Adaptation of agricultural production systems in Coastal Areas of Northwest Guinea-Bissau

PRE-FEASIBILITY STUDY

Bissau, August 2022

Pre-feasibility study report to support the development of the complete project proposal for submission to the Green Climate Fund

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Study commissioned by ADPP-GB

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Acronyms

AFS	Agroforestry Systems
APIR	Annual Project Implementation Review
AWP	Annual Work Plan
BTOR	Back-To-Office Report/Field Visit Report
CBO	Community-Based Organization
CCC	Community Climate Centres
CDM	Clean Development Mechanism
CSO	Civil Society Organization
EU	European Union
EVB	Vocational School Bissorã
FC	Farmers' Club
FR	Final Report
FTPR	Final Tripartite Review
GCCA	Global Climate Change Alliance
GCF	Green Climate Fund
GEF	Global Environment Facility
GGCA	Global Climate Change Alliance
GO	Observation Group
IBAP	Institute for Biodiversity and Protected Areas
IGA	Income-Generating Activities
IUCN	International Union for Conservation of Nature
INPA	National Institute of Agricultural Research
IPCC	Intergovernmental Panel on Climate Change
ITF	Intertropical Front
MADR	Ministry of Agriculture and Rural Development
MBA	Ministry of Environment and Biodiversity
MICS	Multiple Indicator Cluster Survey
M&E	Monitoring and Evaluation
NAPA	National Adaptation Programmes of Action
NDC	Nationally Determined Contributions
NGO	Non-governmental Organization
NHQ	National Headquarter (ADPP)
OC	Community Observers
O&MM	Operation and Maintenance Manual
OSS	Observatoire du Sahara et du Sahel
PCU	Project Coordination Unit
PIR	Project Implementation Report
PMU	Project Management Unit
PNTC	Cacheu River Mangroves National Park
PO	Producer Organization
PSC	Project Steering Committee
QPR	Quarterly Progress Report
REDD+	Reducing Emissions from Deforestation and forest Degradation
SIDS	Small Island Developing States
SiSSAN	Food Security and Nutrition Monitoring System
SLM	Sustainable Land Management
SMQQA	Water and Soil Quality and Quantity Monitoring Stations
TOC	Theory of change
TOR	Terms of Reference
TPR	Tripartite Review
UNFCC	United Nations Framework Convention on Climate Change

Executive Summary

Guinea-Bissau is considered the second most vulnerable country in the world to climate change after Bangladesh. It ratified the United Nations Framework Convention on Climate Change in October 1995, the Kyoto Protocol in 2005 and the Paris Agreement in 2015 (COP 21).

The North and Northwest regions of Guinea-Bissau are currently subject to land degradation phenomena that are detrimental to agricultural activities and water security with harmful effects for populations and agro-forest-pastoral activities. Likewise, wetlands and coastal areas are increasingly subject to saline intrusion and river silting, also resulting in land degradation and leading to loss of biodiversity.

The immediate effects of climate change are reflected in the increase of sea levels, the increase in temperatures and in the variability of the rainfall regime, with shorter rainy seasons and greater uncertainty as to their onset. All of these events have led to the progressive abandonment of salted rice production systems and, consequently, to falls in the amount of global and household production.

In order to produce a Complete Proposal document to be submitted to the Green Climate Fund for access to financing for the implementation of the project, this pre-feasibility study was prepared to serve as the main element for the development of the complete proposal.

The main objective of this work is to prepare a pre-feasibility study that complies with the standards of the GCF. The study will conduct a detailed assessment that will support ADPP in the design and development of the complete project document based on research, analytical work and consultation.

This work consists of 8 chapters and annexes.

The first chapter characterizes the country, including a description of the population and ethnic groups, geography, biodiversity, maps, political/administrative organization, social issues and development challenges. It also includes a brief analysis of the key sectors in the country and a specific emphasis on the agricultural sector reveals aspects related to the Food and Nutritional Security of the population, which tend to be the main factors of food and nutritional insecurity.

Issues related to vulnerability to climate change are also presented in this chapter, highlighting the climate of Guinea-Bissau, its seasons and weather as well as climate trends and climate sensitivities to the population's main livelihoods. Additionally, description of the actions that the country is taking to deal with climate change in terms of main policies and strategies is provided.

An analysis of vulnerability to climate change in the regions targeted by the project (Cacheu and Oio), the administrative/political organization and certain key characteristics of the two regions are discussed. Agricultural practices, specific adaptation challenges, as well as the main impacts of climate change to be addressed, reasons/causes of vulnerability and barriers, are also addressed.

Furthermore, this chapter analyses and evaluates the potentialities, vulnerabilities and needs of the population and natural resources regarding the adverse effects of climate change in the Cacheu and Oio regions, through quantitative and qualitative data. This allows for an understanding of the socioeconomic aspects of vulnerable categories and of the cost-effectiveness of the proposed interventions to be assessed. Lastly, the best practices in the country and relevant regions for the project's intervention area are identified, in order to ensure that the project takes into account the lessons learned and the practices that can contribute to the success of the project.

Chapter 2 deals with the project as a whole, specifically the following aspects: theory of change, detailed description of the components, results, outcomes and activities. The characteristics of rural families in the target regions, identification of beneficiaries and criteria for selecting beneficiaries are also explained.

Chapters 3 and 4 present the intervention logic (logical framework) of the project (indicators, baseline, targets to be reached, risks/hypotheses, means of verification) and the project implementation schedule, respectively.

The fifth chapter addresses details of implementation, analysing the overall institutional details, implementation and organization of the project as well as the alignment of activities with executing entities. It also presents existing international and regional funds that can be used for project co-financing. Finally, it proposes a system for the monitoring and evaluating the project.

Chapter 6 discusses the feasibility of the project, focusing on an analysis of national policies, strategies and initiatives related to previous and ongoing climate change, to support the project's alignment with existing national strategies and to ensure synergies with ongoing projects in order to avoid duplication of efforts.

The innovations that will be introduced by the project are also addressed. Moreover, this chapter shows how the project can be replicated in other regions of the country, through the existence of financing, application of good practices and dissemination of experiences based on synergy and complementarity. Aspects of economic, institutional and environmental sustainability are issues that close this chapter.

Chapter 7 undertakes a technical assessment of previous and existing efforts in the country, successes and failures, explanation of how this project uses the lessons learned, solid research references, publications and reports to prove the viability of the interventions.

Chapter 8 shows the indicative budget for each component and activity, always from a perspective of durability.

The state of vulnerability of the rural population in the regions of Cacheu and Oio is characterized by a lack of goods, limited access to public services and low levels of economic development. The coastal areas of these regions are mostly plains with high tides occurring locally, often reaching 6m in height. Large coastal areas are therefore exposed to its impact. Over the years, this situation has led to devastating effects on soils, with arable land subject to erosion and the destruction of protection dykes leading to the degradation of soils compromised by salinisation excessive. As a result, the regions are characterized by food insecurity and famine, contributing to rural exodus, malnutrition and disease.

It should be emphasized that during the study, ethical, inclusive and gender considerations were taken into account, as well as those related to the fight against the Covid-19 pandemic.

1. CONTEXT

1.1 Country Characterization

Guinea-Bissau is a small coastal country, located between Senegal in the north and the Republic of Guinea in the south. It is part of the ecoregion of West Africa and its southernmost part, known as the "Rias do Sul" due to the indented character of its coasts and islands, holds a special status in the Convention on Wetlands. The country has an area of about 36,125 km² and is formed by a continental and an island part.

The demographics of Guinea Bissau consists of more than 20 ethnic groups, with different languages, social structures and customs. The majority of the population relies on agriculture for their livelihood (more than 72% depends on agriculture or fishing as a source of subsistence) and professes traditional local religions. About 45% of the population practices Islam. The most widely spoken languages are Fula and Mandingo, spoken by populations concentrated in the North and Northeast. Other important ethnic groups are the Balanta and the Papel, in the southern coast, and the Manjacos, Mancanhas and Felupes, in the coastal regions in the centre and the north (Aménagemet linguistique et des langues dans le monde).

With 1.9 million inhabitants and an estimated GDP of 4.1 million USD, Guinea-Bissau's socio-economic indicators are among the lowest in the world. According to the Human Development Index (HDI) by the UNDP 2019, the country ranks 177th out of a total of 189 countries. Average life expectancy at birth is 57.7 years, GDP per capita is less than 800 USD, and population growth is 2.5%, with a fertility rate of 4.6 children per woman. One third of the population lives in extreme poverty, one third of children under the age of five still suffer from malnutrition and about 9% of children die before the age of five. The coastal zone, due to its characteristics and for historical and economic reasons, presents a greater concentration of the population and consequently a greater ethnic diversity.

Guinea-Bissau is a West African coastal country in the transition zone between the Sudanese and Congolese Sahel, with a remarkable and world-renowned biodiversity. The majority of the Guinean population lives and depends on biological resources, which are the basis of its economy and social well-being.

Guinea-Bissau, like other countries in the world, aims to conserve this heritage handed down by prior generations to future ones and to humanity. Consequently, it joined other partner countries in signing on 12 June 1992 and ratifying on 27 October 1995 the Convention on Biological Biodiversity, whose objective is to conserve biological biodiversity, to ensure the sustainable use of its components and the fair and equitable sharing of benefits derived. Signatory countries are obliged to take necessary measures to achieve their goals through national strategies and action plans for biodiversity conservation. The first version of Guinea-Bissau's related document was prepared in 2002.

The ethnic population of Guinea-Bissau has developed and applied a method for the management of spaces and natural resources that still persists in some areas of the country. As a coastal country, it decided to prioritize a coastal zone conservation program as part of its conservation strategy. According to this program, which took into account traditional conservation methods, a national protected area system was created consisting of six marine protected areas. Guinea-Bissau intends to further increase its internal efforts regarding the conservation of protected areas, which will lead to a national system of protected areas covering about 26% of the national territory. (National Action Program for Adaptation to Climate Change, December 2006). Despite efforts being made by the inherent entities (IBAP, and other organizations), there are still numerous pressures on biodiversity resources and services, with some causing irreparable losses and damage to the country.

Guinea-Bissau's rule of law is democratic, multiparty and constitutionally instituted, with four sovereign bodies (Presidency of the Republic, National People's Assembly, Government and Courts), based on their separation and independence. Regarding administrative organization, the national territory is subdivided into eight administrative regions, 38 sectors and several sections, and an autonomous sector of Bissau.

Meanwhile, the country has faced major social problems for several years, mainly in the education, health, and basic sanitation sector. The situation of poverty is increasingly shaping society due to the context in which the country finds itself. In its operational strategy, the Government of Guinea-Bissau aims to achieve sustainable development, which includes major axes, namely: a diversified economy based on four growth drivers (agriculture and agribusiness, fishing, tourism and mining).

Guinea-Bissau is a fragile country with quite alarming socio-economic indicators, which have deteriorated due to constant socio-political and military instability resulting from constitutional changes and the dynamics of external assistance, especially with regard to bilateral cooperation. Despite abundant natural resources and favourable agroecological conditions, the country is lagging significantly behind in its achievement of the Sustainable Development Goals (SDGs). Considering the challenges of sustainable development in the country, the national development plan for Guinea-Bissau, "Terra Ranka 2015-2025", highlighted the following key sectors in connection to climate change adaptation: Energy, Agriculture and Agribusiness, Fisheries, Tourism and Mining.

Agriculture, on one hand, plays an important role in the production of food, the creation of income and employment. On the other, it also contributes to the eradication of malnutrition through food systems, namely the process of agricultural post-production, which includes the processing, storage, marketing and consumption of food. The crises or stressful situations that affect agriculture, therefore, have negative repercussions on livelihoods and, by extension, on the food security of vulnerable populations. In recent years, nutritional statuses have deteriorated for these groups due to food insecurity. Agriculture is the foundation of Guinea-Bissau's economy. To date, it is founded on rain agriculture. It is estimated that about 99% of agricultural production and productivity depends on the level of precipitation in quantitative and qualitative terms, its distribution over time, the potential and natural suitability of the soil and the adaptability of crops to the aggressive physical environment. However, more than 80% of the population lives off of agro-silvo-pastoral resources, which, despite the efficacy and effectiveness of harnessing the existing potentials, also depend on the ethno-cultural and anthropological factors of each people (Djata, R.N., Mane, A. & Indi, M., 2003).

In Guinea-Bissau, the development of rice farming is more than a priority, a fact that justifies its placement in the forefront of the Government's concerns, as expressed in the development policy document "Agrarian Development Policy Letter". In addition to the importance and cultural value that this cereal represents for the Bissau-Guinean people, it supplies 62% of the national cereal production and 75% of the current consumption of cereals, which is equivalent to 130,000 T/year or 130 kg/person/year per capita consumption (Djata R.N. & Pereira A., 2015). The socio-economic matrix of rice farming is characterized by a gigantic variety of "ethno-cultural traditions", the size and structure of the family, the networks of connections between families, tabancas (villages), inter-tabancas, communities, etc. (Djata, R.N., Mane, A. & Indi, M., 2003). Currently, despite the considerable rice production potential, the country faces a production deficit to cover its needs. With a rudimentary production technique and archaic working methods, the subsector consists of small producers who are dedicated to rice production with an average yield of 1.7 tons/ha (Djata, R.N., Mane, A. & Indi, M., 2003). This yield is due to the fact that most of the work is manual, requiring physical work by the people involved, mostly of age and illiterate. Modern producers (ponteiros) with extensive agricultural land (between 20 and 2,500 ha) granted by the state occupy about 27% of arable land (that is, 9% of the total area of the country), but use only a small portion of their land for agricultural production.

Guinea-Bissau is experiencing a situation of malnutrition and structural food insecurity. National food production is not sufficient to cover the country's food needs. According to the SiSSAN survey carried out in 2019 and published in March 2020, in 2019, the rate of food insecurity in the country was 30.7% (368,458 people), with the exception of the Autonomous Sector of Bissau, which was not included in the survey. The rate was 34.2% in rural areas and 19.2% in urban areas. The proportions increased with age, with food insecurity for children aged 6 to 11 months standing at 3.2% and for children aged 18 to 23 months at 13.5%.

The regions of Gabu, Biombo, Oio and Cacheu are the most affected by food insecurity, with rates above 38%. The regions of Bafata, Quinara and Bolama Bijagós are the least affected, with rates below 22%. The situation of food insecurity among rural families deteriorated from September 2016 to September 2019, from 30.6% to 34.2%. The drop in food security in 2017 was a staggering 15.5% in May and 20% in October. To overcome these difficulties, 61.4% of households were forced to use strategies based on consumption and/or subsistence. Difficulty meeting minimum food needs was experienced by 20% of families, forced to use irreversible survival strategies that hinder their future capacity to generate income or invest in the formation of human capital or productive assets. The average number of meals per day was 2 for adults and 3 for children under five.

An analysis of the profile of families facing food insecurity carried out during a survey conducted by SiSSAN in September 2019 shows that rural families are more vulnerable to food insecurity than urban ones. The analysis also shows that agricultural families are more vulnerable than those that do not directly depend on it, that is, those that do not have agriculture as their main source of income. The level of education of heads of households has a major influence on the situation of food security. The lower the level of education of the head of the family,

the greater the food insecurity. In addition, families with a small number of members are the most vulnerable to food insecurity.

The change in this proportion is also due to the gradual introduction of new foods in the children's diet. According to the minimum food diversity indicator, only 17.9% of women of reproductive age (15 to 49 years) had adequate food in September 2019, 16% in rural areas and 24.5% in urban areas. Of the women questioned, 8.4% were pregnant at the time of the survey and 77.3% of them did not eat an adequate diet, which could lead to possible negative consequences for the health of the woman and of her future child (SiSSAN Survey, Sept. 2019)

The main factors that contribute to food insecurity are: i) repetitive political-military crises, ii) high prices of food products on the market, iii) very little diversified food production, iv) low agricultural productivity, v) low food security, vi) instability of family income, vii) insufficient infrastructure and adequate logistics, and viii) uneven distribution of legal responsibilities related to food production (low security of land tenure for women and youth) (SiSSAN September 2019). Among the causes of food insecurity in the country, widespread poverty is one of the most important factors, with 70% of the population living in poverty (ILAP 2010). Cashew nut monoculture also affects the food security of rural families in Guinea-Bissau, particularly since the expansion of cashew culture has come at the expense of land destined for the production of cereals and food products as well as absolute dependence on selling cashew for income for food.

The country has few legal instruments that guarantee the right of citizens to adequate food and effective information systems on food security. These remain incapable of providing continuous and quality information on the food security of populations and the factors that influence them. The capacities of national institutions and other organizations are very weak and unable to provide lasting solutions to the problem of food insecurity in Guinea-Bissau.

The conditions of drinking water supply and hygiene and sanitation practices in the country are not adequate. Less than 20% of families use improved sanitation facilities and 50% of the population in rural areas has no access to improved latrines. Only 50% of the rural population has access to protected wells and a quarter of the population in urban areas has no access to drinking water sources. Also, according to the MICS survey of 2014, it was found that only 35.6% of households had a specific place to wash their hands with soap.

1.2 Geographic Coverage

The project "Adaptation of agricultural production systems in Coastal Areas of Northwest Guinea-Bissau" will be implemented in two coastal regions, Cacheu in the northwest and Oio more to the centre. Oio and Cacheu were selected for their high levels of vulnerability towards climate change impacts, most notably sea level rise (being the lowest-laying Regions with large coastal surface – see section below). In addition, Oio and Cacheu were also selected for being the Regions most affected by food insecurity, with rates above 38%. Equally, Oio and Cacheu are not benefiting from the Adaptation Fund project, which has a similar scope, and which targets the drier Regions in the East.

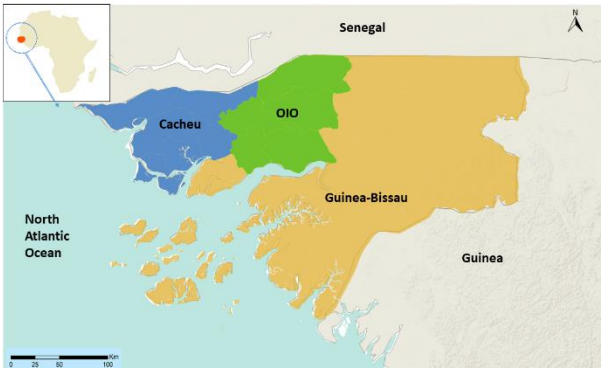


Figure 1. Map of the project area: Cacheu Region and Oio Region

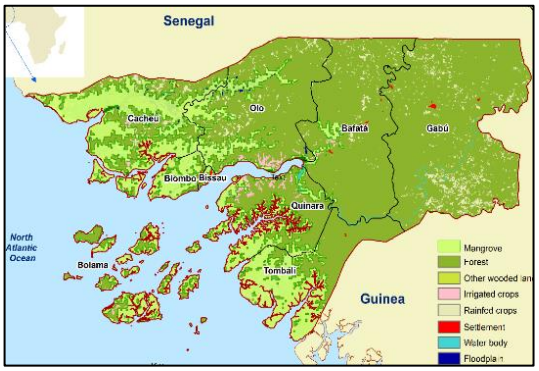


Figure 2. Map with the land cover of Guinea-Bissau

Figure 3. Map with the names of the pre-selected target communities – Cacheu Region and Oio Region

Table 1. Targeted communities and their location (GPS coordinates of pre-selected project communities).

