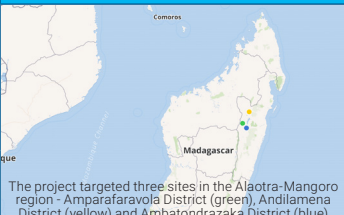






# Ecosystem-based Adaptation and an Integrated Resilient Rice Model in Madagascar

## UNEP Lessons in Climate Change Adaptation

PROJECT NAME	LOCATION	IMPLEMENTING AGENCY	EXECUTING AGENCY
Promoting Climate Resilience in the Rice Sector through Pilot Investments in Alaotra-Mangoro Region	 <p>The project targeted three sites in the Alaotra-Mangoro region - Amparafaravola District (green), Andilamena District (yellow) and Ambatondrazaka District (blue)</p>	UN Environment Programme	Ministry of Environment & Sustainable Development
Project ID: AFB-5060-1111-2G49		<b>BUDGET</b>	<b>FUND</b>
		USD 4.7 million	Adaptation Fund
PROJECT PARTNERS	MAIN APPROACHES		SDGs
<ul style="list-style-type: none"> <li>Ministry of Agriculture, Livestock and Fisheries</li> <li>Ministry of Water, Energy and Hydrocarbons</li> <li>National Center for Applied Research on Rural Development</li> <li>Lake Alaotra Agricultural Research Center</li> </ul>	 Building scientific & technical capacity	 Piloting a climate-resilient rice model	
		 Leveraging policy change	TIMEFRAME
			2012-2019

## Summary

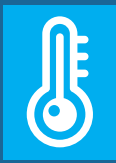
In 2012, the Government of Madagascar secured funding from the Adaptation Fund to reduce the negative impacts of climate change on vulnerable communities. Madagascar's rice sector is experiencing climate change through alterations in rainfall patterns and a rise of temperatures, leading to a reduction of water availability and decreasing yields.

A central approach of the project was to build the climate resilience of vulnerable communities in the Alaotra-Mangoro region by developing and piloting an Integrated Resilient Rice Model (MIRR) to protect the rice sector from climate hazards. The rice sector is the most important sector in Madagascar's economy, generating 41% of households' income. The rice model was developed, piloted and disseminated through three project components: i) scientific and technical

capacity; ii) adapted and resilient rice production cycle; and iii) leveraging policy change.

In Madagascar, deforestation for agricultural land is leading to widespread erosion from run-off, resulting in the loss of topsoil, depletion of soil nutrients, and landslides. The project therefore also applied an ecosystem-based adaptation approach to protect the ecosystem services that benefit rice production. The pilot investments in the Alaotra-Mangoro region have the potential of being upscaled at the national level, and two other regions – Itasy and Vakinankaratra – were selected for upscaling the MIRR approach.

In all components of the project, key lessons were learned for the implementation of the MIRR model, agroforestry, reforestation, monitoring and evaluation, sustainability, and more.



## Climate Change in Madagascar

- Madagascar, a country of 27 million people, is facing a series of existing and anticipated climate changes, including a reduction of winter and spring rainfall in many parts of the country.
- By 2065, temperatures are projected to increase between 1.1°C and 2.6°C on average.
- The main consequence for the rice sector is anticipated to be a reduction in water availability, leading to the stagnation or even decrease of rice yields.
- The challenge is intensified by deforestation for agricultural land, leading to widespread erosion due to run-off, resulting in loss of topsoil, depletion of soil nutrients, landslides and heavy siltation of lowlands and waterways.

