

### **Objectives of the project**

To contribute to poverty and hunger eradication and green growth in an inclusive and ecologically sustainable way, through the transformation of agricultural and food systems in Guinea-Bissau associated with Mangrove Swamp Rice (MSR) cultivation, and through the strengthening of farmers' and researchers' skills in the co-development and co-dissemination of innovations. More broadly the project aims at developing a sustainable Agricultural Knowledge and Innovation System (AKIS) towards resilience to climate change, political instability, and economic crisis.

### **Background**

MSR cultivation is a complex and highly productive agricultural-fishing-livestock system that demands a delicate equilibrium between human activity and the mangrove ecosystem to prevent the loss of ecosystem services, bio-cultural diversity, and natural-cultural heritage. The national Country Strategy "Terra Ranka" ensures an important focus on biodiversity while it considers the agricultural sector as the main pillar for development in Guinea-Bissau. At present, the situation of MSR production is mobilising a convergent attention from several government bodies, donors, and agencies; however, public investment in MSR innovation has been ineffective and there has been no coordination efforts between both governmental and non-governmental interventions and among donors.



The irregular start and end dates of the rainy season, the frequent and unpredictable dry spells, the increase in air and water temperatures, and sea level rise together with extremely high and strong tides and storm surges which destroy dikes' infrastructure, all are contributing to the loss of large areas of productive fields and to the degradation of the mangrove ecosystem partly through coastal erosion, siltation, and soil salinization. Furthermore, rural out-migration, school enrolment and an increase in the price of agricultural labour have been intensifying pre-existing vulnerabilities and deepening food insecurity. This context deprives mangrove people of Guinea Bissau coastal areas from a critical source of food and revenues and deepens the country's trade deficit due to a need to increase rice and wheat imports. Thus, a holistic, transdisciplinary Research for Development (R4D) lens is needed to fully understand the complex dynamics of change in the interconnected socio-ecological landscape constituted by mangrove forests and the agricultural-fishing-livestock production system, as well as rural people knowledge gaps and needs to face these abrupt changes.

### **The theory of change to achieve the objectives**



This DeSIRA project draws lessons from past experiences with conventional research and development approaches to improving mangrove swamp rice production, farmers' livelihoods and mangroves' ecosystem services through the mobilization and integration of science and local knowledge in the co-production of innovations. The project adopts an action-research and participatory-learning approach and contributes to creating an AKIS through the co-production of knowledge and socio-technical innovations, the creation of a network of farmers-researchers, and the conception of early warning systems for the behaviour of the rains and the tides. These will also result in some policy recommendations which can only be put into practice if there is willingness from Guinea-Bissau political actors and R4D staff.

To achieve the expected results, the project has made an initial diagnosis of the existing endogenous knowledge and practices, followed by the systematization of farming practices across ethnic groups and coastal regions, and the identification of the main knowledge gaps and rice production risks. The project is also identifying the conflicts between rice production, oysters and fuelwood collection, and mangroves' conservation through ethno-ecological analysis and geospatial techniques. This socio and agroecological diagnosis is providing explanations for production failures and ecosystem degradation drivers (both human and climate change associated) and is helping in the identification of relevant actions to be taken.

The project (especially the junior researchers and the Principal Investigator (PI)) work with 30 young farmers-researchers (and their families) and with senior dike and dam local experts. A set of new technologies better adapted to changing agro-ecological, socio-economic, and cultural conditions is being co-identified, co-tested, and co-disseminated to achieve higher and more stable inter-annual rice yields in the targeted areas. Among these we can single out: a) new rice varieties being tested in farmers' fields and assessed by farmers themselves, and the nutritional properties and organoleptic characteristics (responsible for variety adoption or rejection) of the most cultivated varieties are being analyzed in laboratories; b) diverse cultivation practices are being improved after soils' characterization and analysis; c) rice pests and diseases are being identified both in the field and in storage facilities to propose integrated pest management practices; d) water management technologies are being characterized and co-developed innovations are being tested and disseminated. To accomplish long-term, sustainable results, the project identified a need to reinforce the research capacities of the country institutions with the installation of meteorological and hydrological stations. Early warning systems for the behaviour of the rainy season and of spring tides would allow to better adjust the agricultural calendar and prepare for sudden climatic events.

