TO INCREASE ECOSYSTEM AND BIODIVERSITY RESILIENCE TO CLIMATE CHANGE**

### **Reforestation**

As mentioned earlier reforestation is one of the high priorities of the NAPA of Madagascar. Species are known to adapt naturally by migrating to areas where the climate is more suitable. However deforestation has destroyed some of the key forest corridors allowing natural migration. Therefore conserving riverine corridors and connecting isolated forest blocks to have continuous forest migration routes are critical to maintaining resilience in the face of future climate change (Lee et al., 2008).

### **Nursery organization**

There is a specific *modus operandi* that applies, for all three projects, to the creation and management of the nursery for the reproduction of endemic species. This includes setting up of the area where the nurseries will be based, placing overshadowing canes, preparing soil blend (mould, dung, sand) and seeds collection.

The seeds are collected at the S.N.G.F. "Silo National du Grain Forestier" organized by the Ministry of the Environment in Antananarivo and in Mahajanga. The team and local communities also organized the harvest of small plants grown under the older specimens in the selected areas, of seeds below existing plants and on top of trees. FpS has provided for the purchase of the necessary tools for planting, materials for the nursery and for the construction of the required irrigation infrastructures.

### **Plants species selection**

The south of Madagascar is characterized by a high degree of biodiversity; its importance is related to the high anthropic pressure that undermines the remaining ecosystems. In order to preserve local biodiversity FpS Team has undertaken a geo-botanical characterization of the forest residual elements (species, composition etc.).

The plants selected for reforesting the area are all endemic. The selection has come after a thorough analysis of the local vegetation, supported by the contribution of existing relevant literature. The resulting abacus of the existing species includes more than a hundred species (list of the species available here).

### **Forest re-creation**

Holes of adequate dimensions (not smaller than 35 cubic centimetres) are dug once the soil presents the adequate consistency. The planting activities consist mainly of: the removal (and recovery) of the plastic bags around the roots, disposal in the holes, plants adjustment, and placement of a small cane for monitoring purposes.

The maintenance of young plants and conservation of existing plants that have survived external aggressions (climate, cattle, fires) is undertaken mainly through irrigation and through the use of natural herbicide with hoes (one month after the end of the rainy season (mid April – mid November). Additional care and more intensive irrigation are provided for the plants that most suffer from dry climatic conditions. Even though all species are drought resistant, at the early stages too many plants would die without additional water input. The forest ecosystems have been completely modified therefore the usual conditions at which native species could grow (e.g. under the shade of bigger plants) do not exist anymore. For this reason the strong water need at the beginning is supplied by concentrating the initial activities during the rainy season and through the subsequent irrigations provided by FpS and the local team. Water is provided through

manual irrigation, transported with the support of local donkeys from the closest well and poured through buckets onto the plants (not more than 10/15 litres per plant)).

Technical assistance -when available- is given by one or two local experts who are recruited for training the local staff, managing project activities and for drafting the reports on the daily and long term outputs.

## **ADPTATION STRATEGY n°2: creating alternative source of incomes through a Payment for Ecosystem Services (PES) scheme**

### **Which services are paid for?**

The payment for ecosystem services scheme mainly aims to get funds to pursue reforestation. The virtuous circle is done by getting payments to invest in securing ecosystem services such as:

- Carbon sequestration and storage
- Watershed protection (and avoided soil erosion)
- Biodiversity protection
- Landscape beauty enhancement

In this context 'adaptation to climate change' is not one of the environmental services directly provided for, but it results as an indirect benefit yielded by the restoration of the local ecosystems which benefits the local communities.

### **Who pays?**

This PES scheme responds both to public and private interests in addressing environmental concerns through positive incentives to land managers. The Environmental Services provided through the projects are paid by:

- **LifeGate**, which is the Italian network for sustainability and the major supplier of carbon offsets from re/a forestation projects for the national voluntary carbon market;
- **The province and municipality of Modena** (Italy).

The service of interest to the voluntary carbon market in Italy is mainly carbon sequestration sold through LifeGate program 'Impatto Zero®' to organizations (mostly private) that wish to offset the CO<sub>2</sub> emissions generated through their operations. The additional services yielded by the scheme (landscape beauty, watershed protection and biodiversity conservation) are complementary to carbon sequestration and they are actually primarily beneficial to the local communities where the projects are developed.

### **Financial beneficiaries**

The Diocese redistributes the income deriving from the PES program to the inhabitants involved in the project activities (through salaries to the workers, provision of basic needs, creation and restructuring of infrastructures, etc.) and supports all the additional implementation costs. Also they regularly report on both the economic expenses and the activities developed as they are held responsible by FpS for the accomplishment of the projects' targets. FpS team is in fact not constantly present on the field but only for periodic ad hoc missions.