## Project Outcomes & Achievements



### Component 1: Scientific & Technical Capacity

- An Integrated Resilient Rice Model (MIRR) was developed, including guidelines for seed varieties, field preparation, fertilization, integrated pest management and post-harvest storage.
- Agricultural calendars were updated based on 7-day climate forecasts and advisories, and training on their use was provided to **305** farmers and extension staff.
- **4** vulnerability maps were produced to guide rice cultivation planning, and **15** government staff were trained to use a new downscaled climate-hydrological model developed by the project.
- **2** new weather stations were installed. Local radios have been disseminating climate forecasts **twice a day** due to a contract signed with the project.
- **85** individuals at the regional and district levels were trained on climate risk management and how to disseminate knowledge to farmers.
- use of compost to increase crop yields. Farmers are now producing compost independently from the project, showing they recognise the value and have taken ownership. **432** farmers were trained on Integrated Pest Management.
- **1,137** hectares were reforested to rehabilitate watersheds.
- **12,650** agroforestry plants, covering **31.6** hectares, were planted, and **530** farmers were trained in agroforestry practices.
- Irrigation and drainage infrastructure was constructed or rehabilitated, including the dredging and clearing of **21km** of canals and the strengthening of **6km** of dikes to prevent flooding. In one project site, water availability increased between **28-55%** near the dam.
- **1,623** members of water users associations were trained on water management, and financial and administrative management.
- **3** climate-resilient post-harvest storage facilities were built to reduce post-harvest losses.
- **350** farmers were trained on the use of rice straw as an energy source, increasing the use of rice byproducts.



### Component 2: Adapted & Resilient Rice Production Cycle

- Around **1,900** farmers were trained on the new resilient rice model in Alaotra-Mangoro, and an additional 500 in Itasy and Vakinankaratra. The project achieved strong results, multiplying the average yields of targeted farmers by **2.5 to 3 times**.
- **11,808kg** of improved rice seeds were distributed. **30** Seed Producer Groups were trained, and produced a total of **26,000kg** of improved seeds. The 3 rice varieties developed by the project offer good results, and can be used in regions with a similar toposequence as Alaotra-Mangoro.
- **2,438** farmers were trained on the production and



### Component 3: Leveraging Policy Change

- A replication and upscaling strategy was developed and implemented in **2** other regions (Itasy and Vakinankaratra).
- The MIRR principles were integrated in the National Strategy for Rice Development.
- Local Development Plans were updated and validated in the 3 intervention areas in Alaotra-Mangoro to integrate the MIRR approach.
- A report on best practices and lessons learnt was developed and disseminated.

# Lessons Learned

## Integrated Resilient Rice Model (MIRR)

- Overall, the project achieved significant results in strengthening the Malagasy capacities to improve the rice sector's resilience to climate change. This occurred not so much through the creation of scientific knowledge, but rather through the dissemination of existing knowledge to stakeholders tasked with implementing agricultural practices.
- In addition, valuable training was provided on the use of tools that will enable Malagasy stakeholder to increase the rice sector's climate resilience (e.g., multivariate geographical analyses and quick decision matrixes).
- Farmers' experience and knowledge, as well as their willingness to change practices, are essential to the implementation of the MIRR. A project aiming for behavioural changes among farmers must account for sufficient time to enable the uptake of new practices.
- The fact that farmers are continuing to produce compost after project completion illustrates the value of compost production as a simple, replicable, environmentally-friendly and profitable way to increase agricultural yields when raw materials are available.
- For quick and tangible results, projects should collaborate with existing farmers' platforms at the level of each targeted municipality, which this project achieved in Itasy and Vakinankaratra. This collaboration also reduces the cost of broadcasting best practices.
- A strong aspect of the project design was to build on existing scientific capacities and facilities to develop the MIRR, select climate-resilient rice varieties and disseminate best practices.
- Even though adequate risk mitigation measures were successfully implemented for the project execution (for example, travelling only by day), the security situation in the Alaotra-Mangoro region affected some of the project activities. For instance, cattle theft increased the rarity of cow dung, making compost production more expensive. As a result, trained farmers are not producing as much compost as they would have liked.
- Agroforestry has multiple ecological and economic advantages for the application of the MIRR, and the project found that 400 tree seedlings per hectare is optimal for best results.
- One of the Seed Producer Groups in the Alaotra-Mangoro region was especially successful with developing sustainably produced certified seeds, and a specific case study should be prepared to document the reasons for this success.
- Projects that support resilient rice models and/or introduce new crops to farmers should also:
  - i) Ensure there is sufficient water for irrigation at the start of the season, and that seeds are locally available for the rice farmers;
  - ii) hire technical experts, such as an integrated pest management consultant;
  - iii) develop agricultural calendars and train farmers on their use;
  - iv) develop guidelines on the use of fertilizers and other inputs;
  - v) develop climate hazard maps, sectoral risk maps, and vulnerability maps to guide climate-resilient planning of rice cultivation.