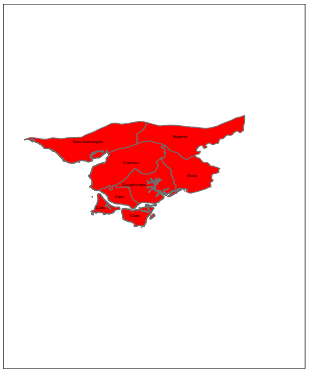
Region	Community name	Latitude*	Longitude*
Cacheu	KanKan		
	Pechilal (Pitchilan)	12.13344666173502	16.03192388411548
	Charobrique (Tchur-Brick)	12.13764753799205	16.041553014409246
	Pelundo	12.11922461482844	15.966001350134716
	Jolmete	12.220826005838608	15.85632822798525
	Calequisse	12.066499047491074	16.21492161985179
	Ponta de Pedra	11.881089288111124	16.097228970479552
	Ilha de Pecixe	11.774000890401137	16.074133799017744
	Ilha de Jeta	11.857603951148148	16.233583479875
	Mato de Có		
	Có	12.081099212256841	15.811947883818194
	Ponta Geraldo (João Landim)	12.014845561577896	15.717905289245508
	Nhelem (Nhilim)	12.041966035116648	15.710911988847698
	Campada (Campada Maria)	12.388848106204843	15.882398783256896
	Ponta de Leão	12.360042292898573	16.09082859807706
	Barro	12.389268026257996	15.618782068562771
	Antótinha	12.2787743545769	15.793274078344817
Oio	K3	12.468605320821691	15.22404278855541
	Galomba (Farim)		
	Bafantadin (Bafatoio)	12.380727499574295	15.349831645984159
	Jagali Balanta (Tchagal)	12.36066115365042	15.445307733702768
	Jugudul	12.033819604564046	15.327465321131353
	Contobó	12.066498744818297	15.382088508166897
	Impasse (Ntchasse)	12.05686453517656	15.495580942040219

Region	Community name	Latitude*	Longitude*
	Cuboi	12.148781433746551	15.441665698635335
	Ensalma	11.983024288925966	15.63746671453066
	Jugudul Com	12.00723077928431	15.51493000553512
	Nhoma	11.976458592554698	15.590352021411427
	Missira	12.330844847304883	15.340034762097304
	Uatine	12.214084268796762	15.461090528489446
	Blassar	12.259001358509204	15.496360391739652
	Iara (Iaran)	12.357524768218214	15.515162952573386
	Pache (Patche Iala)	12.066924857910506	15.626452172192309
	Uuncur (Ungro)	12.040148518008673	15.486118996582368

The Cacheu Region is limited to the North by the Republic of Senegal, to the Northwest by the Atlantic Ocean, to the Northeast by the Oio Region and to the South by the Biombo Region, particularly by the Safim sector. The Cacheu River divides the region into two parts, a continental part and another island part composed of the Pecixe and Jeta Islands that are part of the Caio sector. The region is divided into 6 sectors: Bigene, Bula, Cacheu, Caió, Canchungo and São Domingos.

This region is characterized by a relatively dry climate compared to other regions in Guinea-Bissau (average rainfall of 1500 mm/year). This region is named after the Cacheu River, whose estuary, in 2000, became part of a Natural Park (Parque Natural dos Tarrafes do Rio Cacheu), which includes the largest mangrove patch on the West African coast.

The populations that live in this region have developed the traditional know-how of rice cultivation in mangrove (the Balanta and Felupe people) and plateau (the Fulas and Manjaco) soils and depend heavily on these ecosystems for survival.



Sector	Total Inhabitants	Female Inhabitants	Area (km^2)	Population Density (inh/km^2)
1. Bigene	51,412	26,723	1,082.2	47.5
2. Bull	29,557	15,467	746	39.6
3. Cacheu	18,563	9,621	1,004.4	18.4
4. Caius	12,696	6,758	664.3	19.1
5. Canchungo	43,739	23,822	1,035.2	42.2
6. S. Domingos	29,116	14,530	642.9	45.2

Figure 4. Geographic representation of the Cacheu region (INE 2009).

The Cacheu region has a surface area of 5,175 km^2 and has 192,508 inhabitants[1]. It consists of the main ethnic groups Manjacos, Mancanhas, Balantas and Felupes. According to Rui Andrade[2], the population movement in the region has been traditionally known since the mid 1940s and has been constant. Young people tend to emigrate seasonally, after the rice harvest, to areas of palm groves dedicated to the exploration of the same, and for the weaving of cloths, where the Manjacos de Canchungo stand out, accompanied by smaller numbers of Manjacos from Caió and the Pecixe and Jeta islands.

[1] Instituto Nacional de Estatística da Guiné-Bissau, Recenseamento Geral da População e Habitação, 2009.
[2] Elementos para a elaboração do esquema director agrícola regional (Regiao de Biombo, Cacheu e Oio, Julho de 1995, PNUD/FAO.

Many Manjacos from Canchungo, with the support from emigrant family members, move to the sector of São Domingos, in order to open agricultural farms for planting cashew and fruit trees and for producing mancarra and beans. Many Felupes, especially girls, travel to Senegal, Gambia and Bissau in search of domestic jobs. Boys tend to move to continue their studies in São Domingos and Bissau and most do not move back to their place of origin. Both only return periodically in the rainy seasons from late July to October to support family members in the cultivation of rice.

Emigration is permanent in the case of Manjacos, Mancanhas and Felupes to Senegal, Gambia and Europe (Portugal and France), with mainly Manjacos moving to the latter two countries. The reasons given for seasonal emigration are to guarantee financial support for the next agricultural season and to purchase individual goods. As for permanent emigration, the reasons given are the weakening of the country's economy, the individualization and monetization of ethnic societies. In some cases, families influence and encourage young people to leave their own tabancas for lack of socioeconomic conditions, in search of jobs and wealth.

The Manjaca are the predominant people in the Cacheu region, especially in the southern part of the Cacheu River. In the northern part of the Cacheu River, the Felupe constitute the largest ethnic group. Christian and animist religions are predominant among inhabitants of the region.

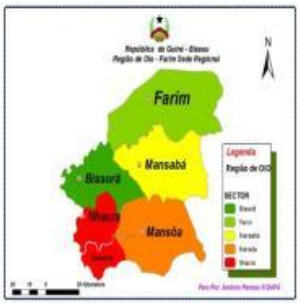
The Felupes, for example, are mostly animists, although some have converted to Christianity and Islam. They live on the coast, north of the Cacheu River, in the strip of land that goes from Cabo Roxo to Ponta de Bulor (Bulol), passing by the south border of Casamança until close to the village of S. Domingos to the north. Many of the tabancas (villages) on the coastal strip are in the vicinity or practically within the natural areas of mangroves. Ancestral traditions are maintained in the area and are closely linked to rice farming (Elements for the elaboration of the regional agricultural master scheme - Biombo, Cacheu and Oio Region, July 1995, UNDP/FAO).

The Cacheu Region is characterized by its low altitudes (0 to 75 meters) and a slightly accentuated relief. This configuration allows water from the Atlantic Ocean to penetrate, with every high tide, the rivers that cut across the territory: the Cacheu River, in the north of the region, and the Mansoa River, in the south. Secondary rivers that connect to them are also affected. These rivers constitute a network that occupies a third of the regional surface (1,722/5,175 km^2) and the influence of the tides is felt throughout the region. The level and salinity of river waters evolve cyclically depending on the strength of the tides and the seasons. The salinity level drops as the rainy season (from June to October) moves in due to freshwater replenishment and increases when the rains stop (from November).

Created in 2000, through Decree nº 12/2000, of December 4, 2000, the Cacheu River Mangroves National Park (PNTC) is the area with the highest concentration of mangroves in all of West Africa (PAN/LCD, 2010). It extends over 886.15 km^2, is composed mainly of tarrafes/mangroves (68% of its surface) and represents 17% of the regional territory. These mangroves constitute a fundamental ecosystem for riverside populations, who obtain an important part of their resources from them, and for other actors external to the region. By way of illustration, up to 12 tons of carbon per hectare of mangrove can be fixed per year, which contributes to the mitigation of climate change (Twilley et al. 1992).

The PNTC also concentrates important natural places of refuge and breeding for different species of fish, molluscs and crustaceans, notably shrimp, a species of great economic importance for the riverside populations as well as for foreign fishermen. In addition to this avian and aquatic fauna, the park is home to several rare and protected mammal species, such as the hippo (hippopotamus amphibius), the manatee (trichechus senegalensis), the Nile crocodile (crocodylus niloticus) and the dwarf crocodile (crocodylus tetraspis), the Atlantic humpback dolphin (sousa teuzsii) and the bottlenose dolphin (tursiops truncatus), the painted gazelle (tragelaphus scriptus) and the green monkey (cercopithecus aethiops) (UICN 2008). Recently, the PNTC coordinated a participatory work on the delimitation of fishing zones and prepared differential regulation, according to the rivers and the origin of the fishermen. Native fishermen (from the region) enjoy privileged access to this resource.

The Oio Region is located in the north of Guinea-Bissau with an area of 5,403.4 km^2, corresponding to 15% of the national territory. It is limited to the North by the Republic of Senegal, to the South by the channel of the river Geba and by the region of Biombo, to the West by the region of Cacheu and to the East by the region of Bafatá.



Sector	Total Inhabitants	Female Inhabitants	Area (km^2)	Population Density (inh/km^2)
1. Bissorã	56,586	29,233	1,122.9	50.3
2. Farim	46,264	25,123	1,531.5	31.5
3. Mansaba	43,725	22,934	1,387.0	31.5
4. Mansoa	46,046	23,601	1,096.7	42
5. Nhacra	20. 639	11,184	265.3	77.0

Figure 5. Geographic representation of the Oio region (INE 2009).

The Oio region is the second largest and most populous in Guinea-Bissau, with the following most prevalent ethnicities: the Balantas, Mandingas and Fulas. It has a total of 224,644 inhabitants, with a population density of 41.6%, and is distributed into five Administrative Sectors, including: Bissorã, Mansaba, Farim (Headquarters of the Region) Mansoa and Nhacra (INE-RGPH 2009).

These two regions are representative of the diversity of climatic, ecosystem and ecological contexts in the coastal zone of Guinea-Bissau. According to the rain gradient from north to south, lessons and best practices related to technical options and strategies for the rehabilitation of rice fields will be gathered for different agro-climatic contexts.

This original topographic sequence of natural habitats has gradually evolved over the centuries, according to the settlement of human populations and their systems of agricultural production and rice cultivation. Three rice cultivation systems are practiced in the two intervention areas of the project: rice fields in the mangroves, freshwater rice fields in low and humid lands, and itinerant rice production in the highlands where forest areas are cut and burned. This last practice must be reduced or eradicated over time as it is a harmful for the environment.

As the cashew nut became the main national commercial and export crop in the 1990s, its production spread throughout the country, including the coastal zone. Cashew plantations are now at risk of gradually replacing forest areas that were first cleared for the cultivation of rice.

The continued expansion of cashew plantations is contributing to the destabilization of natural habitats and to the gradual disappearance of dry and wet forests. This trend contributes to increasing sedimentation in high areas of bolanhas, leading to water management problems (aggravated by the decline and irregularity of rains) and often leading to the abandonment of important parts of the rice paddy areas. To compensate for these losses in terms of upstream production space, a strategy widely adopted by local farmers in the coastal zone is to expand tidal rice fields into mangrove areas, leading, in some cases, to a sharp decline in ecosystems.

The socio-economic impacts of climate change in coastal areas in the northeast of Guinea-Bissau can be analysed through:

(i) Decrease in marine biodiversity (many plants and animals will become extinct, which will have negative effects on agriculture, fisheries and tourism);
(ii) Rising average sea level that will cause more frequent flooding in coastal regions and greater coastal erosion;
(iii) Sedimentation of the beaches and sediment transport from the coasts, causing silting in the rivers (decreasing the flow of the river, making irrigation more difficult and reducing the water reserves for consumption);
(iv) Displacement of populations and species;

The rise of seawater has posed great challenges to the continuity and subsistence of the traditional way of life of the target communities. The population is small and lives closely together. There is a progressive aging of the population as a result of the exodus of young people to urban centres in search of better educational and work conditions. Traditional power still represents the central structure of governance and conflict mediation.

The populations of both regions depend strongly on ecosystem services, especially that of the mangroves, to ensure their food security and way of life. They are highly knowledgeable of this natural environment and of cultivation techniques of their soils. The mangrove represents a central element for this way of life, as well as an

important element of protection for their housing zones and rice production systems, against coastal erosion and flooding of their cultivation fields.

The productive and food regime of the communities in the Cacheu and Oio regions is closely linked to a set of factors related to the forms of land occupation, the productive cultures, the cultural traditions associated with them, the mechanisms for mobilizing labour force, income generation, savings and investment, and consumption priorities (Government of Guinea-Bissau 2019).

The excessive weight of manual production in all phases of agricultural activity in these regions has negative impacts in terms of public health, mobilization of labour due to physical exhaustion and accelerated and premature aging of men and women, further motivating rural exodus. The mobilization of labour in the traditional production system used to enjoy a certain level of sustainability based on corporatism and solidarity. Currently, due to the phenomenon of rural exodus, especially among young people, labour force has become more expensive.

In these areas, problems are still found associated with the accessibility of production techniques. This is due to a lack of knowledge on the part of producers regarding new agricultural production techniques, including those of an agroecological basis, as well as the use of favourable technologies, adapted for greater production and safeguarding the health of soils and ecosystems.

According to the Ministry of Environment and Biodiversity, in recent years, pressure on forests has increased in coastal areas of northeastern Guinea-Bissau due to the clandestine exploitation of wood, the practice of itinerant agriculture and fruit growing. The clearing of forests and the anarchic planting and exploitation of cashew trees is particularly worth mentioning.

If the current rate of degradation continues, it is likely to seriously threat the existence of some dense nuclei of sub-humid forest. With regard to the mangroves, these are also facing increasing pressure due to the exploitation of firewood for fish smoking and deforestation for rice growing. The country's National Biodiversity Strategy and Action Plans further states that itinerant agriculture activities, and particularly the cultivation of rice and monoculture of cashew, carry the most responsibility for the transformation of forests in the Cacheu and Oio regions. These practices are reaching more and more dry and semi-dry forests as well as arboreal and shrub savannas.

Desertification is land degradation in arid, semi-arid and dry sub-humid areas. It is fundamentally caused by human activities and climatic variations. It constitutes a process of environmental degradation that depends on a multiplicity of factors, which can lead to situations of irreversible degradation. Its manifestations include accelerated soil erosion, increased soil salinisation, increased runoff due to a decrease in the retention of water in the soil, reduced species diversity and productivity, leading to the impoverishment of human communities dependent on this ecosystem. Communities in the Cacheu and Oio regions recognize that desertification is an important economic, social and environmental issue and that it concerns many countries worldwide.

The cultivation of upland rice (pam pam) in itinerant parcels, in the coastal zone of northeastern Guinea-Bissau, constitutes one of the pillars of the family economy. It guarantees an important part of the rice consumed annually and, therefore, the basis of food. This system of rice production is characterized by being an extensive cultural practice, essentially based on the conquest of arable land through the use of burning. The cutting-burning-cultivation of rice is followed by the planting of cashew or fallow. Deforestation for rice cultivation affects dense forest areas that are more developed, leading to a progressive degradation of the vegetation cover. In most tabancas, subsequent cashew planting prevents any natural regeneration. The use of chemical and synthetic products is still favoured over agroecological and organic products, due to lack of knowledge and technical support.

Currently, the lack of investment and access to agricultural credit in the coastal regions of northeastern Guinea-Bissau has led to greater adherence to the exploitation of cash crops. Cashew monoculture is causing deforestation at a galloping pace, loss of biodiversity and less access to diversified, and balanced consumption, without market dependencies. On this basis, it is necessary to organize the territory, to structuring agricultural land, particularly with regard to agricultural zoning by types of crops and technical assistance to farmers.

Another critical element in relation to the production, and which effects sustainable consumption processes, has to do with low food productivity associated with post-harvest loss. This is due to pests and diseases in the surrounding environments, which poor farmers lack the mechanisms to immediately prevent and biologically fight, thus generating an enormous productive insecurity.

Firewood is the main domestic fuel used for cooking in the tabancas of the Cacheu and Oio regions. Now, with the proliferation of the bakery and confectionery industry, the consumption of such products has heavily increased, requiring more of the only source of domestic energy (Tiniguena 2017).

Guinea-Bissau is the country with the largest mangrove area in the world in relation to its total area. Of the 350,000 hectares of mangroves that the country had in 2015, 130,000 (corresponding to more than 35% of the total) would be located in the Cacheu Region. This space has, since ancient times, been ordered by man, who uses it in particular for rice cultivation. The traditional ordering consists, first of all, in the construction of a waist dyke, followed by deforestation, burning and removal of the roots of the tarrafes (mangroves) that are in the space and thus protected from the water of the rivers. Then comes the work of parcelling and damming the channels fed by the rainwater, when it penetrates the ordered perimeter.

Parallel to the design of these systems, which aim to manage the inflows and outflows of river waters and the dam or drainage of rainwater, varieties of wild rice have been progressively domesticated, creating “African rices”. The typical landscape of the mangrove bolanhas and the originality of the culture system practiced there, on the border between fresh water and saltwater, strongly marked observers outside the region. The soils of the flooded areas are, in a clear way, predominantly clayey and subject to acidification and salinisation phenomena that the inhabitants of the area value (saliculture) or try to regulate in the bolanhas. Fresh water brought from rainfall allows the first centimetres of the soil to leach at the beginning of the rain cycle.

The destruction of mangrove ecosystems has immediate impacts on the knowledge about resource and agricultural exploitation in these soils. Traditional knowledge of exploiting mangrove resources is strongly linked to the knowledge of how to use nature to produce food and explore resources without breaking the ecological balance. Traditional knowledge must therefore be recovered and combined with current knowledge and environmental conservation technologies.

Productive landscapes linked to mangrove ecosystems, such as rice fields, also face a number of threats that directly cause soil degradation and food insecurity problems. Farmers living in the coastal zone of northeastern Guinea-Bissau generally cultivate different types of rice fields: tidal or mangrove rice fields and freshwater bas-fonds rice fields.