### **Awareness raising activities and information campaigns**

The entitlement to the responsibility and to the success of the project activities, especially because integrated with local needs and priorities, has been key to the proactive involvement of the local communities. To this end many resources have been devoted to provide an adequate support and training to the inhabitants of the villages involved and in particular to the people that are directly involved with the different activities.

Thank to this the local communities of all three projects now have a thorough understanding of the projects developed and of the benefits both at the global and local level. The selection of the areas has in fact been done considering also the availability and potential of all the stakeholders to stay involved overtime and hence guaranteeing the long term success of the project.

The awareness and information campaigns have succeeded also thank to the tight relationship and trust between the local community and the religious groups involved which have prevented in time the creation of internal conflicts and ensured that all funds where reaching their established destination.

Environmental and agricultural education trainings and raising awareness campaigns have been held at the Agricultural School of Andriambosary in Fianarantsoa (50 people trained); the Ilena village and the surrounding communities; the Manamby village in collaboration with the nuns of Mahasoa; the Mahajanga village (30 people trained).

## **ADAPTATION STRATEGY N°3: IMPROVEMENT OF AGRICULTURE FOR FOOD SECURITY AND ALTERNATIVE LIVELIHOODS**

### **Reintroduction of biological agriculture practices to increase local food security (Ilena + Mahasoa)**

Through the projects on agriculture and rural development, FpS aims at ensuring food security against the threats posed by unsustainable agricultural practices and climate change. This objective shall be reached in particular through interventions aimed at diversifying agricultural production.

The reiteration of adverse climatic conditions, mainly due to climatic changes (i.e. a decrease of winter rain falls, increased summer droughts, locust's infestations) has made crops harvesting more difficult and scarce especially the harvesting of the most common Malagasy nutriment (rice). The effect of these factors is exacerbated by soil erosion and by the changes of the rivers hydraulic regimes. Rice cultivation is in fact possible only thank to a capillary network of small wells that collect water from nearby (water) flows and distribute it to the plots created on the terracing on the side of the same (water) flows.

Local political instability and the consequent decrease of international aid (especially for food) have worsened the situation even more.

In order to improve food security two projects have been devoted to the reintroduction of biological agricultural practices. The cultures cultivated are mainly: rice, manioc, sweet potato, beans, mangoes, tapia and other local vegetables. Other products are moringa<sup>2</sup> (incredibly rich in vitamins and minerals) whose leaves are edible for both humans and cattle. By the Ilena village there are also cultivations of citrus fruits. Benefits are in terms of food security but also economic as these products can also be sold at the markets of Fianarantsoa.

To reestablish the abandoned agricultural land FpS and the local team worked on: removal of invasive species, massive pruning, re-establishment of irrigating wells, re-establishment of areas where it wasn't possible to cultivate anymore due to abandonment, and reintroduction of needed infrastructures for the wine yard (Ilena). Fish farming activities have also been introduced in Ilena.

Training courses on sustainable agricultural practices of the species selected complement the project activities.

### **Eco/sustainable tourism**

For all three projects FpS has forecast an ecotourism component with a view to:

- Increase the benefits and economic revenues of the project in support of the local communities by attracting western tourists;
- Organize awareness sessions to involve the tourists in the project activities in order to increase the workforce and efficiency of the local team;
- Contribute to better economic conditions without undermining the environmental balance and cultural heritage of the area;
- Create opportunities to foreigners to travel through Madagascar and get a direct experience of the local environment;

<sup>2</sup> See Abacus

- Create opportunities to interact with the local communities and raise awareness on the social and cultural customs (food, handicraft techniques, religion, etc.).

Among the possible activities for the tourists an important focus will be on an 'Eco-trail', to be managed by trained groups within each of the villages that shall be involved (Ankililoka, Mahasoia, Ilena, Ivato, Antsanitia, Bemaneviky). The paths of the trail are yet to be defined. In order to efficiently distribute tasks, responsibilities and incomes FpS will encourage the villages involved to organize themselves through cooperatives and syndicates.

## RESULTS

The **area to be afforested** under the PES scheme includes one area of 100 hectares where all activities have already been completed and another area of 180 hectares, where the work is still in progress (Mahasoia project); 79 of the 100 hectares surrounding the village and 2/3 of the 48.5 hectares adjacent to the village (Ilena project); 280 hectares (Mahajanga project).

The overall project activities entail the **plantation and conservation** of more than **500,000 plants (i.e. 670 hectares which are already afforested)**. Everywhere the reintroduction of local endemic species has been quite successful, especially in terms of biodiversity restoration, with a 40 % survival rate.