Beyond rice production a set of sustainable practices for the agro-fishing-livestock farming system is being formulated and applied to improve the contribution of the mangrove ecosystem to people's livelihoods in the targeted areas. The project is carrying out a study on aquatic e-DNA in the rice fields and surrounding mangroves, and on local farmers-fisherwomen and men knowledge, attitudes, and practices, followed by systematization and analysis, aiming at the development of participatory sustainable aquatic fauna management and eventually aquaculture practices. The project is also processing and making use of satellite and drones' images to assess both anthropogenic and environmental degradation drivers of mangrove forests and their ecosystems services.

Through the use of new communication technologies (namely, cell phones and internet) and the active engagement of young farmers, at least part of this co-produced knowledge and innovations is starting to spread among kith and kin informal networks and to benefit people from their own and neighbouring villages. Other dissemination mechanisms are radio messages and some TV interviews, but especially the videos co-produced during the project (namely, in relation to existing local knowledge and practices and the new co-developed ones) which are meant to be used by R4D organizations in the future.



Malmon project is trying to revalue agriculture as a profession through working with young farmers in the co-development and co-diffusion of innovative technologies and eventually in being able to influence policy decisions. On another front, the project is trying to make technicians, researchers, and politicians become aware of young farmers importance as relevant actors for the future of the country's economy. The project is also training staff from governmental and non-governmental organizations, but mostly investing in the younger generation of future researchers and technicians through the provision of scholarships. Finally, the project is trying to set up an institutional dialogue, while communicating and doing advocacy on the need to co-produce innovations with farmers to mitigate climate change impacts.

However, the DeSIRA project is being implemented under a continued national environment of institutional and political instability and is facing a series of risks/constraints: (i) Malmon empirical research had to start from scratch due to poor previous knowledge of current practices and agroecological conditions; (ii) no support to Malmon R4D activities took place due to the "routine" implementation of activities, absenteeism and lack of dynamics, resources and/or political will of government and nongovernment staff; (iii) endogenous knowledge and innovation practices are not recognized by government and non-government staff; (iv) poor formal and technical education of young farmers reducing their research skills.

### **Main activities**

The main activities of the DeSIRA project were/are:

- ✓ Tendering and selecting junior and postdoctoral researchers committed with research-for-development in the co-production of innovations with farmers.
- ✓ Tendering, selecting and training young and senior innovative farmers and establish a country-wide network aiming to develop a sustainable grassroots AKIS towards resilience to climate change, national political instability and global economic crisis.
- ✓ Installation of meteorological and hydrological stations and of equipment to study soil hydric-saline balance, and provision of tablets and solar panels to young farmers-researchers.
- ✓ Provide training courses to Young Farmers-Researchers (YFR) for digital inclusion, research techniques and knowledge diffusion.
- ✓ Conduct baseline data collection and systematization of local knowledge, farming and fishing practices, knowledge transmission mechanisms, knowledge gaps and reasons for rice production failures.
- ✓ Collection of rice germplasm, and characterization of selected intra- and inter-specific rice cultivars.
- ✓ Collection and identification of rice pests and diseases aiming to develop integrated pest management techniques.
- ✓ Study of soil fertility, toxicity and the hydric-saline balance and development of compost production techniques for soil fertility.
- ✓ Conduction of participatory trials in farmer rice fields for the co-development of new technologies.
- ✓ Identification of water management practices and constraints, and participatory co-development of innovations.
- ✓ Observation, analysis and documentation of the reasoning and technical decisions taken by the country's best dike and dam specialists in face of the new challenges posed by sea water rise and the occurrence of stronger tides.
- ✓ Knowledge diffusion of co-produced innovations through a network of farmers-researchers using WhatsApp and conventional methods (radio programs, leaflets, videos, cell phone SMS, rural extension).



- ✓ Collection, analysis, and systematization of empirical data to identify relevant drivers and complex dynamics of mangroves' ecosystem changes, including conflicts and trade-offs between rice production, oysters and fuelwood collection and mangrove forests' conservation.
- ✓ Agroclimatic characterization of coastal regions.
- ✓ Study of hydrological conditions and creation of a simple early-warning system for tides' behaviour.
- ✓ Study of climate-weather conditions and creation of a simple early warning system for the behaviour of the rainy season and Harmattan wind.
- ✓ Participatory development of scenarios of the impact of climate change on people's livelihoods and conception of co-management rules for climate changes mitigation.