Road access is limited in some of the tabancas in the Cacheu and Oio regions. Rising sea levels due to climate change are further challenging the traditional livelihoods of these local communities through lack of drinking water and less productive agricultural soils as a result of salinisation.

The exploitation of water resources in the coastal areas of northeastern Guinea-Bissau is essentially done through traditional wells. These do not cover the current needs of the population in terms of water supply, being distributed unevenly in time and space, with high level of vulnerability and weak adaptive capacities as climate change intensifies.

Rainwater resources are generally poorly utilized due mainly to the lack of infrastructure to retain these waters. The majority of rainwater drains directly into the sea and only a small part of it serves as a renewal of underground aquifers for the supply of drinking water. Groundwater resources are generally abundant, but rates of exploitation are low and degrees of pollution of various forms are considerable, such as from saline intrusion, facilitated by pressure in coastal areas.

Traditional holes are used in vegetable fields for irrigation, especially during the dry season. In recent years, technological advances have been introduced in horticultural fields by different projects. It is possible to find holes equipped with hand pumps and, in some cases, with electric pumps powered by solar energy.

Agricultural production takes place mainly during the rainy season (between May and September). Due to a lack of hydraulic infrastructures that allow better water management, the country does not take advantage of the irrigation potential that exists, which would allow it to have two harvests per year. Small irrigation techniques are not common (experiments in this field are rare).

In the tabancas, the pumping of water from traditional wells and the irrigation/watering of vegetables are done manually, which is a limitation to labour productivity, not to mention the tough nature of these tasks, practiced mainly by women.

1.3 Climate and Climate Change in Guinea-Bissau

The territory of Guinea-Bissau is limited by the parallels 10º and 13º North and by meridians 13º and 17º West. It is inserted in the domain of action of the Intertropical Front (ITF), characterized by the existence of a land mass north of the 5th parallel, as part of the West African bulge, and of an island part, in the Atlantic Ocean. Guinea-Bissau is crossed by the intertropical convergence zone and is therefore influenced by the monsoon (hot and humid air from the Atlantic Ocean) during the rainy season and the Harmattan (hot and dry air from the Sahara) during the dry season.

Following the apparent annual movement of the Sun, the ITF travels north and south, tracing the national territory twice in a period of about six months. In May, it is usually located in the north of the territory, giving start to the rainy season (June to October), and at the end of October or beginning of November passage to the south occurs, giving start the dry season (December to April). May and November are months of transition. The weather during the year is mainly conditioned by the situation of the territory in relation to ITF and by the subsidiary actions of semi-permanent high-pressure cells, known as the Azores High in the North Atlantic and the St. Helena High in the South Atlantic, and the low pressure installed over the Sahara during the summer referred to as the Saharan heat low.

Guinea Bissau has a monsoonal-type wet season from June through October followed by a dry season from November to May. Based on historical climate data from 1991 to 2020 from the World Bank Climate Change Knowledge Portal (CCKP)3, the total average annual precipitation in Cacheu is 1,488 millimeters (mm) with 97.5% of the precipitation occurring in the wet season. In Oio, the total average annual precipitation is slightly less at 1,451 with 97.9% occurring in the wet season. Annual temperatures for both regions are around 27°C throughout the year with highest average temperatures usually occurring from April through June and lowest average temperatures occurring in December and January (Figure 6).

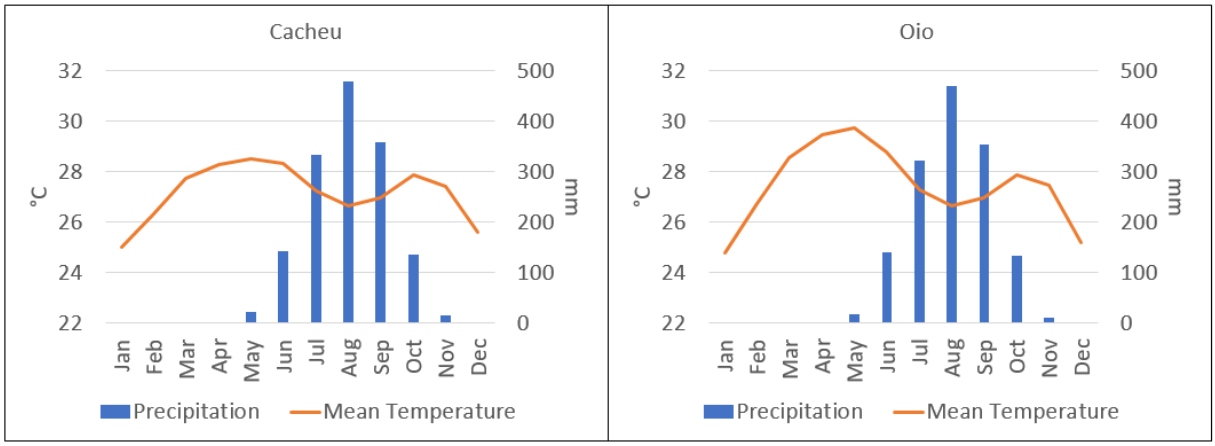


Figure 6. Average precipitation and temperature Cacheu and Oio regions of Guinea Bissau.

1.3.1 Historical climate trends

Historical precipitation data for each year from 1990 to 2018 for the two regions were downloaded from World Clim database4, a database of high spatial resolution global weather and climate data. Further, average historical precipitation for different time periods (1901-1930, 1961-1990, and 1991-2020) in the regions were downloaded from the World Bank CCKP.

1.3.1.1 Historical Precipitation Trends

Total annual precipitation trends between 1991 and 2020 as well as precipitation trends just in the rainy season were evaluated. These data show small positive, but not statistically significant5, trends in annual precipitation as

[3] https://climateknowledgeportal.worldbank.org/. The portal provides global data on historical and future climate, vulnerabilities, and impacts. The dataset is produced by the Climatic Research Unit (CRU) of the University of East Anglia (UEA) CRU- (Gridded Product).
[4] https://www.worldclim.org/. These data are downscaled from CRU-TS-4.03 by the Climatic Research Unit, University of East Anglia, using WorldClim 2.1 for bias correction.
[5] Based on the Significance F value of the regression analysis run using the Excel add-in Analysis Toolpak. An alpha value of 0.05 was applied to assess significance.

well as in precipitation during the rainy season (Figures 7 & 8). As the scatterplots show, there also do not appear to be increases in interannual variability in recent years.

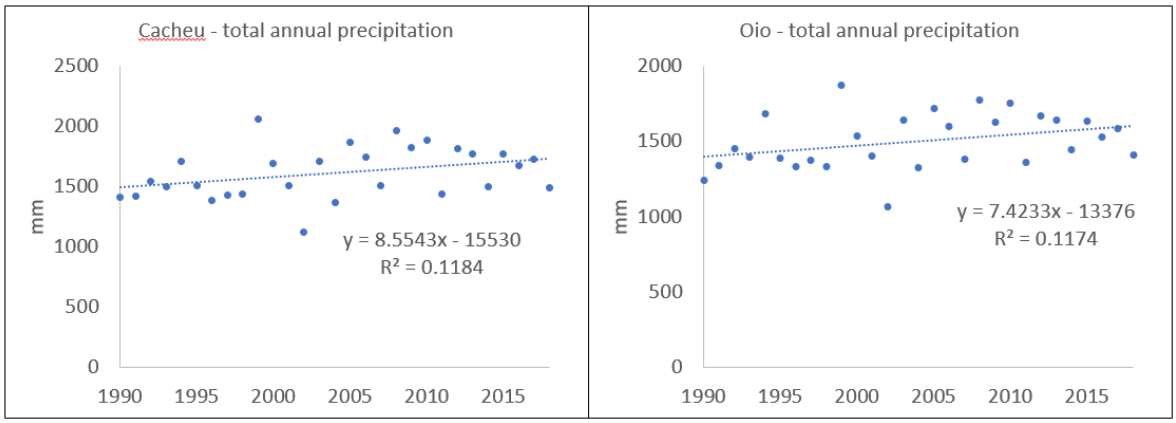


Figure 7. Total annual historical precipitation rates in Cacheu and Oio regions

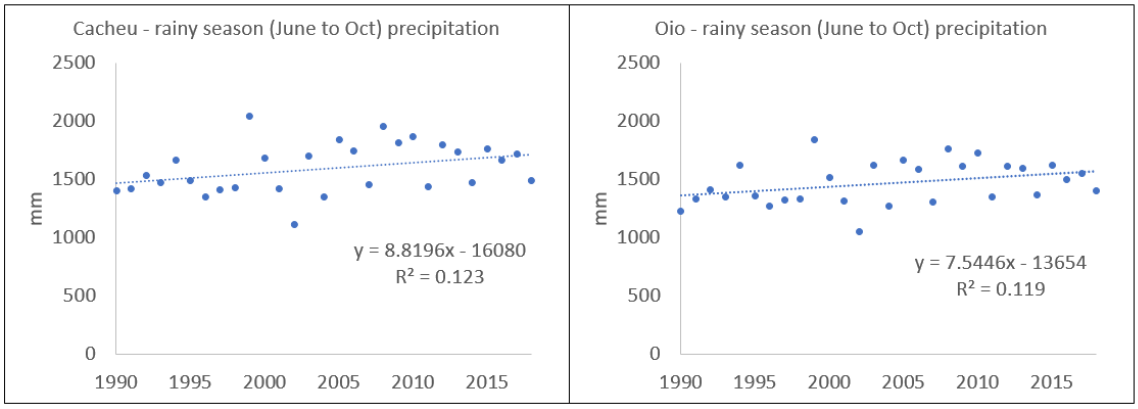


Figure 8. Rainy season historical precipitation rates in Cacheu and Oio regions

Historical trends were also evaluated on a monthly basis focusing on the months from May through November[6] (Figures 9 & 10). In May, both regions showed small positive but not statistically significant trends in precipitation rates. There appear to be more recent years with higher rates of rainfall in May indicating a trend towards an earlier end to the dry season. In June, July, and October, the trends in rainfall are basically flat (i.e., no notable increasing or decreasing rates of precipitation). In contrast, historical precipitation rates in August and September are positive[7]. In September, in addition to this overall positive trend, there has been a notable increase in interannual variability since 2010. An assessment of the standard deviation of precipitation rates in different time periods is evidence of this (**Error! Reference source not found.**). As the scatterplots for that month show, there are more recent years with either very high or low rainfall rates, indicating increased risks of flooding events or water scarcity events. Finally, in November, a negative trend in precipitation rates, although not statistically significant, can be observed. There are fewer recent years with notable amounts of rainfall indicating an earlier beginning to the dry season.

[6] The months from December through April have little to no rainfall and, therefore, were not evaluated.
[7] For Cacheu, this trend was found to be statistically significant for both months. For Oio, the trend was only found to be statistically significant in September.

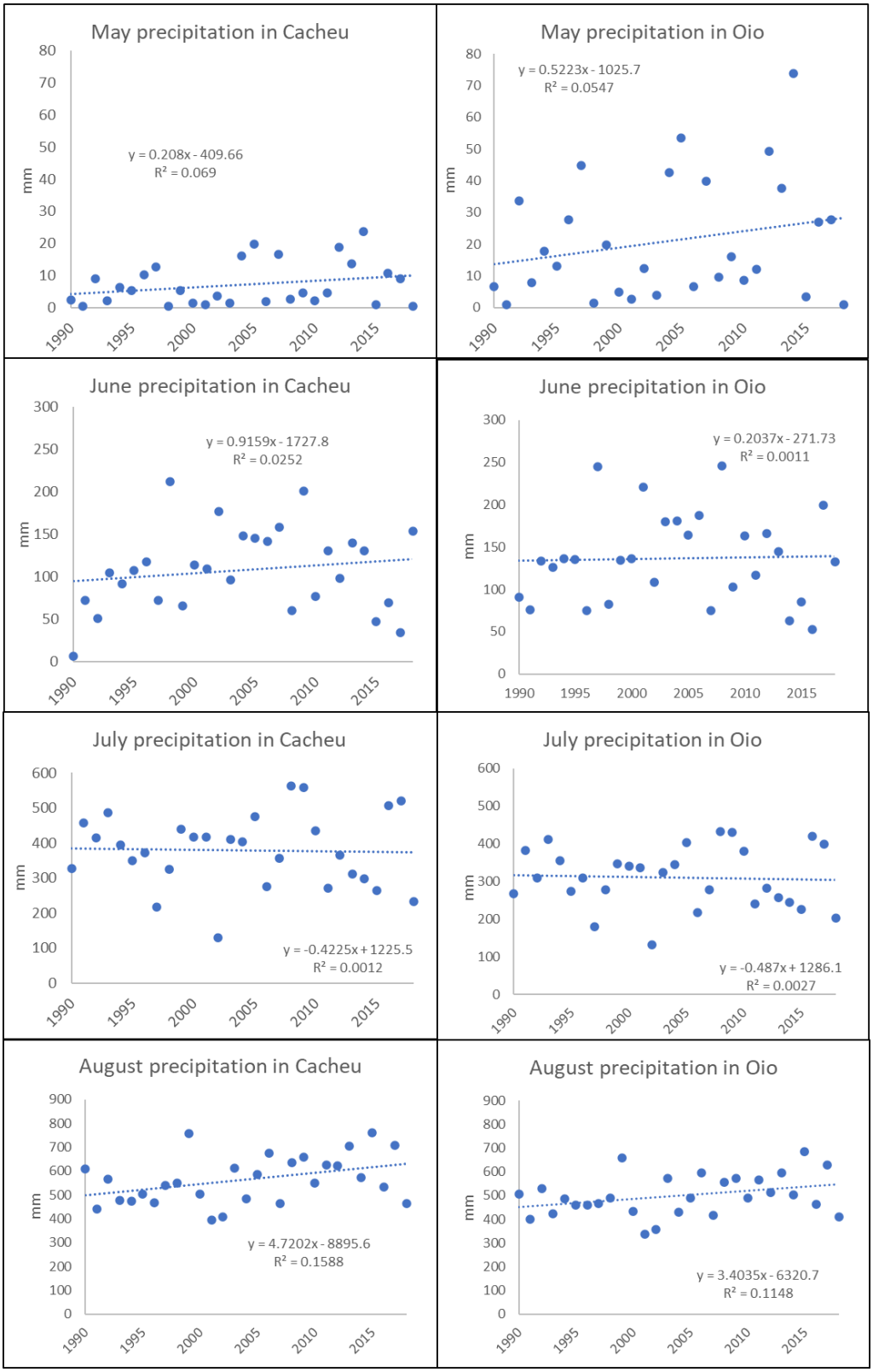


Figure 9. **Historical precipitation trends from May through August**

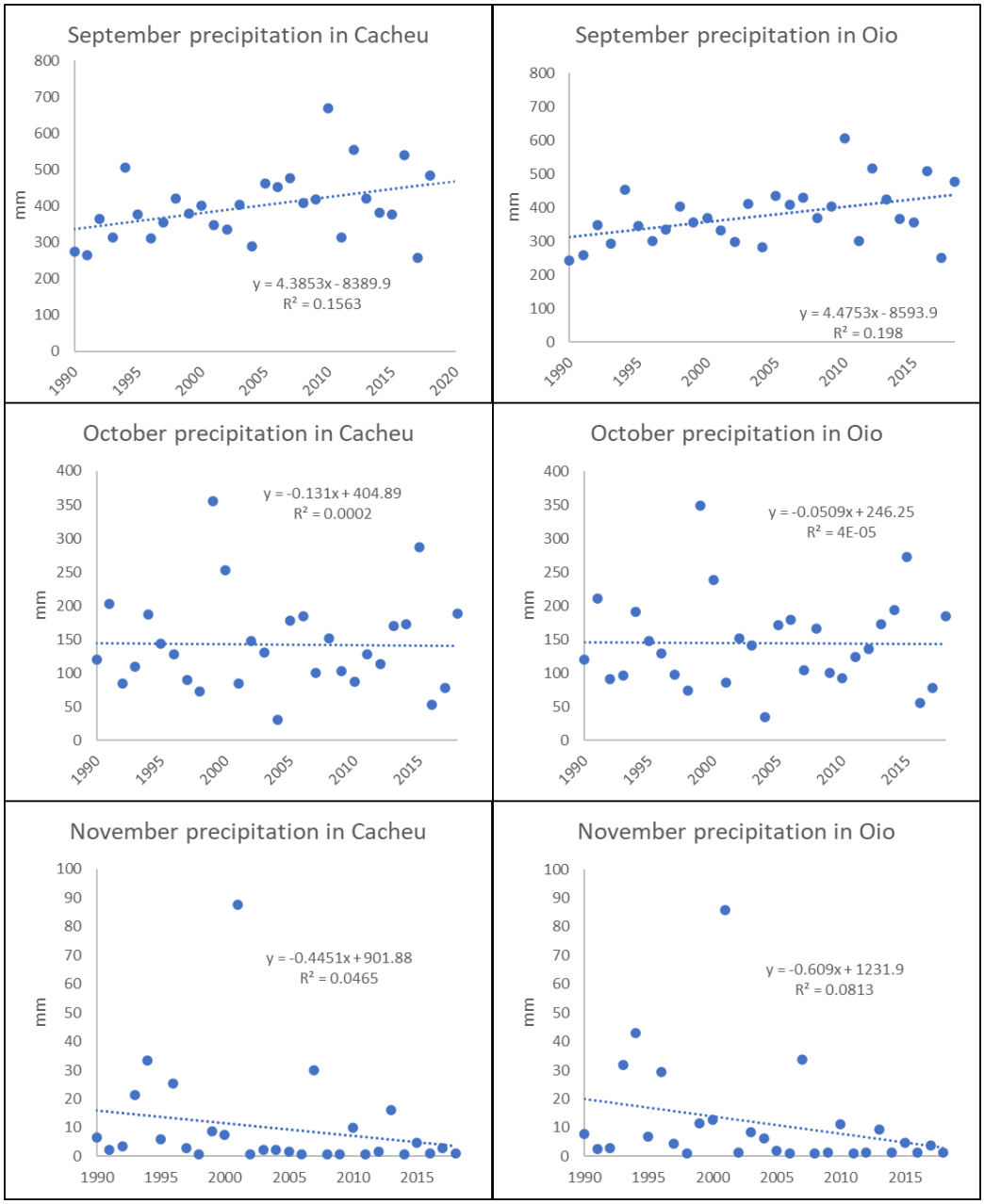


Figure 10. Historical precipitation trends from May through August

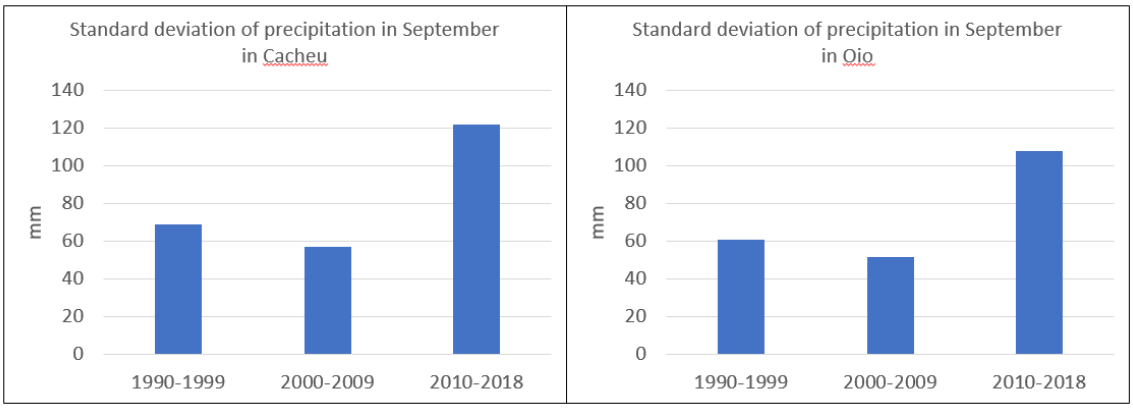


Figure 11. Standard deviation of September precipitation in different historical periods of 9-10 years

In addition to looking at the yearly trends from 1990 to 2018, average precipitation rates for the following time periods were compared: 1901-1930, 1961-1990, and 1991-2020[8]. In Cacheu, compared to precipitation rates in 1901-1930 (an average annual rate of 1692 mm), rates in 1960-1990 (1468 mm) and 1991-2020 (1488 mm) were substantially lower. Likewise, in Oio, rates in 1960-1990 (1417 mm) and in 1990-2020 (1451 mm) were substantially lower than the rates in 1901-1930 (1606 mm). Figures 12 and 13 show the different monthly precipitation rates during these time periods.