In all three projects a smaller portion of the land is devoted to **complementary activities**: 1/5 of the area (20 hectares) for the Mahasoia Project and 16 hectares (ha) for Ilena project<sup>3</sup> is devoted to agricultural purposes<sup>4</sup>. 20 ha and 20,000 trees for Mahasoia, five to seven hectares for Mahajanga and 16 ha for Ilena are assigned to sustainable logging i.e. wood harvesting and production of wood coal to be merchandized.

Thank to the increased **awareness on forest management and sustainable agriculture** the number of accidental and non accidental fires has drastically decreased. Through the training provided to local inhabitants on reforestation and agricultural practices, the level of local employability has improved along with the village economic self-sufficiency. Many of the local inhabitants have been assigned to the project activities, and have proved their commitment and willingness to fully contribute to the implementation of all activities.

Also, thank to the improvement of **local water infrastructures**, an estimation of one thousand inhabitants of the villages involved have now been enabled to access drinkable water and the irrigation wells. As a direct consequence the infective diseases caused by the use of non drinkable water have decreased considerably. The restoration of local infrastructures has been key to enable the long term maintenance of the reforested areas (fireguard alleys, wells, motorized equipment, etc.).

The project has yielded great benefits also in terms of **rural development and food security** thank to the new land availability for cultivation, the diversification of the agricultural production and to the proactive involvement of the local community in agricultural activities.

## LESSONS LEARNED

### Relation with stakeholders:

FpS has continuously provided to ensure that equal opportunities were offered to the members of the local communities involved in the projects. Activities have always been carried forward with extreme attention to the continuation of existing initiatives (e.g. the team has favoured the use of non arable land for afforestation/reforestation activities).

<sup>3</sup> The land in the Ilena project being it flat, fertile and previously used as agricultural land (for vineyards and citrus cultivations), it has been chosen to cultivate fruits and vegetables in order to meet the food demand of the local community. The land so far devoted to agricultural production (rice, manioc, tubers) was in fact not enough to supply the entire village.

<sup>4</sup> Ilena project has been recently included in the Italian program called Slow Food International '1000 gardens for Africa' (see at <http://www.slowfood.it/donate/pagine/ita/progetti.lasso?-idp=030>) thank to which it will benefit of additional funding for the creation of a common vegetable garden for the village and for the school.

Actions, procedure and objectives have always been clarified through regular action plans in order to support the reporting process and favour an efficient implementation of the activities. The winning choice has been **to transfer leadership and responsibility of the project to the local communities**, a choice consolidated in time through a relationship based on integrity, coherence and trust.

#### **Monitoring activities:**

The success of the projects is guaranteed through periodic field inspections and through the introduction of satellite-based monitoring techniques for data collection of not easily accessible areas.

The following specific environmental and social criteria FpS makes sure that:

- The selection of the area is undertaken through the use of GPS, satellite and official cadastral maps, etc. The monitoring is as well conducted through area detection systems (GPS), satellite pictures and direct control of the plants and trees arboreous and biomass growth;
- A correct selection of the areas is undertaken through a prior analysis of the land geomorphologic and geological features and land-use;
- Local flora and fauna (flag species) are classified through synthetic cartographies on land use and forestry coverage;
- Data collection is carried forward through national forest inventories, related references and all other info collected at the national level;
- Land ownership policies are identified in order to guarantee that the areas selected for the project activities can be preserved in the long term;
- Synthetic forestry plans are produced for each project for providing a description of the implemented activities;
- Partners are selected in the local context (and sectoral/local wage policies) to carry forward most of the activities.

Monitoring activities are then undertaken through biological indicators such as: the increased presence of endemic species; the increased availability of ecosystem services; the eradication of invasive species; the protection and reintegration of species at risk (i.e. IUCN Red List) in the local environment. Periodic monitoring is carried forward every 6 months plan in partnership with local partners and is as well conducted through area detection systems (GPS), satellite pictures and direct control of the plants and trees arboreous and biomass growth.

## **CONCLUSION**

“Major investment, much greater than the sum of current conservation investments and potential income from REDD and payments from ecosystem services (e.g. hydrological services), will be required to sustain current initiatives and implement the adaptation agenda needed to ensure that Madagascar’s globally important biodiversity can withstand the impacts of climate change (Lee et al., 2008).”

In alignment with this recommendation, FpS is supporting adaptation strategies through the implementation of a payment for ecosystem services (PES) scheme. Even though the main objective of the project is to implement a re/afforestation scheme, FpS has increased the adaptive capacity of ecosystems as well as enhanced livelihoods and community empowerment. Local communities can benefit from these schemes through direct and indirect economic revenues. Direct revenues are yielded by the PES program, in particular by the payments for the carbon sequestration service, together with the financial support of the Italian partners involved. Indirect revenues come instead as a consequence of:

- Improved competences acquired and employability;
- Improved resilience of local livelihoods to climatic changes;
- Eco/sustainable tourism (under development).