### **Results achieved to date (April 2023)**

*Capacity of MSR actors to co-produce innovation are increased – producers, scientists, government and NGO extension services, donors and international agencies*

- ✓ 10 scholarship holders to do R4D, finish their thesis and get a degree with the support of the project. Attribution of 10 more scholarships. Of the first group, 4 got a new scholarship and 1 a contract within Malmon.
- ✓ 30 Young Farmers-Researchers (YFR) are exchanging information and technologies developed through a WhatsApp group. They have been equipped with 30 tablets and 18 solar panels.
- ✓ The Soil laboratory of Departments of Rural Engineering of Guinea Bissau (DGER-GB) is now providing soil analysis, with the support of 2 PhD and 7 Guinea-Bissauan graduate students and a serious upgrade in infrastructure and know-how.
- ✓ Further to their training, 30 YFR are using their literacy skills to identify problems, assess possible solutions and diffuse their results; they now start revaluing agriculture as a profession due to their acknowledgment that their literacy and research skills can be recognized by the society.
- ✓ Hard data is being supplied with project equipment including 14 hydrological stations, 13 meteorological stations, 32 soil humidity and electric conductivity sensors, 22 water level and Electrical Conductivity (EC) sensors

*Appropriate innovations are actually being co-produced and spread by researchers and farmers*

- ✓ Innovations have been co-produced with farmer-experts, validated and spread, notably aiming at improving dikes' robustness to marine storms, intense rain events and crabs.

*Improved co-ordination between actors regarding agriculture/MSR innovation*

- ✓ Scale-out co-produced technologies through the engagement of 3 NGOs partners.

*An increasing number of farmers are taking up innovation beyond the direct target population*

- ✓ Besides YFR, other farmers in the target villages are now: a) trying to reduce production costs; b) testing varieties and reducing rice plant density; c) trying to better adjust the agricultural calendar and their farming practices to the vagaries of rain distribution (with the support from PhD findings);

Other relevant outputs include:

- ✓ Video illustrating CC destruction of Djobel village water management infrastructures and the Action-Research intervention of Malmon-DeSIRA.
- ✓ Video illustrating farmers' perspectives about the future of agriculture.
- ✓ Participatory video clip heralding farmers' endogenous knowledge and innovation skills.
- ✓ Widening transdisciplinary research to new topics and inclusion of a new PhD student to explore the impact of CC on mangrove forests.
- ✓ 4 articles published, 1 accepted, 6 graduate students' dissertations, 7 conference presentations.

The main beneficiaries of Malmon-Desira project have been the 30 YFR and their close family, the dyke and dam specialists, 21 Guinea-Bissau students, 1 master student, 13 PhD students and 4 post-docs.

### Organization

The project is being implemented by a consortium of European Universities:

- ✓ Instituto Superior de Agronomia (ISA) – Universidade de Lisboa (ISA)
- ✓ Instituto de Geografia e Ordenamento do Território (IGOT, Portugal)
- ✓ Institut de Recherche et Développement (IRD, France)
- ✓ Wageningen University (WUR, Netherlands),

together with a set of local partner institutions:

- ✓ Univers-Sel,
- ✓ Lay Volunteers International Association (LVIA),
- ✓ Institute of Meteorology,
- ✓ Centre for Applied Fisheries Research (CIPA),
- ✓ Department of Rural Engineering / Ministry of Agriculture and Rural Development (DGER/MARD),
- ✓ Department of Plant Protection (DGPP/MARD),
- ✓ the Department of Environmental Sciences of Lusófona University of Guinea-Bissau.

A steering Committee composed of all Work Package leaders is meeting regularly through virtual or face to face meetings. An advisory board composed of all the PhD supervisors, the coordinator of landa Guiné (ex-ProGB), one representative per partner, per local participants and regional research institutions is responsible for the strategic and political orientation of the project.

### Implementing organization

Project coordination and management is under the responsibility of ISA – University of Lisbon as Lead Partner.

### Project partners

- ✓ University of Lisbon, the Instituto Superior de Agronomia (School of Agriculture; ISA)
- ✓ IGOT (Institute of Geography and Spatial Planning),
- ✓ WUR
- ✓ IRD

### Other main stakeholders

The Department of Environmental Sciences of Lusófona University-Guinea-Bissau, the Institute of Meteorology, the Departments of Rural Engineering (DGER) and Plant Protection (DGPP) of the Ministry of Agriculture, the Centre for Applied Fisheries Research (CIPA), Univers-Sel NGO (working on water management technologies), LVIA (NGO working on rice varieties and head of the Pro-GB Mangrove Rice project).

### Location

Guinea Bissau

### Funding and co-funding

EU	€ 3,000,000
Total budget	€ 3,000,000

**Duration**

five (5) years: January 2020 - December 2024

**Website**

<https://www.malmon-desira.com/>



**Updated on 23/04/2023**