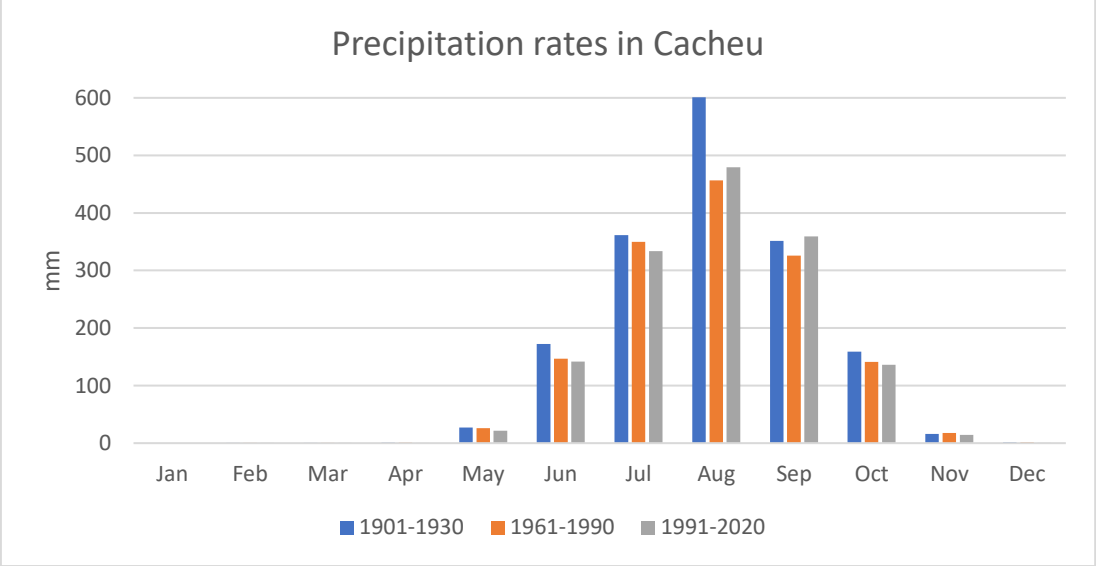


Figure 12. Average monthly precipitation rates for different historical time periods in Cacheu

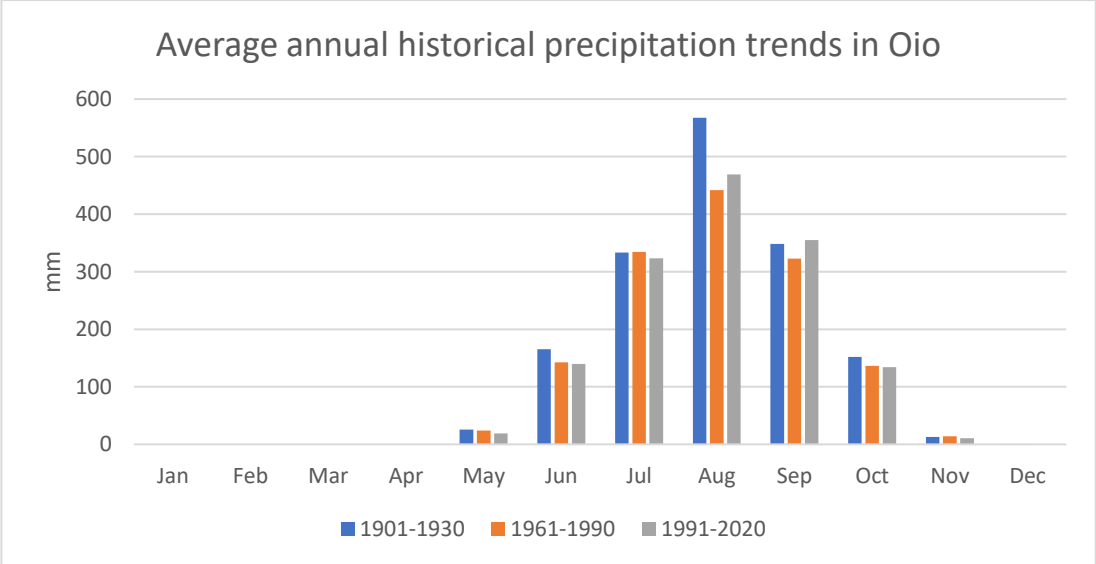


Figure 13. Average monthly precipitation rates for different historical time periods in Oio

1.3.1.2 Historical Temperature Trends

To assess historical temperature trends, both data from World Bank CCKP and World Clim database were applied. CCKP data included average annual temperature trends for the two regions for the period between 1901 and 2020. (Figure 14) shows a marked increasing trend in temperature as compared to historical average rates

[8] From the World Bank CCKP.

beginning around 1990 in both regions. Between 1901 and 1989, the average temperature was approximately 26.5°C and 26.8°C respectively in Cacheu and Oio. Between 1989 and 2020, the average temperature increased to 27.1°C and 27.5°C in the two respective regions. The differences in the averages of time periods were found to be statistically significant[9].

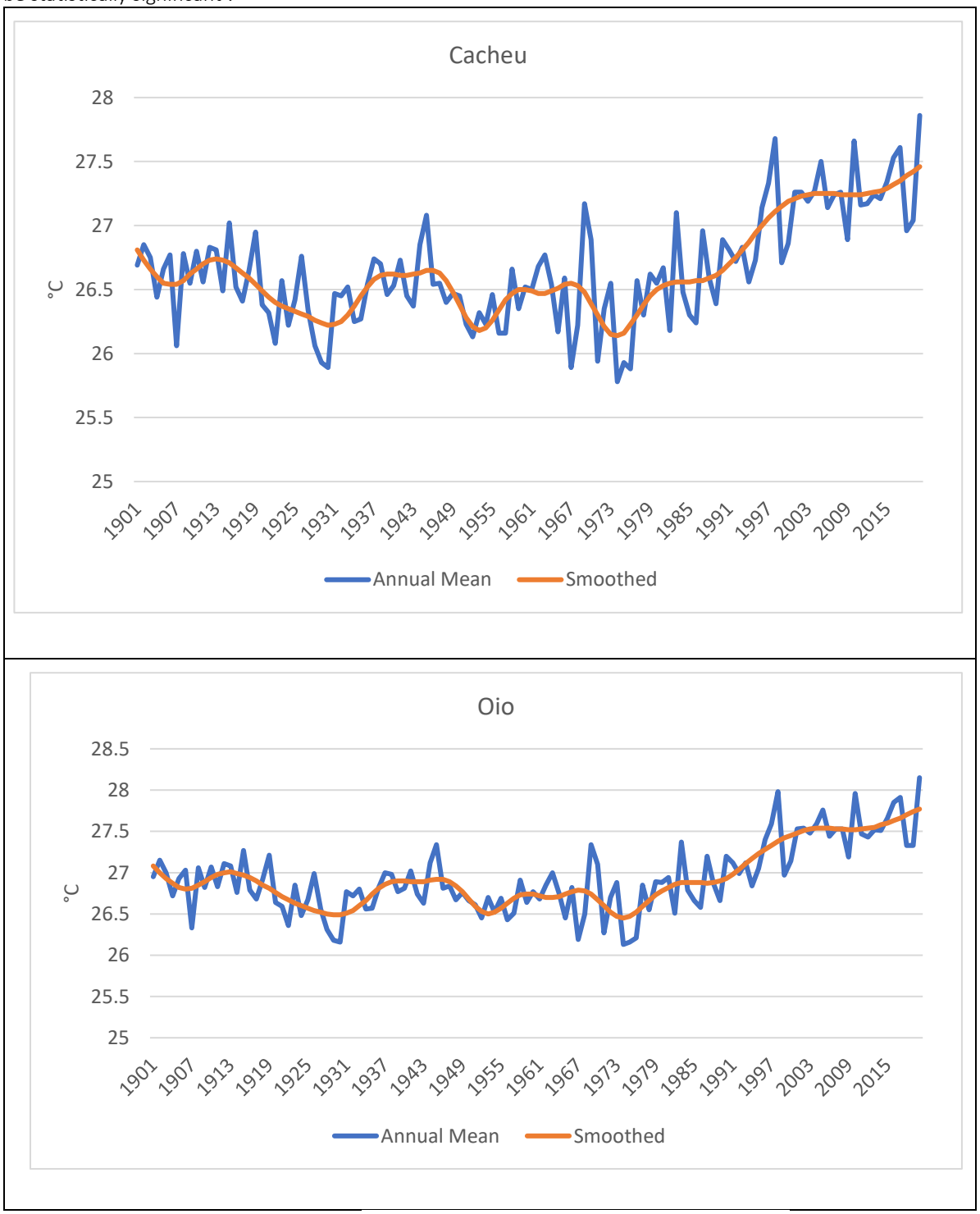


Figure 14. Average annual temperature from 1901 to 2015

In the time period from 1990 and 2015, there are also clear, statistically significant positive trends in temperature in both regions.

[9] In Excel's Data Toolpak, a T-Test: Two-Sample Assuming Unequal Variances was applied to assess statistical significance applying an alpha value of 0.05. For Cacheu, the p-value for the two-tailed T-test was 3.769E-14. For Oio, the p-value was 2.10493E-14.

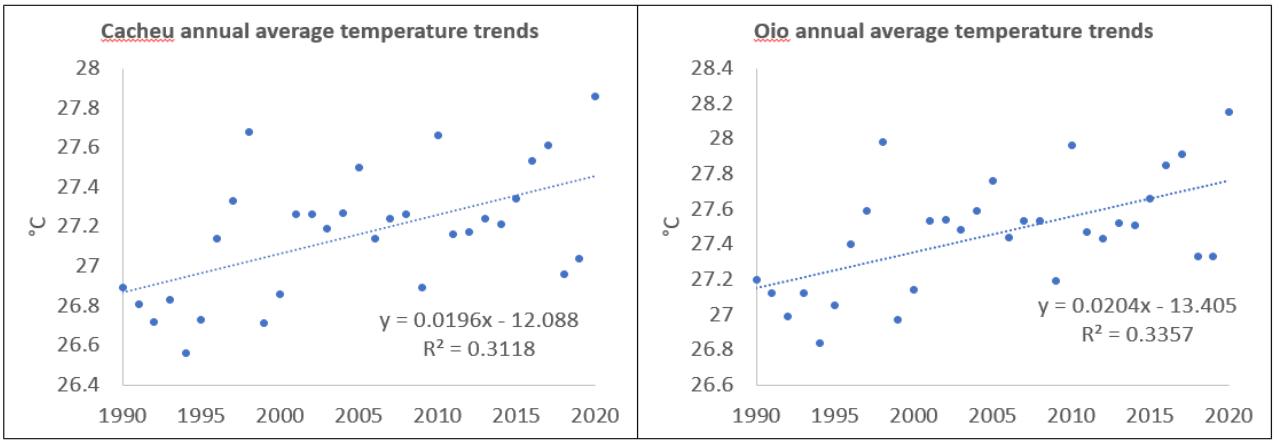


Figure 15. Average annual temperature from 1990 to 2020

In addition to these average annual temperature data, historical data from 1990 to 2020 on maximum and minimum monthly temperatures were obtained from World Clim. With the exception of February, there were positive trends in maximum temperature in each month during the time period, i.e., more recent years experience higher maximum temperatures than earlier years[10]. Annex A contains each month's maximum temperature scatterplot for each region. With regards to minimum monthly temperature, both regions also experienced positive trends (i.e., increasing minimum temperatures) in most months. Cacheu experienced increases to varying degrees11. in all months except February and December. Oio experienced increases also to varying degrees12 in all months except January and November. Annex B contains each month's minimum temperature scatterplot for each region.

1.3.2 Future Climate Projections

1.3.2.1 Methods

Future climate data was derived from World Clim using the downscaled CanESM5[13] projection for rainfall and temperature to 2040 and 2060. This model is part of the Coupled Model Intercomparison Project (CMIP) which is an aggregate of the from around 100 distinct climate. The downscaled data was extracted for the regions of Cacheu and Oio in Guinea Bissau and analyzed using ESRI's Arc Pro Software. The IPCC Sixth Assessment Report (AR6) Shared Socioeconomic Pathway (SSPs) used in this analysis were SSP3-7.0 and SSP2-4.5 (**Error! Reference source not found.**). The SSP3-7.0 scenario assumes strong increases in greenhouse gas (GHG) emissions in the 21st century (i.e., greater than the current trends), whereas SSP2-4.5 represents a scenario with climate change mitigation and assumes GHG emissions follow current trends (Arias et al 2021). These two scenarios were selected because they were deemed by the team to be the most likely to occur.

[10] In both regions, only the positive trends in April, June, July, September, October, and November were considered statistically significant when applying an alpha value of 0.05.
[11] The positive trends in Cacheu were only statistically significant in April, June, July, September, and October.
[12] The positive trends in Oio were only statistically significant in May, June, August, and September.
[13] The Canadian Earth System Model version 5

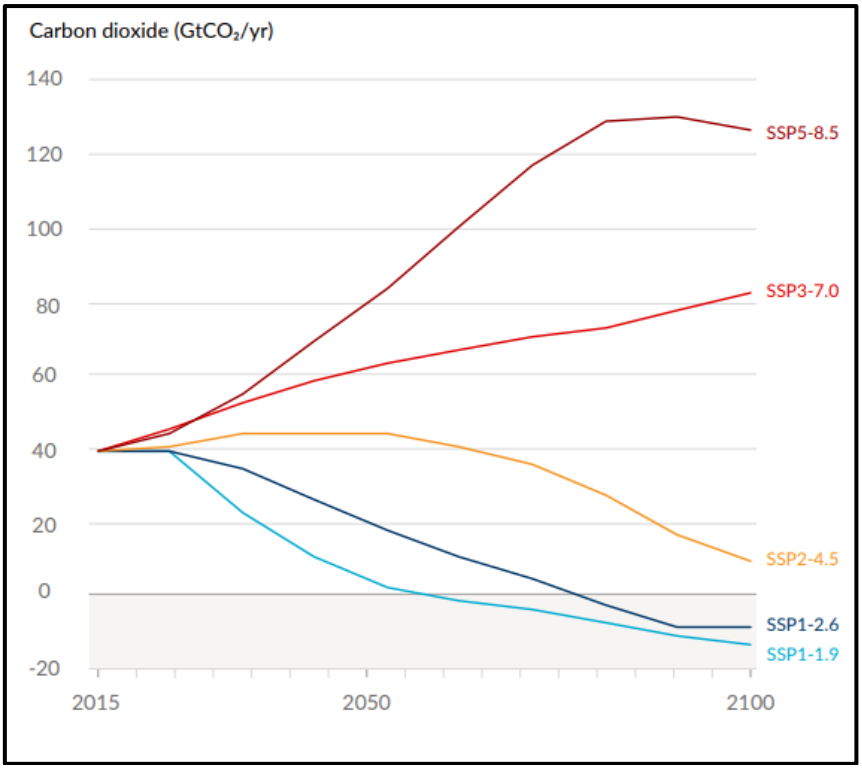


Figure 16. IPCC AR6 report future annual emissions of CO_2 across five illustrative SSP scenarios

Sea level rise was also derived from datasets produced by NASA for the IPCC AR6 working group. This data is available on the web at https://sealevel.nasa.gov/ipcc-ar6-sea-level-projection-tool.

1.3.2.2 Future Projected Precipitation

The projections indicate that average annual rainfall in Cacheu is expected to increase by approximately 19-21% (or an additional 290 to 310 mm) by 2040 and approximately 22-25% (or an additional 320 to 380 mm) by 2060 as compared to the average historical precipitation rate for the time period from 1991-2020. In Oio, the average annual rainfall is expected to increase by approximately 20%-22% (or an additional 295-325 mm) by 2040 and approximately 22-26% (or an additional 325 to 380 mm) by 2060.

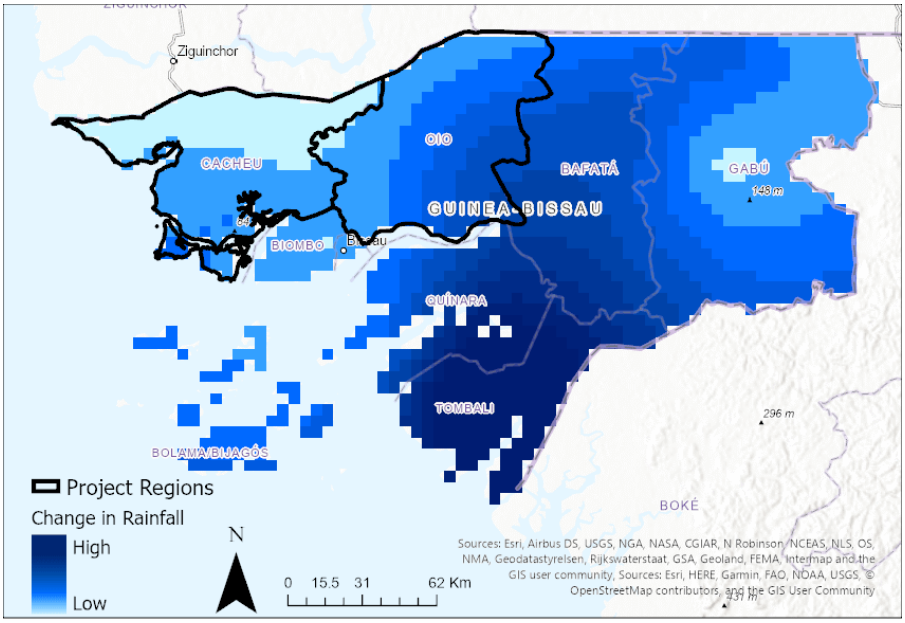


Figure 17. Projected downscaled rainfall from CanESM5.