Based on its long time experience on the field and on existing relevant literature, FpS has created a set of guidelines where key implementation criteria are identified to ensure a successful and replicable organization of the projects activities. The key criteria refer to:

- The **organizational costs**, which account for approximately 10% of the total costs and are generally all covered by FpS as the funds raised are entirely devolved to the projects;
- The **periodical monitoring** activities undertaken by FpS in collaboration with local partners;
- The **transparency** required for donors and investors who must have access to all data (finance, operations);

- The **environmental and social implementation** criteria for optimizing the scientific analysis behind the projects.

FpS Team has always faced various constraints, mostly related to the lack of adequate infrastructures (difficulty of reaching wells, of carrying plants in the reforested area mainly because of lack of motor carts and adequate transporting vehicles) or to adverse environmental and climatic conditions (floods, droughts and potential creation of fires). Nevertheless the team has always succeeded in delivering the projects and in achieving the established targets.

### **Selection criteria**

Based on the existing literature and approved methodologies FpS has identified some key criteria for selecting and developing its projects:

- **Additionality:** it would not possible to develop the same projects, in the specific local context, without the intervention and support of FpS;
- **Permanence:** the local owners of the project (those who receive the benefits of the PES program and transfer them to the local community, i.e. the local Dioceses) have to guarantee that the reforested areas will be preserved and maintained for at least 50 years since the start of the project activities;
- **Leakage:** FpS Team seeks to minimize the generation of CO2 emissions generated by the project activities. For example, invasive plant species that are cut are used to create furniture or working tools. In particular they ensure that carbon intensive activities eliminated by the project are not decentralized elsewhere, e.g. no deforestation initiatives are allowed elsewhere to compensate the conservation project;
- **Biodiversity conservation** and recreation of original environmental conditions in the forest (no green deserts (monoculture crops) are allowed for reforesting the project area;
- **Improvement of the living standards** of the local communities through activities that promote food security, increase awareness of the values and services provided by the forests, support the local health and education system;
- Availability of land and of local stakeholders to collaborate to the implementation and long term management of all activities. Projects are in fact started in collaboration with the local communities that hold the responsibility to follow up and carry forward all the activities. After the first implementation phase FpS Team organizes periodic monitoring missions in loco to make sure that all projects are carried on efficiently and targets are met.

Most risks related to the implementation and continuation of these projects in the long term, i.e. environmental, operational and political have been overcome in time by FpS. The only pending risks are related to external causes in particular to accidental fires (against which a series of security measures has been undertaken (fireguard alleys, wells, motorized equipment) including the recruitment of two permanent guards). However, following FpS interventions the risk has decreased drastically.

### **Sustainability and replicability**

FpS has consolidated a modus operandi that is easily replicable. FpS re/afforestation projects have initially proved to be a success in Costa Rica where the key features have been identified and defined thanks also to the support and commitment of the local institution FONAFIFO and the local Ministry of the Environment (MINAET). Having identified the core criteria for replication, the program in Madagascar has been carried forward with no major constraints and all projects have been implemented in a relatively short amount of time.

The main conditions for replication are:

1. The creation of PES programs to ensure a reliable and constant source of income to finance the projects in the long-term;
2. The identification and involvement of local main stakeholders in particular:
  - Local public institutions to define sustainable development criteria particularly for the assessment of the environmental benefits of the project (e.g. Payments for Ecosystem Services);
  - Local communities in order to guarantee a certain level of continuity after the intervention of FpS;
3. A reliable monitoring methodology and periodic reporting;
4. The involvement of international stakeholders (LifeGate, Italian public institutions and Italian academia) to raise awareness increases the impact of the projects and advances research.

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### More information on payment for ecosystem services on the World Bank website at:

[http://web.worldbank.org/WBSITE/EXTERNAL/TOPICS/ENVIRONMENT/EXTEEI/0,,contentMDK:21168763~menuPK:1187891~pagePK:210058~piPK:210062~theSitePK:408050,00.html#Payments\\_for\\_Environmental\\_Services](http://web.worldbank.org/WBSITE/EXTERNAL/TOPICS/ENVIRONMENT/EXTEEI/0,,contentMDK:21168763~menuPK:1187891~pagePK:210058~piPK:210062~theSitePK:408050,00.html#Payments_for_Environmental_Services)

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## Ecosystem & Livelihoods Adaptation Network

ELAN is enhancing poor and marginalized people's resilience to the impacts of climate change by integrating ecosystem and rights-based approaches into adaptation policies and practices.

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