## Reforestation

- The initial partner for the restoration activities lacked the necessary capacity, resulting in low seedling survival rates. As a second approach, the project employed a combination of NGO and commune contracts, but again with low success. Through adaptive management, the project achieved significantly better results in a third approach by employing a fully community-based approach on private land. Thus, reforestation by community members on their private land was found to be more effective and sustainable than reforestation by external parties.
- This may have arisen because community members were not remunerated for the planting, but only provided with technical support and plant materials. That way only landowners convinced of the reforestation benefits would engage.
- Furthermore, restoration by local, private land-owners has the added benefit of raising awareness about the benefits of restoration "on the job".
- Reforestation projects should utilize indigenous plant species, however, communities may request non-native species that conflict with conservation practices (e.g. acacias or eucalyptus). A middle ground can be found with a mix of indigenous and requested species. Extensive awareness raising may be required for communities to understand the benefits of adopting indigenous species.
- The project was implemented in generally unfavourable climatic conditions. The planting

season 2016-17 was characterized by unusually low rainfall, which affected the survival rate of seedlings. Dry seasons were also marked by the occurrence of bushfires, damaging some of the reforestation efforts. Finally, some water infrastructures were damaged by the intense rainfall and severe floods in February 2020.

- Reforestation activities are more likely to succeed if they can generate income for farmers after 5-6 years by selecting species with market demand.
- It is unreasonable to expect to measure the benefits of reforestation in terms of erosion control within a project timeframe of 6 to 7 years. Indicators measuring erosion rate will therefore likely not be useful for projects of such duration.
- When planting, conduct in-depth assessments and technical studies on the optimum duration of plants' stay in pots, size of planting holes and the timing of planting. The supply of young plants, which is often a main constraint for reforestation activities, should be ensured through a needs assessment and risk analysis.
- Some planting activities were delayed until the end of the rainy season due to contractual issues, which showed the importance of procurement planning and sound contract management for ensuring successful planting during rainy conditions.
- A high mortality rate among seedlings was recorded in the second planting season because of these delayed planting operations that did not allow

- capitalizing on rainfall.

## Project Management Capacity & Structure

- The project's efficiency level was relatively high because the management structure was streamlined and smooth, avoiding duplication.
- Projects should systematically assess the best institutional anchoring for the project based on its focus.
- Staff turnover and changes in local government representatives was a main constraint on the implementation of this project, particularly with regards to the supervisory officers. Risk analyses should identify strong mitigation options for this constraint, along with a risk analysis of political change.
- An overly complicated process for the approval of contracts and payments (e.g. double signature) proved inefficient and caused delays with some project deliverables.
- The water infrastructures are being managed by water users' associations (WUA), which functioned generally well and were trained by the project. Even though some conflicts over water use arose in one project site during the course of the project, WUAs were able to seek assistance and the project assisted in solving the conflict.



The project found that reforestation by local, private land-owners has the added benefit of raising awareness about the benefits of restoration "on the job". ©UNEP/Lisa Murray



Farmers are continuing to produce compost after the project completion, which illustrates the value of compost production as an environmentally-friendly and profitable way to increase agricultural yields when raw materials are available. ©UNEP/Lisa Murray

## Monitoring & Evaluation

- Projects should include a dedicated budget in the project design for the recruitment of an monitoring and evaluation (M&E) specialist.
- If the monitoring plan lacks details (e.g. on the frequency of data collection or the methodology for M&E activities), it should be refined in the baseline study.
- A process for conducting baseline studies should be systematised and standardised across all future projects.

## Gender

- Although the project targets for three indicators were disaggregated by gender, the project did not include a systematic gender assessment, which would have helped to formulate a gender-sensitive intervention strategy, thereby ensuring equal access to project benefits for both women and men. Therefore, a key recommendation from the Terminal Evaluation is to “systematically conduct a gender assessment and a gender action plan in the project design phase.”