Figure 18 shows the breakdown of these projected increases in the months of May through November[14]. The expected increases in precipitation are the most substantial in the months of August and September in both regions with smaller increases expected the months of July and October. In Cacheu, projected precipitation is expected to fall in May[15], June, and November in both scenarios. In Oio, projected precipitation is only expected to fall in 2060 in the month of June in the SSP 370 scenario.

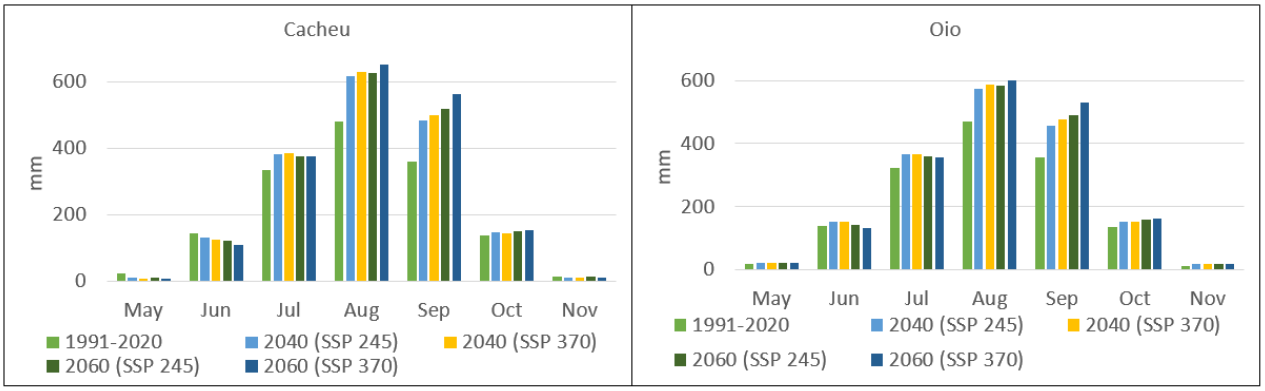


Figure 18. Projected changes in monthly precipitation rates under different SSPs in 2040 and 2060

Table 2. Projected shifts in monthly precipitation (mm) as compared to rates from 1991-2020 in Cacheu

	2040		2060	
	SSP 245	SSP 370	SSP 245	SSP 370
May	-12	-15	-12	-15
Jun	-12	-18	-20	-34
Jul	47	51	40	40
Aug	136	149	145	172
Sep	124	141	158	202

[14] The months from December through April have little to no rainfall, and this is not projected to change. As such, they are not included.
[15] Note that this projection varies from the historical trend which showed more recent years with increased rainfall.

	2040		2060	
	SSP 245	SSP 370	SSP 245	SSP 370
Oct	10	7	14	18
Nov	-4	-4	-3	-4

Table 3. Projected shifts in monthly precipitation (mm) as compared to rates from 1991-2020 in Oio

	2040		2060	
	SSP 245	SSP 370	SSP 245	SSP 370
May	4	3	3	3
Jun	11	11	1	-7
Jul	42	42	38	32
Aug	107	119	116	133
Sep	103	121	135	176
Oct	19	18	24	29
Nov	7	7	7	8

1.3.2.3 Future Projected Temperature

Projections for temperature were available for minimum and maximum temperature values.

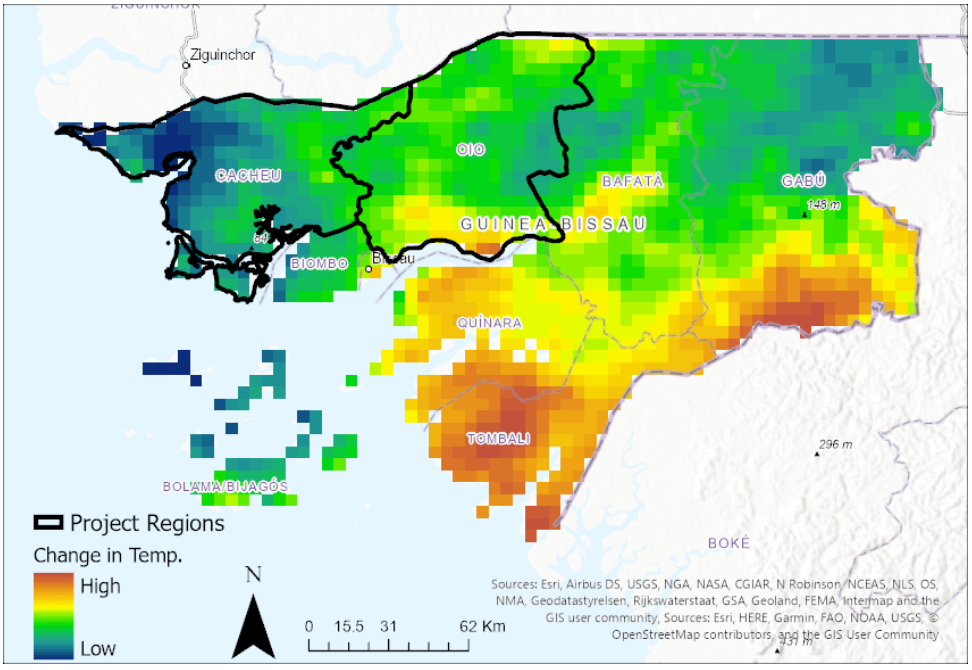


Figure 19. Projected downscaled temperature from CanESM5.

As Figure 18, **Error! Reference source not found.**, and **Error! Reference source not found.** show, with few exceptions, the maximum monthly temperatures are projected to increase as compared to the average historic maximum temperature for the years 1990 to 2018. The exception to this is the month of November in 2040 which is expected to experience a decrease. The months with the highest projected percent increase are January through April.

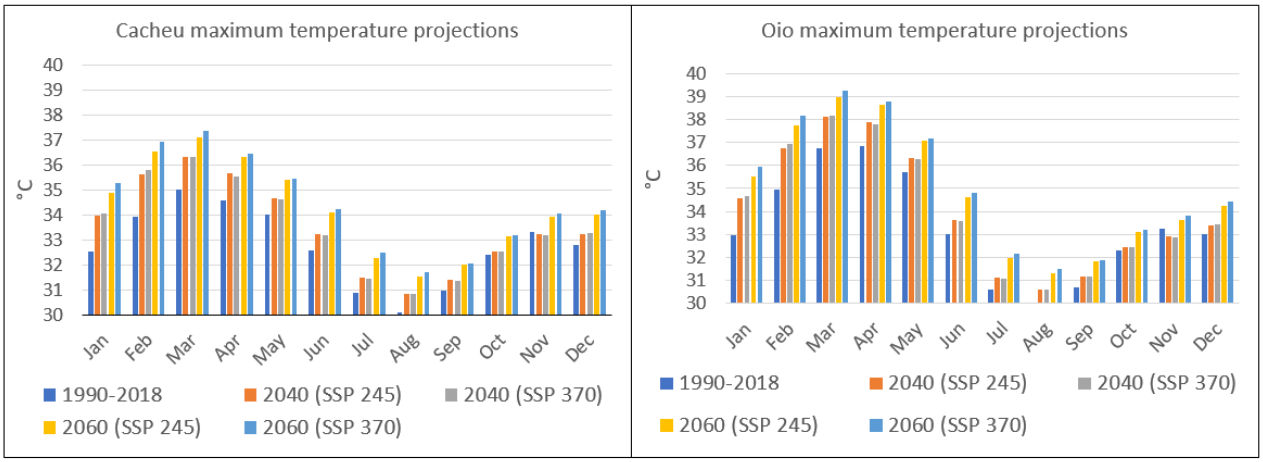


Figure 20. Projected increases in maximum monthly temperatures in Cacheu and Oio

Table 4. Projected percent change in maximum temperature in Cacheu as compared to historic maximum temperatures from 1990-2018

	Percent increase in 2040		Percent increase in 2060	
	SSP 245	SSP 370	SSP 245	SSP 370
Jan	4.4%	4.7%	7.2%	8.4%
Feb	5.1%	5.5%	7.8%	8.9%
Mar	3.7%	3.7%	5.9%	6.7%
Apr	3.1%	2.8%	5.0%	5.3%
May	2.0%	1.8%	4.1%	4.2%
Jun	2.1%	1.9%	4.7%	5.1%
Jul	2.0%	1.9%	4.6%	5.2%
Aug	2.4%	2.4%	4.7%	5.3%
Sep	1.4%	1.3%	3.4%	3.6%
Oct	0.3%	0.4%	2.3%	2.4%
Nov	-0.3%	-0.3%	1.8%	2.2%
Dec	1.3%	1.5%	3.7%	4.3%

Table 5. Projected percent change in maximum temperature in Oio as compared to historic maximum temperatures from 1990-2018

	Percent increase in 2040		Percent increase in 2060	
	SSP 245	SSP 370	SSP 245	SSP 370
Jan	4.8%	5.2%	7.7%	9.0%
Feb	5.2%	5.7%	8.0%	9.2%
Mar	3.7%	3.7%	6.0%	6.8%

	Percent increase in 2040		Percent increase in 2060	
	SSP 245	SSP 370	SSP 245	SSP 370
Apr	2.9%	2.7%	4.9%	5.3%
May	1.7%	1.5%	3.8%	4.1%
Jun	1.8%	1.7%	4.8%	5.4%
Jul	1.7%	1.6%	4.6%	5.2%
Aug	2.3%	2.2%	4.7%	5.2%
Sep	1.6%	1.4%	3.7%	3.7%
Oct	0.4%	0.5%	2.5%	2.8%
Nov	-1.1%	-1.2%	1.0%	1.6%
Dec	1.1%	1.3%	3.7%	4.2%

Minimum temperature projections show a similar but sharper increase compared to the maximum temperature projections as shown in Figure 21**Projected increases in minimum monthly temperatures in Cacheu and Oio**,

, and **Error! Reference source not found.**. All months, with the exception of February and March in Oio in 2040, show an increase in projected minimum temperatures. In Cacheu, these increases are the greatest in December through April. In Oio, these increases are greatest in October through December.

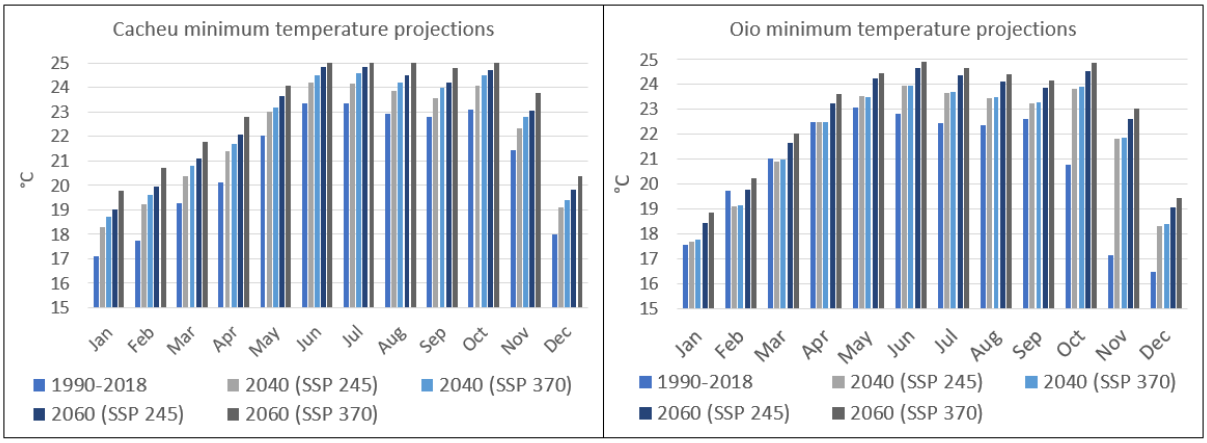


Figure 21. **Projected increases in minimum monthly temperatures in Cacheu and Oio**

Table 6. Projected percent change in minimum temperature in Cacheu as compared to historic minimum temperatures from 1990-2018

	Percent increase in 2040		Percent increase in 2060	
	SSP 245	SSP 370	SSP 245	SSP 370
Jan	6.9%	9.3%	11.3%	15.7%
Feb	8.4%	10.5%	12.5%	16.7%
Mar	5.8%	7.9%	9.6%	13.1%
Apr	6.4%	7.8%	9.7%	13.3%

	Percent increase in 2040		Percent increase in 2060	
	SSP 245	SSP 370	SSP 245	SSP 370
May	4.3%	5.2%	7.3%	9.3%
Jun	3.6%	4.9%	6.5%	8.8%
Jul	3.5%	5.4%	6.5%	9.2%
Aug	4.0%	5.6%	6.9%	9.5%
Sep	3.3%	5.2%	6.0%	8.7%
Oct	4.3%	6.1%	7.1%	10.0%
Nov	4.3%	6.4%	7.6%	11.1%
Dec	6.2%	7.9%	10.2%	13.5%

Table 7. Projected percent change in minimum temperature in Oio as compared to historic minimum temperatures from 1990-2018

	Percent increase in 2040		Percent increase in 2060	
	SSP 245	SSP 370	SSP 245	SSP 370
Jan	0.8%	1.2%	5.0%	7.4%
Feb	-3.2%	-2.8%	0.2%	2.6%
Mar	-0.6%	-0.3%	2.9%	4.7%
Apr	0.1%	0.1%	3.4%	5.1%
May	1.9%	1.8%	4.9%	5.9%
Jun	5.0%	5.0%	8.1%	9.2%
Jul	5.3%	5.5%	8.5%	9.8%
Aug	4.8%	5.0%	7.8%	9.1%
Sep	2.8%	3.1%	5.7%	6.8%
Oct	14.7%	15.1%	18.1%	19.7%
Nov	27.4%	27.7%	31.9%	34.5%
Dec	11.3%	11.7%	15.9%	18.1%

1.3.2.4 Future Projected Sea Level Rise

Around 11-15% of Guinea Bissau is low coastal plains, swamps or mangroves and therefore sea level rise is one of the primary climate change concerns. The most recent IPCC AR6 report produces a spatially explicit estimate of sea level rise. It shows an average expected rise of 10 to 15 cm by 2030, 22-32 cm by 2050, and 50-60 cm by the end of the century with a potential range of 30-120 cm (Figure 22) relative to the period 1995–2014.

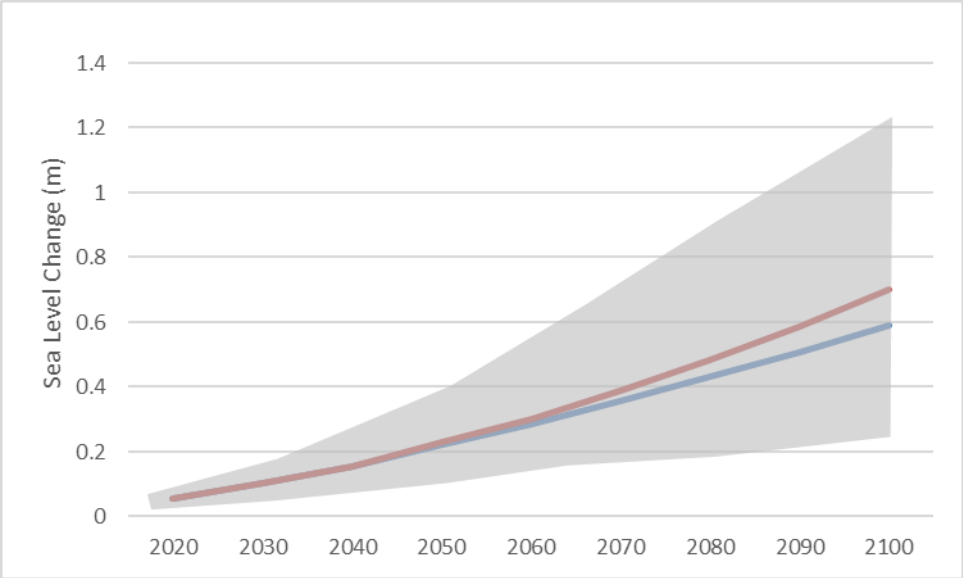


Figure 22. Sea level rise prediction for the coastal areas of Guinea Bissau from IPCC AR6 results https://sealevel.nasa.gov/ipcc-ar6-sea-level-projection-tool

1.3.3 Climate Change Impacts

Guinea-Bissau is a country with a vast coastal zone containing fragile ecological specificities. Combined with structural scenarios of economic vulnerability, in particular energy and food dependence, this poses very serious challenges for the country. With a group of islands (Bijagós archipelago), Guinea-Bissau is also part of the Small Island Developing States (SIDS).

The coastal zone, low in depth, is exposed to rising tides as average levels increase, caused by the phenomenon of thermal expansion in the oceans. This puts the country in danger of flooding and coastal erosion and can lead to the disappearance of beautiful sandy beaches, vegetation, road and tourist infrastructure, schools, residences, and entire villages. Important reserves of active biodiversity, on which the local economy is based, is also threatened by rising sea levels.

Table 8. Climate sensitivity matrix showing severity level of climatic impacts, on a scale from 1 to 5 (1 = very weak; 2 = weak; 3 = medium; 4 = strong; 5 = very strong) (NAPA 2006).

	CLIMATE RISKS						Presentation of Indicators (in %)
	Seasonal Drought	Heavy Rain	Rising Ocean Temperature	Increase in Atmospheric Temperature	Cyclones (strong winds)	Sea Level Rise	
Subsistence means	Scale from (1 to 5)						
Soil fertility	1	4	1	3	1	3	48
Water resources	3	5	3	4	1	4	60
Biodiversity	2	2	3	3	3	5	66
Cultivated land at risk	2	4	1	3	3	4	63
Sectors							
Agriculture	2	4	1	3	3	2	57
Livestock	3	3	1	4	2	1	54
Fishing	2	1	4	2	1	4	51
Cheers	1	3	1	5	3	4	54

Typical aspects of island ecosystems, such as fish stocks, corals and the high degree of endemism of terrestrial species, are also directly threatened by climate change, extreme climatic situations and unplanned economic growth. These phenomena can have negative consequences for different economic sectors, including tourism, fishing and agriculture; directly or indirectly, it can also have negative impacts on food security.

Agriculture, the base of Guinea-Bissau's economy, is predominantly traditional and dependent on rain. As rainfall becomes more and more irregular in space and time, a phenomenon accompanied by an increase in temperature, agricultural productivity decreases. This is due to the degradation of soils exacerbated by the intensification of evapotranspiration.

Water resources are very vulnerable, as the irregularity of the rains and the high temperatures cause a decrease in the flow of rivers, a significant fall in the water table and the advance of saltwater. As an example of this phenomenon, we have the current situation of the river Geba and the adjacent aquifer sectors with which this river maintains hydraulic communication.

Regarding the evolution of parameters related to rain, temperature, relative humidity, sea level and the amount of water resources, the following phenomena have been observed in recent years:

(i) Late onset of the rainy season (mid-June), compared to normal (early May);
(ii) Less regular distribution of precipitation;
(iii) Shortening of the period of regular temperatures, called "cold weather", from three months (December to February), to just two months (December to January);
(iv) Warmer and drier environment;
(v) Frequent waves of dust clouds;
(vi) More frequent appearance of high tides, of greater amplitude, destroying dykes and rice paddies;
(vii) Reduction of water quality, by invasion of saltwater and infestation of the water point by aquatic plants;
(viii) Decrease in wetlands, due to droughts.

Currently, rains are always accompanied by strong winds, especially in the months of August and September. The loss of production per grain bed during this time is great. In the plains and small valleys, the damage caused by floods can be significant, as well as in rice paddies implanted in hydromorphic soils colonized by mangroves.

With the rise in the average sea level, recently the invasion of the high tides in the rice fields occurred, resulting in the destruction of the dykes, in the loss of the production capacity of the lands for the rice cultivation. In the south, centre and islands, with productions that require more water (rice), negative phenomena related to the concentration of precipitation and its bad temporal distribution are also observed (3rd National Communication on Climate Change).

According to the country’s Third National Communication on Climate Change, the insufficiency and poor distribution of rainfall has facilitated an increase in levels of salinity and acidity of soils in mangroves as well as in some small valleys, making the cultivation of rice unviable. As a result, the number of deteriorated, and subsequently abandoned, mangrove rice fields have increased. An example is the case of the five villages of Cubucaré, in the south of the country, which were prevented from cultivating 3,015 ha of bolanhas (rice fields) due to the destruction of their dykes and loss of their cultivated rice fields, attributed to saltwater intrusion. In search of new land, more and more rice producers are cutting down and burning forests to establish new rice fields.

The rains, concentrated in a very short period of the year, cause agricultural activities to be carried out only once a year. This reduces the availability of agricultural residues and by-products necessary for feeding cattle. The decrease in natural pastures, as a consequence of the decrease in precipitation, will lead to an increase in the use of pastures, which, in turn, will contribute to the destruction of herbaceous vegetation and promote bush development. Periods of prolonged drought, accompanied by an increase in temperature, modification or deterioration of vegetation cover, give rise to changes in the composition of most forest species. The extinction of certain plant species and animal migrations are also a growing concern (NAPA 2006).

Other effects of climate change on water resources include reduced vegetation cover, desertification, increased evaporation, erosion and soil loss. The decrease in water availability, associated with temperature changes, will also threaten Guinea-Bissau's terrestrial biodiversity and its specificities.

In relation to public health, the spread of climate-sensitive diseases is visible. The increase in temperature and humidity will lead to an increase in malaria transmission areas. The occurrence of floods promotes the spread of water-borne diseases, such as cholera and other diarrheal diseases. Droughts increase the risk of meningitis,

which will lead to infections and epidemics. Warming worsens air pollution and, consequently, increases the risk of contracting acute respiratory diseases (Third National Communication on Climate Change). Food security is also strongly affected by climate change and the environmental challenges facing Guinea-Bissau. The impact of natural disasters is most severe on the poorest and most vulnerable segments of the population, especially those whose livelihoods depend on agriculture. The latter are, in fact, increasingly confronted with recurrent climatic risks that lead to production deficits, loss of livestock and reduced availability of fish and forests.

About 80% of Guinea-Bissau's active population, more than half of whom are women, work in the agricultural sector and are therefore dependent on climate risks and environmental factors. This is reinforced by the fact that the majority of agricultural production is dedicated to subsistence and almost exclusively based on rainfed agriculture and extensive livestock systems.

The rainfall regime, vegetation and soil quality continue to be determining environmental factors to ensure food security in Guinea-Bissau. Food crops, mainly focused on cereal production in Guinea-Bissau, depend mainly on the characteristics of the rainy season. Climate change, favourable or not, can change the quantity and quality of pastures. This will lead to new forms of transhumance with an increased risk of weakening livestock, transmission of animal diseases and conflicts over land between farmers.

Extreme weather events further weaken vulnerable families by destroying their livelihoods, reducing their purchasing power and reducing their resilience capacity already diminished by structural factors such as poverty, limited access to basic services and instability in food prices. The capacity of local people and the government to deal with natural disasters remains very weak and extreme weather events, which are increasing in frequency and impact in the context of global climate change, represent direct threats to the food and nutritional security of the Bissau-Guinean populations.

Like other countries concerned with the evolution of climate change trends, their negative impacts, global environmental protection, and with the intention to leave future generations with a habitable planet, Guinea-Bissau ratified the United Nations Framework Convention on Climate Change on October 27, 1995. The ratification of this convention, the efforts made to comply with its provisions, as well as the strategic actions described in the country’s Second National Communication, demonstrate Guinea-Bissau's willingness to contribute effectively to the effort to combat global warming of the planet.

Although considered a poor country, with a weak economy, the Government of Guinea-Bissau continually takes on the responsibility to elaborate public policies for climate change adaptation and mitigation and their implementation with development partners. Aware of the fragility of its ecosystems and aware that its economy is heavily dependent on sectors sensitive to climate variability, Guinea-Bissau will intensify its efforts to overcome the challenges it faces to contribute to the fight against global warming. In this process, in addition to its own will and commitment, financial and technical support from development partners is necessary for the country to adapt to this global commitment. This sum of efforts is the great challenge for international cooperation.

The National Action Program for Adaptation to Climate Change (NAPA 2006) and National Communications strategic documents were prepared with this imperative in mind. Concerning the projects, there are two private initiatives. One supported by the Coastal Planning Office in the tabancas of Mansoa (Cussana and Cussentchi) and another supported by the project of resilience/promotion of Intelligent Agriculture in Bafatá (Ganadu and Contubel) and Gabu, (Pitche and Pirada). These initiatives are linked to the country's short and medium-term development objectives that aimt to contribute to the achievement of adaptation objectives and their effectiveness.

The problems of prevention and management of food crises are not managed by a single institution, but by different services, many of which suffer from operational problems and lack the technical capacity to carry out their duties. Difficulties in preventing and managing food crises and other natural disasters are linked to: i) insufficient food supply, ii) weak rules and regulation, iii) disorganized taxation of markets, including in the informal sector, and iv) low operational capacity of the technical services, in particular the Food Security Planning Office (GPSA), the Agricultural Statistics Division, the Plant Protection Service, the Meteorological Service Directorate, the Livestock Directorate-General and the Civil Protection Service.

State institutions, as well as community and civil society organizations, do not have sufficient capacity to effectively manage food crises and other disasters in Guinea-Bissau. Therefore, for the execution and fulfilment of the proposed objectives, involvement of the population, different actors and development partners inherent in the matter of adaptation to climate change in the country is integral.

1.4 Freshwater Resources

1.4.1 Soils

The terrain of Guinea-Bissau is mostly low coastal plain with mangrove swamps, rising to low savannah in the east. Arable land is around 8% of total land cover. As described below and illustrated in , Guinea-Bissau soils consist mainly of six main FAO Classifications (www.fao.org/soils-portal/data-hub/soil-classification/en) described as follows:

- Acrisols (AC) – Acrisols have clay-rich subsoils and are associated with humid, tropical climates. Acrisols have high amounts of aluminum, limiting their agricultural use. They are suitable for silviculture, low intensity pasture and protected areas. Acrisols form on old landscapes that have an undulating topography. The age, mineralogy, and extensive leaching of these soils have led to low levels of plant nutrients, excess aluminum, and high erodibility, all of which make agriculture problematic. Nevertheless, traditional shifting cultivation of acid-tolerant crops has adapted well to the conditions found in Acrisols
- Ferrasols (FR) – Ferralsols are red and yellow weathered soils whose colors result from an accumulation of metal oxides, particularly iron and aluminum (from which the name of the soil group is derived). They are formed on geologically old parent materials in humid tropical climates, with rainforest vegetation growing in the natural state. Because of the residual metal oxides and the leaching of mineral nutrients, they have low fertility and require additions of lime and fertilizer if they are to be used for agriculture.
- Fluvisols (FL) – Fluvisols are found typically on level topography that is flooded periodically by surface waters or rising groundwater, as in river floodplains and deltas and in coastal lowlands. They are cultivated for dryland crops or rice and are used for grazing in the dry season. Fluvisols are technically defined by weakly-developed soils.
- Leptosols (LP) – Leptosols are soils with a very shallow profile depth (indicating little influence of soil-forming processes), and they often contain large amounts of gravel. These soils are unattractive soils for rainfed agriculture because of their inability to hold water but may sometimes have potential for tree crops or extensive grazing.
- Lixisols (LX) – Lixisols are strongly weathered soils in which clay has washed out down to an argic B horizon which has a moderate to high base saturation.
- Plinthosols (PL) - Plinthosols form under a variety of climatic and topographic conditions. They are defined by a subsurface layer containing an iron-rich mixture of clay minerals (chiefly kaolinite) and silica that hardens on exposure into ironstone concretions known as plinthite. The impenetrability of the hardened plinthite layer, as well as the fluctuating water table that produces it, restrict the use of these soils to grazing or forestry.

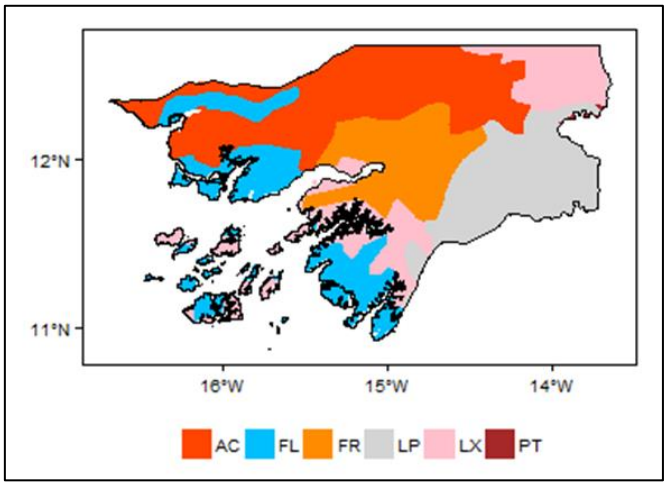


Figure 23. Soil Types of Guinea-Bissau

1.4.2 Geology

Figure 24 is a generalized geologic map of Guinea-Bissau. Structurally, Guinea-Bissau lies between the Fouta Djallon massif and the Mesozoic-Cenozoic Mauritania-Senegal-Guinea-Bissau Basin ('MSGBC') basin (Upton et al, 2018). It can be roughly divided into two geological units:

- An eastern zone with predominantly sedimentary Paleozoic rocks, and some Precambrian rocks; and
- A western zone with mainly Cenozoic sediments of Cretaceous to Tertiary age, mainly of marine origin.

There is Quaternary alluvium infill in many valleys, and marine/coastal Quaternary unconsolidated sediments on coastal plains.

MSGBC essentially is a Mesozoic rift basin, which developed as the Atlantic Ocean opened in the Late Triassic to Early Jurassic periods, forming a series of grabens, half-grabens and horst blocks along the coastal areas. Thick Jurassic salt was deposited in the grabens and half-grabens. Thick sequences of Cretaceous marine and deltaic sediments were deposited above the salt, loading the sediment and initiating diapiric movement (Penn, 2012).

A buried sequence of Mesozoic sedimentary rocks is considered to rest on the Paleozoic sequence, the equivalent of the 'intercalated continental' series known in Senegal. These do not crop out at the surface in Guinea-Bissau, and so are not shown on the geology map. Little is known of these rocks in Guinea-Bissau, as they are buried at depths of over 800 m (UN, 1988). They are thought to include schists with some sandstone and limestone intercalations in the northeast, and a dominantly continental series of schists with intercalations of fine sandstone in the center of the country. This series is 120 m thick at Safim and 330 m thick at S. Domingos (UN, 1988). **Error! Reference source not found.** presents descriptions of the various rock formations.

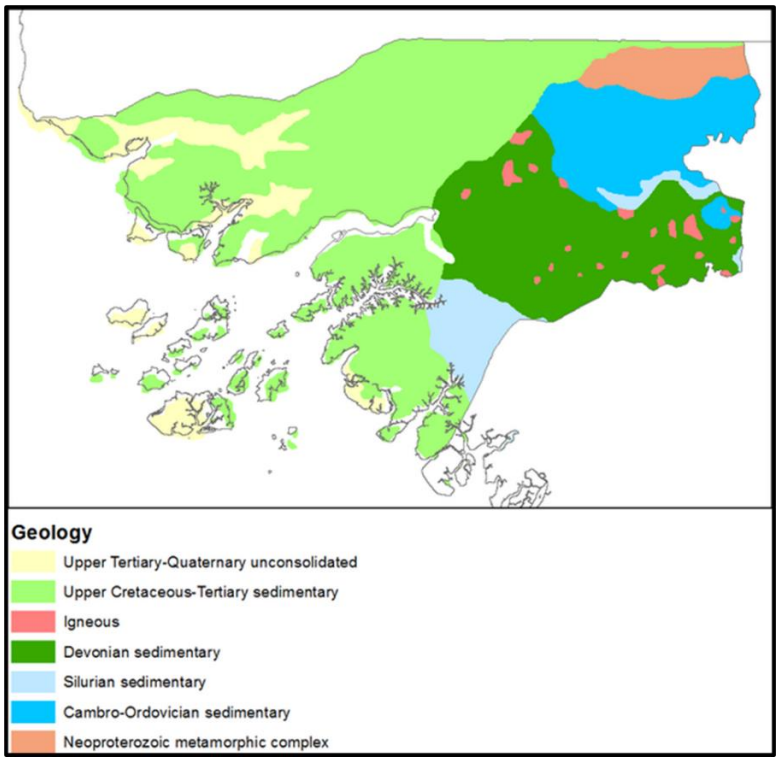


Figure 24. Generalized Geologic Map of Guinea-Bissau (Upton et al, 2019)

Table 9. Generalized Lithology of Rock Units in Guinea-Bissau (Upton et al, 2018)

Period	Lithology
Quaternary	Coastal sediments, including beach sands; river and coastal alluvium. Including sands, silts, and clays. These often overlie similar lagoonal/coastal

	Oligocene-Miocene sediments
Tertiary (Paleocene-Eocene, Oligocene, Miocene); Cretaceous (Maastrichtian)	A sequence of largely marine, coastal or lagoonal sedimentary rocks, including limestones, marls, clays, silts, sands and phosphates. Most are of Tertiary age. A strip of Cretaceous rocks of Maastrichtian age lies along the eastern boundary of this western zone. The Paleocene-Eocene sequence is dominantly marine, formed of sandy marl-limestone formations with dolomitic intercalations (UN 1988). The Oligocene-Miocene 'continental terminal' series comprises Oligocene lagoonal fine grained, clayey sandstones at the base, overlain by Miocene marine limestone-marls that are sometimes sandy (UN 1988). The Cretaceous series is very thick (1360 m at S. Domingos and 600 m at Safim). The base of the sequence consists of schists with some limestone-dolomitic intercalations, overlain by dark shales with some sand, and terminating at the top in a thick sandstone layer of Maastrichtian (top Cretaceous) age (UN 1988). This top sandstone is up to 490 m thick in the northwest (S. Domingos) and 540 m in the west (Cangongue) (UN 1988)
Devonian	Shales and sandstones over a large area in the east of the country, forming a northwest/southeast syncline. At the base of the series are Lower Devonian sandstones, seen in the Cusselinta-Saltinho area. These are mostly well-consolidated micaceous and feldspathic sandstones. Overlying this is the Middle to Upper Devonian Bafata Group, comprising argillaceous schists with intercalations of fine grained quartz sandstone.
Silurian	The Buba Group: mostly sandstones with some organic rich/carbonaceous black shales. Drilling in the southeast of the country showed very compact black, carbonaceous schists with fine grained sandstone intercalations, and some doloritic layers. In the northeast, schists interbedded with dolerite were seen, with varying indications of metamorphism, and fine grained, clay-rich sandstones at the top at the transition to the overlying Devonian rocks. Ordovician and Cambrian Sandstones, shales, conglomerates and rare limestones. These are found in the northeast of the country, overlying older Neoproterozoic metamorphic rocks.
Ordovician and Cambrian	by the Canjufa-Canjadude series of quartz-arenites. The other dominant Ordovician series is the Gabu sandstone series, thought to be mostly steeply dipping at up to 50 degrees. At its base is a white, coarse grained sandstone unit up to 170 m thick, overlain by less compact, sandier strata of considerable thickness, and then by a fine grained sandstone unit that is 10-30 m thick (UN 1988). Cambrian rocks are dominated by fine grained sandstones and shales, including shales of Pirada and Canquelifa, schist-sandstones of Cantari, and the younger sandstones of Upper Cambrian age.
Precambrian (Neoproterozoic) metamorphic complex	A volcanic and metasedimentary complex, including schists, quartzites and metavolcanic rocks. There are few outcrops - these mostly in the far north-east - as they generally lie below fairly thick younger geological formations.

1.4.3 Hydrogeology

As with many West African nations, groundwater is the main source of rural water supply for drinking water, especially during the dry season. Traditional groundwater abstraction supplies are largely from hand dug wells, water holes in low lying areas, and artesian springs (BGS, 2019). Newer abstractions include improved dug wells, often equipped with a rope and bucket system; improved dug and drilled wells equipped with a handpump; and

drilled wells equipped with wind or solar pumps (Visscher and van der Werff, 1995). Groundwater is also used for small scale (garden) irrigation, traditionally via shallow, hand dug wells. Groundwater is not used much for large scale commercial irrigation, although in at least one area - Granja de Pessub - drilled boreholes up to 300 m deep are used for irrigation (FAO, Aquastat).

1.4.3.1 Nature and Extent of Aquifers

Although there were over 4300 registered wells (as of 2018), little is known about Guinea-Bissau hydrogeology. UNDP in 1988 describes the nature and extent of aquifers in the nation. As presented in Figure 25 which is a generalized hydrogeologic map of G-B, aquifers consist of shallow unconsolidated alluvium and consolidated rock units composed of sedimentary and igneous rocks.