## Sustainability & Upscaling

- Engaging key ministries for project implementation, working with strategic partners and local communities, using a participatory approach and collaborating with local NGOs for implementation saved costs and enhanced sustainability.
- The financial sustainability of the rice model will rely on the farmers’ ability to save money to buy

improved seeds, while the maintenance of water infrastructures will depend on the success of established financing systems.

- A strong training programme on business skills, financial management and entrepreneurship is required when setting up cooperatives for their long-term sustainability and to enable autonomous up-scaling of the project approach.
- Mainstreaming the MIRR into the National Strategy for Rice Development and disseminating MIRR technical guidelines can ensure that MIRR principles inform future policymaking.
- Sufficient time and budget should be planned for the upscaling phase of a pilot approach to yield significant results. This should be accounted for adequately in project design.
- The success of the upscaling initiated by the project will depend on political will at the regional level as it requires an institution taking a leadership role to source funding.
- It was found that some individuals intentionally burnt down some of the planted seedlings in order to graze cattle in the reforested plots. Therefore, project sustainability can be improved in future by considering how livestock management should be included in adaptive management approaches. Mayors and community leaders in the districts recommend that much more action should be taken on awareness raising.
- Where feasible, opt for the establishment of fully automatic weather stations, as these are less dependent on maintenance and the collection of data in situ, and are therefore very useful in

# Project Stakeholders

Organization	Type	Role in the project
UNEP	Intergovernmental organization	Multilateral implementing entity
Ministry of Environment & Sustainable Development - National Office for the Coordination of Climate Change (MEDD)	Government	Executing entity
Ministry of Environment & Sustainable Development - Direction of Finances (MEDD)	Government	Financial services for the executing entity
Ministry of Agriculture, Livestock & Fisheries (MAEP)	Government	Main partner
Ministry of Water, Energy and Hydrocarbons (MWEH)	Government	Main partner
Agence Nationale de Contrôle Officiel des Semences et plants	Government	Partner
National Institute of Geography and Hydrography	Government	Beneficiary
National Institute of Statistics	Government	Beneficiary
National Office for Risks and Catastrophes' Management (BNGRC)	Government	Involved in some activities
PAZC staff and staff of other baseline or related projects (e.g. PAPRIZ, PRODAIRE, PURSAPS)	Community	Implementing baseline /related projects
National Center for Applied Research on Rural Development (FOFIFA)	Research institution	Main partner
Lake Alaotra Agricultural Research Centre for International Development (CALA) - the regional center for FOFIFA	Research institution	Main partner
International Rice Research Institute (IRRI)	Research institution (international)	Involved in some activities
General Directorate for Meteorology (DGM)	Government	Involved in some activities
Prefecture of Alaotra-Mangoro	Local government	Local oversight
Regional Directorate for Agriculture, Livestock and Fisheries	Local government	Involved in some activities
Regional Directorate for Environment and Sustainable Development	Local government	Involved in some activities
Regional Directorate for Water, Energy and Hydrocarbons	Local government	Involved in some activities
National Silo for Forest Seeds (SNGF)	Private sector	Supplier
Mayors of target communes	Local government	Local partner
Development Agents in each commune	Community	Beneficiary/local facilitators
Traditional authorities of target communities	Community	Local partner
Farmers	Community	Beneficiaries
Water users' associations (WUA)	Community	Beneficiaries
NGOs in charge of reforestation (one per commune)	Local organization	Service providers

Adapted from the Project Terminal Evaluation 2020

## Resources & Multimedia

- Terminal Evaluation 2020 - [link](#)
- UNEP project page - [link](#)
- MIRR Technical Guidelines (French) - [link](#)
- Best Practices & Lessons Learnt (French) - [link](#)
- Compilation of Project Results (French) - [link](#)
- Project Sustainability Strategy (French) - [link](#)
- UNEP's climate adaptation web portal – [link](#)
- UN Decade on Ecosystem Restoration – [link](#)

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