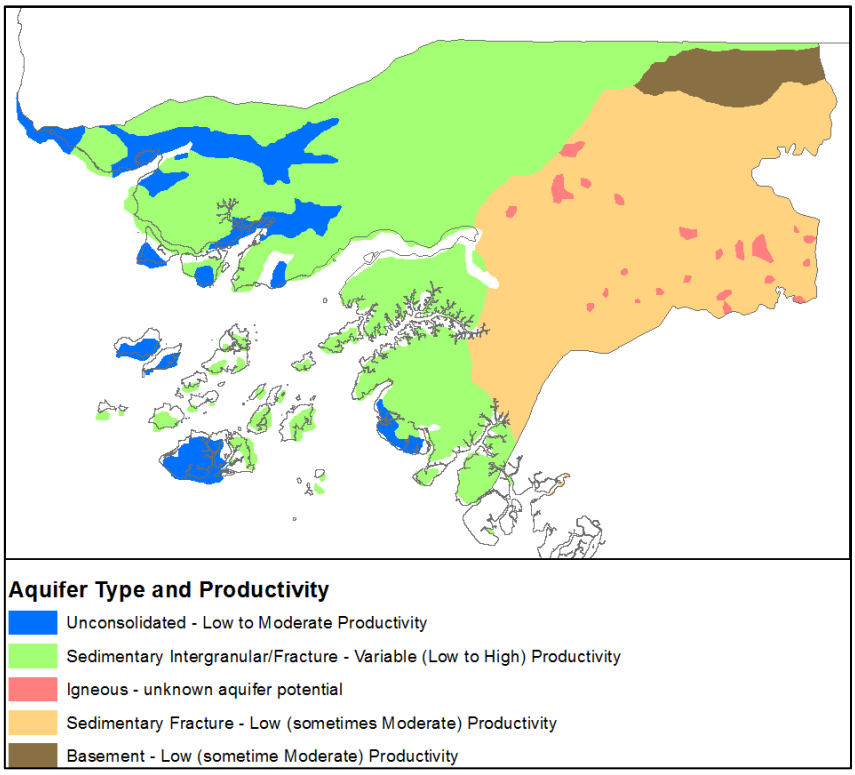


Figure 25. Simplified Hydrogeologic Map of Guinea-Bissau (BGS, 2019)

The characteristics of these aquifer systems are described in **Error! Reference source not found.**. Of primary concern in the Casheu and Oio Provinces are unconsolidated alluvial aquifers found along major river systems. These areas are underlain by what is known as the Senegal-Mauritanian sedimentary basin. However, their potential for groundwater exploitation is not very well understood in Guinea-Bissau.

Table 10. General Guinea-Bissau Aquifer Descriptions (Upton et al, 2018)

Aquifer	Age	Productivity	Description
Unconsolidated	Quaternary to Tertiary	Low to Moderate Productivity	Mostly coastal/marine/alluvial sands, with small banks of Tertiary (Miocene) limestone. Laterite is found over most of the central and western regions. These aquifers are usually unconfined and provide low storage and low borehole yields, although yields can vary from place to place and from season to season (UN 1988). Thicker and coarser grained sediments may form locally higher productivity aquifers.
Sedimentary - Mixed Intergranular and Fracture flow	Tertiary (Paleocene-Eocene-Oligocene)	Low to High (Variable) Productivity	These marine sands, sandstones, and limestones form an important aquifer, which is buried below ~175-200 m, depending on the area. There are no major low permeability beds in the sequence, and so the whole unit behaves as a single aquifer, which is confirmed by groundwater levels (piezometry) and groundwater chemistry. The sands and sandstones are

			likely to be dominated by intergranular flow, and the limestones by fracture flow. The upper surface of the aquifer was proved at depths of ~180 m at S. Domingos and Cagongue, where it is between 275 m and 315 m thick. The aquifer is typically confined. Only the uppermost sand-sandstone Oligocene formations, if they are thick enough, have relatively uniform permeability and provide high storage capacity and yields. The lower limestone series have more variable permeability, both vertically and laterally.
	Cretaceous	Low to High (Variable) Productivity	The main Cretaceous aquifer is the thick sandstone bed of Maastrichtian age, at the top of the Cretaceous sequence, which is an aquifer of major importance in Guinea-Bissau. The aquifer is largely confined, except at rare points where it crops out. Artesian heads occur across much of the center and west of the country, but not in the southern part of the coastal zone. Close to the sea and estuaries, groundwater heads are affected by tides. The main direction of groundwater flow appears to be towards the northwest and west (UN 1988). Permeabilities range from 0.1 in clay rich sandstones to 10 m/day in coarse grained sandstones
Igneous	Mesozoic Igneous Intrusive rocks	Unknown	Very little is known of the aquifer characteristics of these rocks. They are likely to be crystalline with very low intergranular porosity and permeability, so that groundwater potential will depend largely on the degree and type of weathering and/or fracturing in the rocks.
Sedimentary - Fracture flow (Paleozoic aquifers)	Devonian	Low productivity	Drilling into these rocks at shallow depths to about 20 m in the Nhabijocs plain (Bombadinca) showed them to be well consolidated with low permeability and to form a poor aquifer.
	Silurian	Low productivity	The dominantly fine grained, sometimes clay-rich sandstones, black carbonaceous shales and intercalations of dolerite, sometimes metamorphosed, all have low permeability and formed very poor aquifers.
	Cambro-Ordovician	Generally Low, occasionally Moderate Productivity	The Cambrian rocks, dominated by fine grained, well consolidated sandstones and shales, generally form very poor aquifers. Small local aquifers can be found in shallow weathered zones, and particularly in sandstones, which typically have slightly higher permeability. Little is known of the groundwater potential of the Ordovician sandstones, although drilling in the Canjadude region showed the sandstone to be compacted, with low permeability, and unproductive.
Basement	Pre-Cambrian	Low to Moderate Productivity	Crystalline basement rocks have virtually no intergranular porosity and permeability, and groundwater flow and storage are entirely dependent on the nature and degree of weathering and/or fracturing of the rock. A typical pattern in basement rocks is 'pockets' of weathering forming weathered basins, typically a few tens of meters deep and a few tens or hundreds of meters across, in which there is enhanced permeability and groundwater storage potential.

As shown in Figure 26, this basin contains a transboundary aquifer system underlying portions of Senegal, Mauritania, Gambia, and Guinea-Bissau that is the largest of the northwest African Atlantic margin basins and covers more than 300,000 km^2 with 159,000 km² in Senegal, 111,000 km² in Mauritania, 9,900 km² in Gambia and 2,100 km^2 in Guinea-Bissau. Guinea-Bissau's coastline is 1,400 km long from north to south and takes the form of a coastal plain (OSS, 2020). It approximately extends between 10° (Southern limit) and 21° Lat N (Northern limit) (Travi et al, 2017). The estimated reserve of the aquifer is approximately 1,500 billion m^3 and the annual recharge is estimated at 0.130 billion m^3 (Margat, J. and Van der Gun, J., 2013).

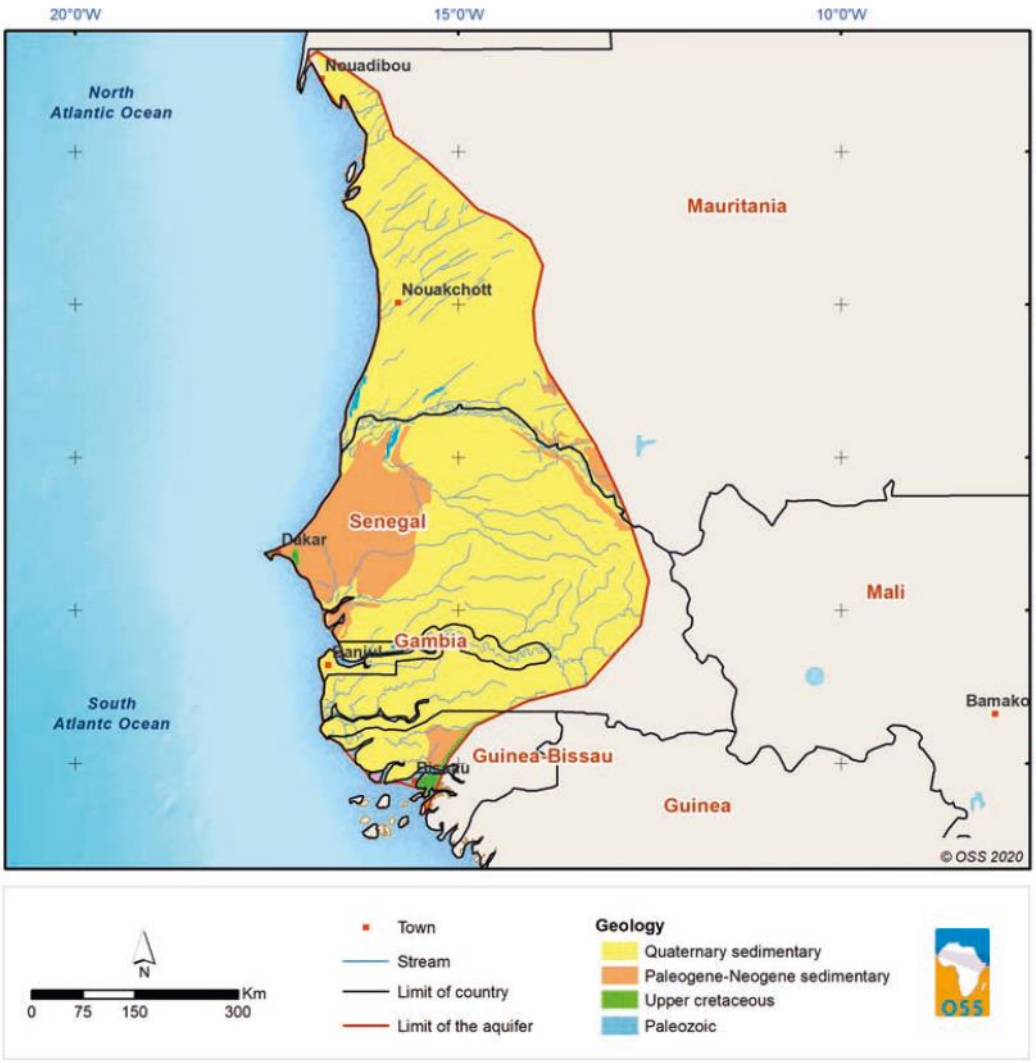


Figure 26. Geographic and geological framework of the Senegal-Mauritania Aquifer System (OSS, 2020)

More recently, Djim et al. (2020) developed a groundwater flow model of the basin along the Oussouye Plateau in southern Senegal along the border with Guinea-Bissau. Figure 27 is a cross section of the basin near the Guinea-Bissau border. This cross section which is based on numerous boreholes and wells depicts a thick sequence of sedimentary rocks and the relationship between the Cretaceous Maastrichtian sandstone aquifer discussed above and the basin. The result of the model indicates that there is a groundwater mound in the middle of basin with flow radiating from it to discharge areas along rivers which flow to the sea. As part of the study, groundwater quality was also evaluated. These data indicate that electrical conductivity varies from 28 to 1314 µs/cm (micro Siemens per centimeter) with the aquifer as a whole having excellent groundwater quality with major ion content not exceeding WHO standards except for Iron (Fe) concentrations which are relatively high in some wells.

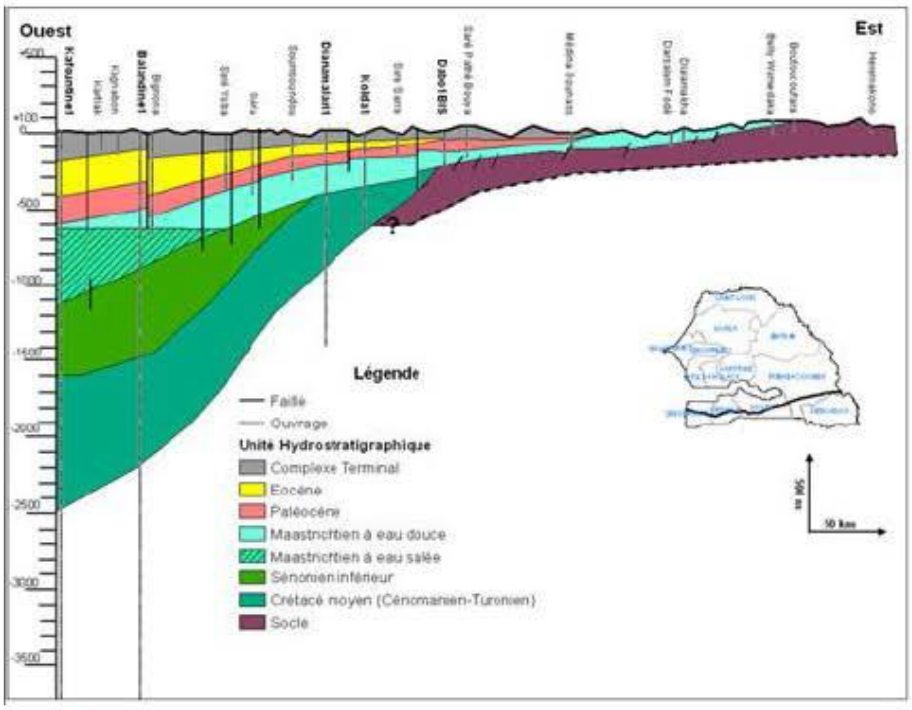


Figure 27. Cross Section of the Senegal-Mauritanian Sedimentary Basin (Djim, 2020)

1.4.4 Surface Water:

As shown in Figure 28, there are six main rivers in Guinea-Bissau. The first, the Cacheu, originates near the northern border with Senegal. Known as Farim for part of its course, it is the largest river in Oio and Cacheu. It has a basin area of around 1,722 km^2 and annual flow of 96 million cubic meters (MCM). The Mansôa River Basin is in the center of the country and flows into the Atlantic Ocean near the city of Bissau. The Gêba River source is in Senegal and has the largest watershed in the country. The Corubal originates in Guinea and flows close to the southern border. On the southern border with Guinea is the Cacine River. The last of the major rivers is the Rio Grande.

These rivers provide the principal means of transportation. Ocean-going vessels of shallow draught can reach most of the main towns, and flat-bottomed tugs and barges can reach most of the smaller settlements, except for those in the northeast. It runs west, by the town of Farim and close to Bigenè, and broadens into an estuary on whose south shore the town of Cacheu is located. Elia Island is a large island located on the right bank of the river close to its mouth. The island's western end lies east of the confluence with the Elia River with Ongueringao Island on the other bank. The Cacheu is navigable to large (2,000-ton) ships for about 97 km inland and to smaller vessels for much farther distances. It was formerly an important route for commerce (https://en.wikipedia.org/wiki/Cacheu_River).

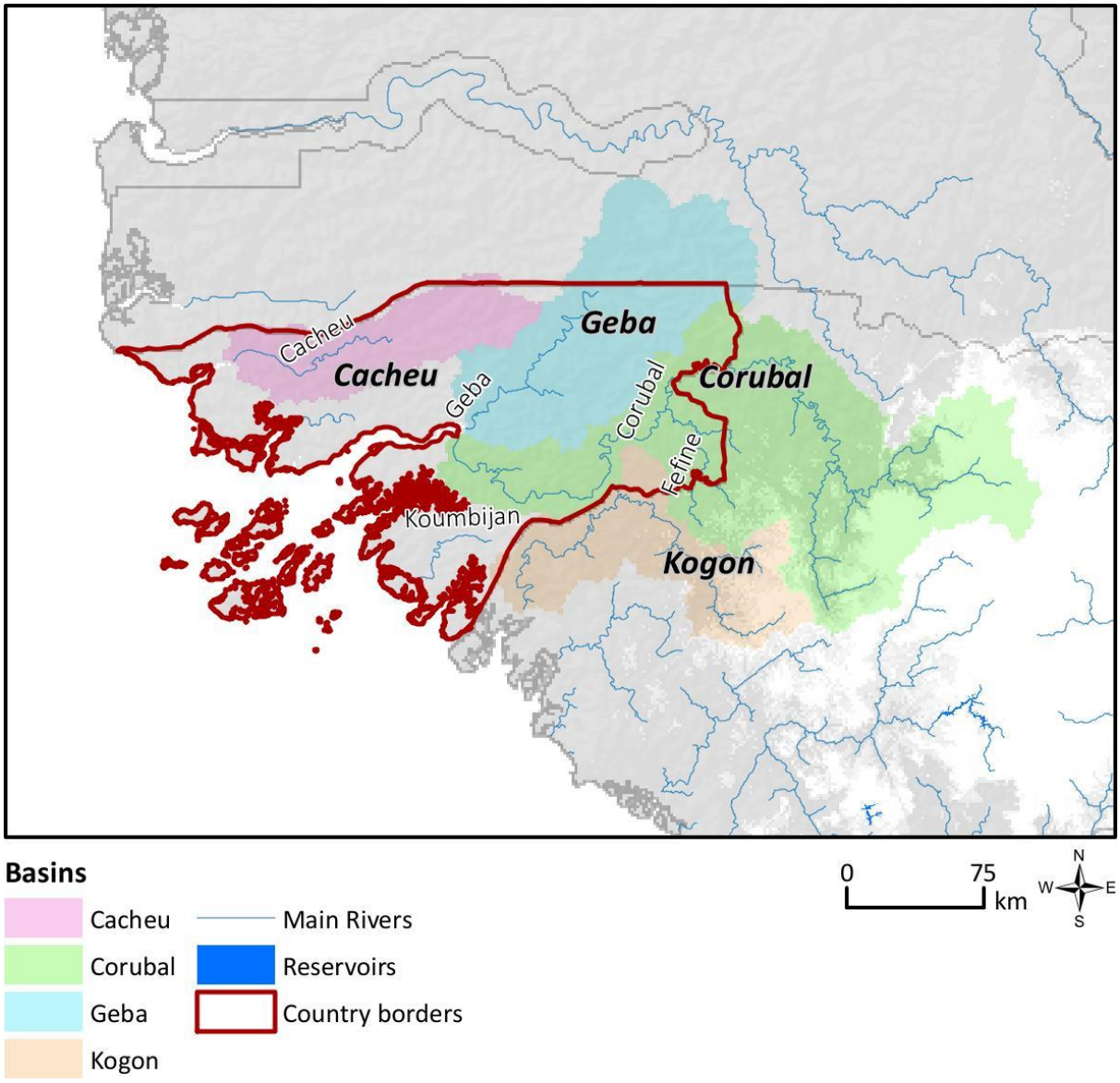


Figure 28. River Basins of Guinea-Bissau (ECREEE, 2017)

A main feature of the Cacheu River basin is the Casheu River Mangroves Natural Park (PNTC) which covers an area of 88,615 ha, it corresponds to the largest area of contiguous mangrove forest on the African west coast and supports a huge number of fish (Figure 29). The East bank of the river has, however, eroded due to land use for agriculture leading to a regression of mangrove coverage.

Figure 29. Satellite Image of the Casheu River Mangroves Natural Park (https://www.deimos-imaging.com/earthnet-a-research-program/)

1.4.5 Land Use

Guinea-Bissau is primarily an agricultural country. Land use in general consists of (CIA, 2021):

- Agricultural land: 44.8% (2018 est.)
- Arable land: 8.2% (2018 est.)
- Permanent crops: 6.9% (2018 est.)
- Permanent pasture: 29.7% (2018 est.)
- Forest: 55.2% (2018 est.)
- Other including urban areas: < 1% (2018 est.)

Agricultural lands are the major land use in Cacheu and Oio with a little less of 77% of land of Cacheu and around 80% of the land in Oio being dedicated to agriculture. Major crop areas as of 2013 are presented in **Error! Reference source not found.**.

One of the major land use features in Cacheu is the Cacheu River Mangroves Natural Park (Figure 30), one of the most extensive mangrove areas of West Africa. The Park has an area of 88,615 ha, 68% of which is covered by mangals (del Toro et al, 2019). Studies have shown that the mangrove coverage in the park is decreasing for other land uses.

Table 11. Major Crops Farmed in Cacheu and Oio – cultivated hectares (GoGB, 2019)

Crops	Cacheu	Oio	Country
Pam-pam	3126	7405	27934
Sweet Rice	4491	7534	33977
Salty Rice	2416	2192	19330
Total Rice	10033		81241
Bacil Corn	738	839	5764
Corn horse	607	3079	15324
Black Corn	1419	2231	10484

Crops	Cacheu	Oio	Country
Fundo	234	243	599
Total Other cereals	2998		32171
Total Cereals	13030		
Yam			
Sweet Potatoes	92	102	1807
Cassava	127	135	2163
Manfafa			
Peanuts	8818	5448	43855
Beans	367	360	1707

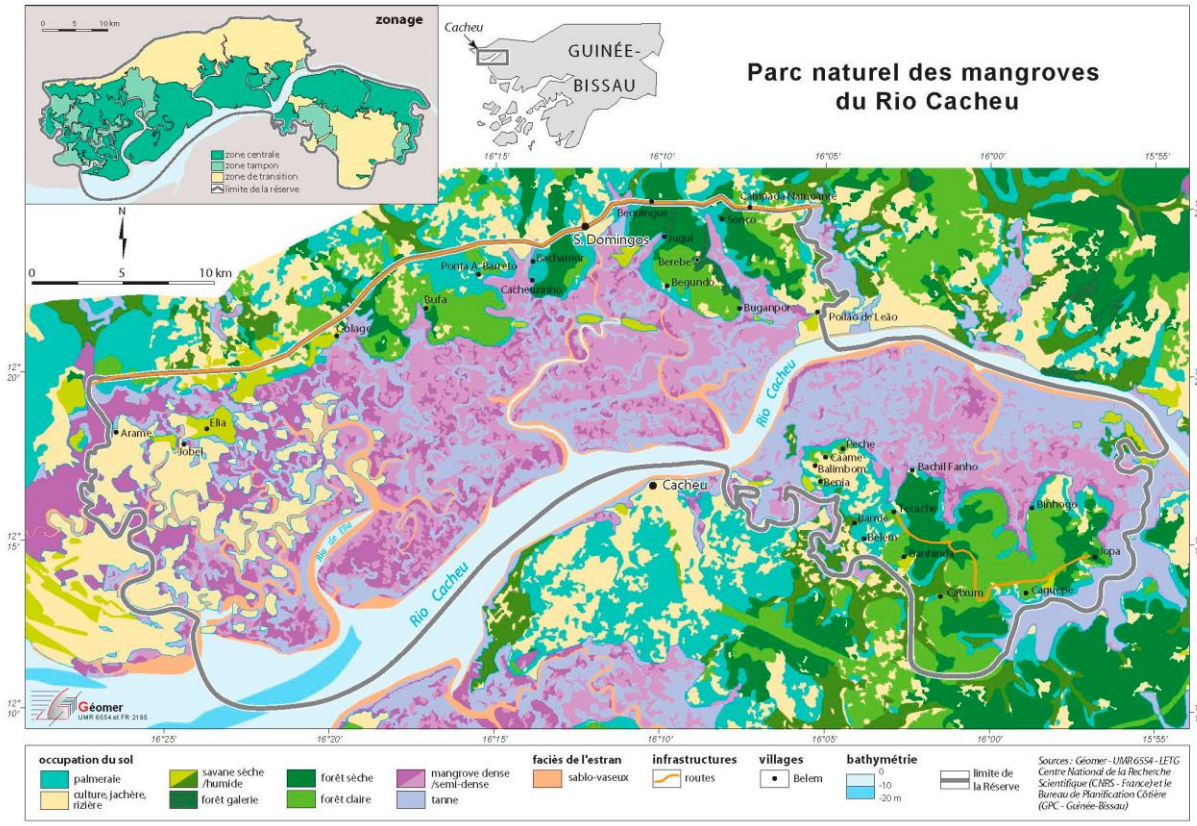


Figure 30. Cacheu River Mangroves National Park (del Toro et al, 2019)

In Cacheu and Oio, forests make up approximately 113,700 ha or 23% of Cacheu and 105,000 ha or 19.4% of Oio. Forest distribution for Cacheu and Oio are illustrated in Figure 31 and Figure 32.

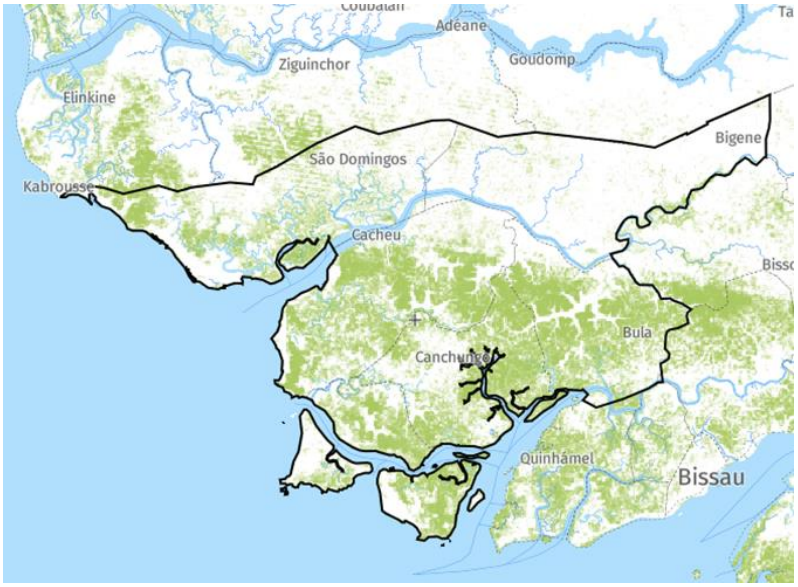


Figure 31. Forest Distribution in Cacheu (https://www.globalforestwatch.org)

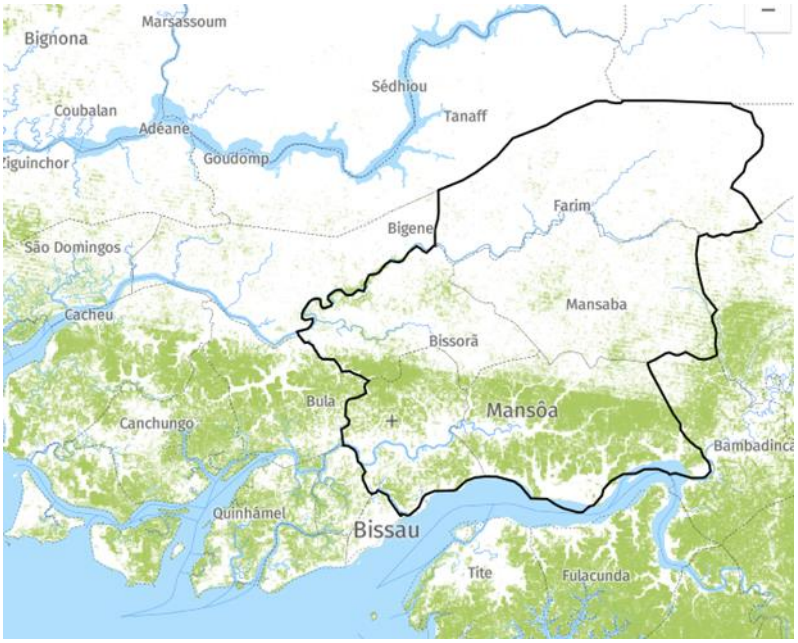


Figure 32. Forest Distribution in Oio (https://www.globalforestwatch.org)

1.4.6 Water Usage

Data on water usage in Guinea-Bissau and especially Oio and Cacheu is somewhat limited. The most comprehensive information on water resource utilization has been compiled by FAO (2021) in their Aquastat database. A summary of these data along with demographics is presented in **Error! Reference source not found.**.

Table 12. Guinea-Bissau Water Utilization (FAO Aquastat)

Year	1992	1997	2002	2007	2012	2017
Surface water produced internally (10^9 m3/yr)	12	12	12	12	12	12
Groundwater produced internally (10^9 m3/yr)	14	14	14	14	14	14
Overlap between surface water and groundwater (10^9 m3/yr)	10	10	10	10	10	10
Total internal renewable water resources (IRWR) (10^9 m3/yr)	16	16	16	16	16	16
Total internal renewable water resources per capita (m3/inhab/yr)	15680.89	14127.91	12754.56	11335.11	9968.98	8752.04

Surface water: entering the country (total) (10^9 m3/yr)	15.4	15.4	15.4	15.4	15.4	15.4
Surface water: inflow not submitted to treaties (10^9 m3/yr)	15.4	15.4	15.4	15.4	15.4	15.4
Surface water: accounted inflow (10^9 m3/yr)	15.4	15.4	15.4	15.4	15.4	15.4
Surface water: total external renewable (10^9 m3/yr)	15.4	15.4	15.4	15.4	15.4	15.4
Water resources: total external renewable (10^9 m3/yr)	15.4	15.4	15.4	15.4	15.4	15.4
Total renewable surface water (10^9 m3/yr)	27.4	27.4	27.4	27.4	27.4	27.4
Total renewable groundwater (10^9 m3/yr)	14	14	14	14	14	14
Overlap: between surface water and groundwater (10^9 m3/yr)	10	10	10	10	10	10
Total renewable water resources (10^9 m3/yr)	31.4	31.4	31.4	31.4	31.4	31.4
Exploitable: regular renewable groundwater (10^9 m3/yr)	0.35	0.35	0.35	0.35	0.35	0.35
Total exploitable water resources (10^9 m3/yr)	0.35	0.35	0.35	0.35	0.35	0.35
Agricultural water withdrawal (10^9 m3/year)	0.034	0.144	0.144	0.144	0.144	0.144
Industrial water withdrawal (10^9 m3/yr)	0.002	0.008	0.010	0.012	0.012	0.012
Municipal water withdrawal (10^9 m3/yr)	0.013	0.023	0.027	0.034	0.034	0.034
Total water withdrawal (10^9 m3/yr)	0.048	0.175	0.181	0.190	0.190	0.190
Irrigation water requirement (10^9 m3/yr)		0.0263	0.0263	0.0263	0.0263	0.0263
Agricultural water withdrawal as % of total water withdrawal (%)	69.59	82.29	79.56	75.79	75.79	75.79
Industrial water withdrawal as % of total water withdrawal (%)	4.31	4.57	5.28	6.26	6.26	6.26
Municipal water withdrawal as % of total withdrawal (%)	26.10	13.14	15.16	17.95	17.95	17.95
Total water withdrawal per capita (m³/year per inhabitant)	47.32	154.52	144.29	134.60	118.38	103.93
Environmental Flow Requirements (10^9 m3/year)	19.7	19.7	19.7	19.7	19.7	19.7
Fresh surface water withdrawal (10^9 m3/yr)	0.14	0.144	0.144	0.144	0.144	0.144
Fresh groundwater withdrawal (10^9 m3/yr)	0.03	0.031	0.031	0.031	0.031	0.031
Total freshwater withdrawal (10^9 m3/yr)	0.05	0.175	0.175	0.175	0.175	0.175
MDG 7.5. Freshwater withdrawal as % of total renewable water resources (%)	0.15	0.56	0.56	0.56	0.56	0.56
Agricultural water withdrawal as % of total renewable water resources (%)	0.11	0.46	0.46	0.46	0.46	0.46
Total population with access to safe drinking-water (JMP) (%)	39.1	47.1	55.5	64.3	73.6	79.3
Rural population with access to safe drinking-water (JMP) (%)	34	39.7	45.4	51.1	56.9	60.3
Urban population with access to safe drinking-water (JMP) (%)	50.7	61.2	71.6	82.1	92.5	98.8

Evaluation of these data shows that rural and urban populations are growing at approximately the same rate with the highest percentage of inhabitants of the country living in rural areas (Figure 33). However, as shown in (Figure 34) access to safe water drinking supplies is higher in urban areas than in the rural. For the most part, water in rural areas is supplied by shallow wells which are highly susceptible to contamination from domestic wastewater with few households having properly designed septic systems.

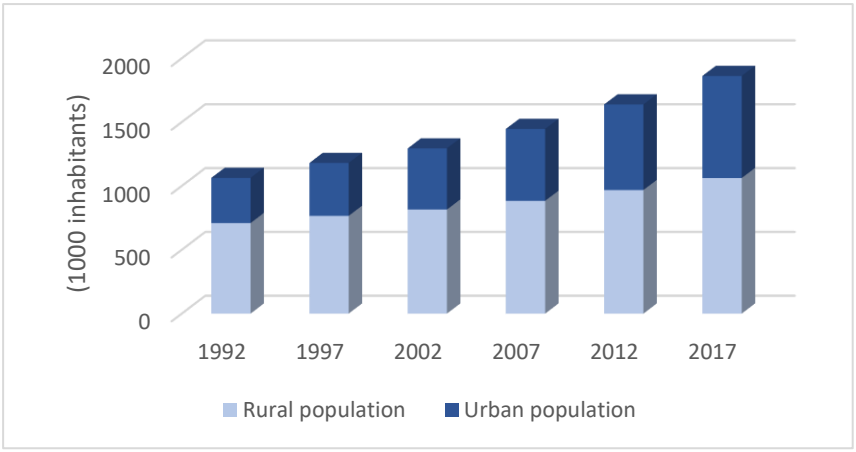


Figure 33. Guinea-Bissau Population Growth (FAO Aquastat)

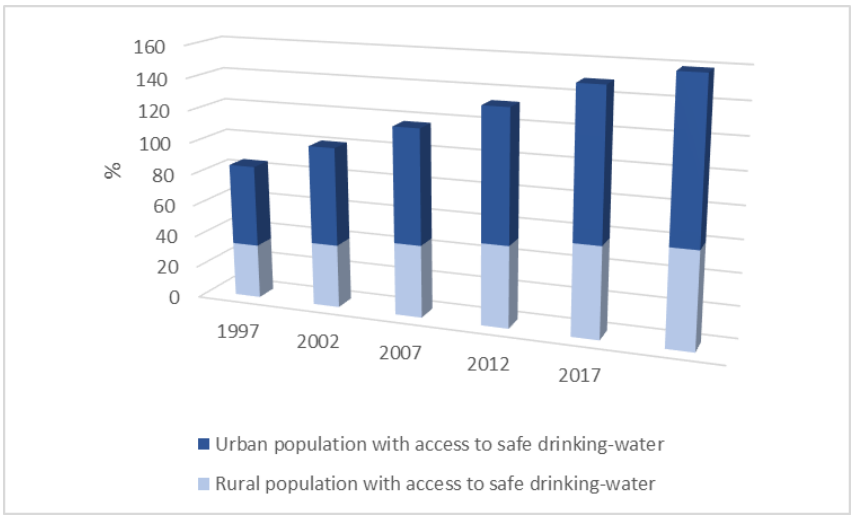


Figure 34. Access to Safe Drinking Water (FAO Aquastat)

Water supply for domestic, municipal, agricultural, and industrial use is quite abundant with renewable groundwater and surface water supplies of over 41 billion m^3/year (Figure 35). As shown in Figure 36, water withdrawn for these sources is mainly used for agriculture and significantly less for municipal water and other uses.

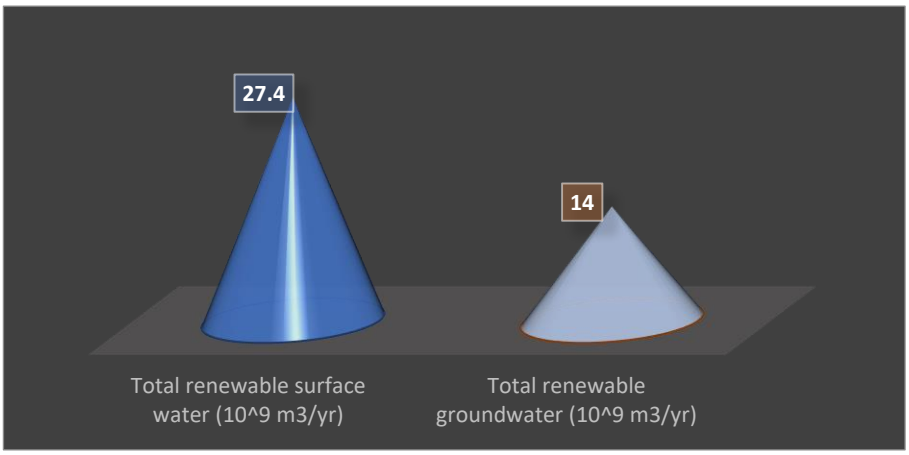


Figure 35. Renewable Water Resources (FAO Aquastat

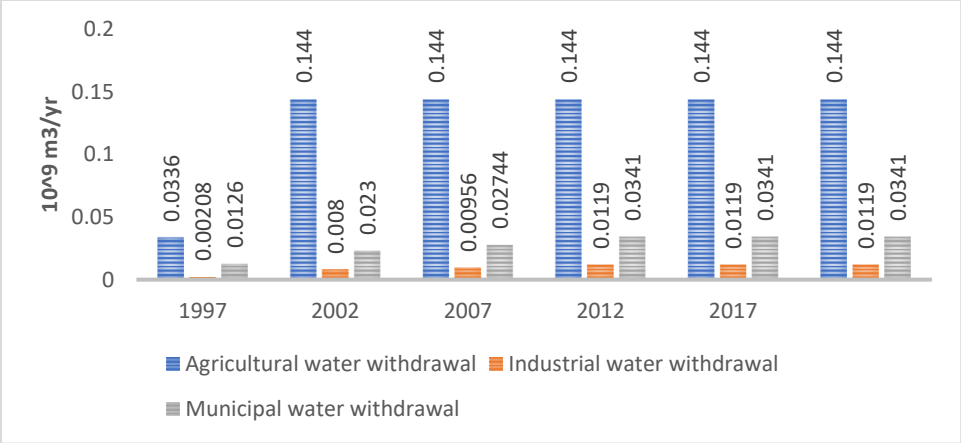
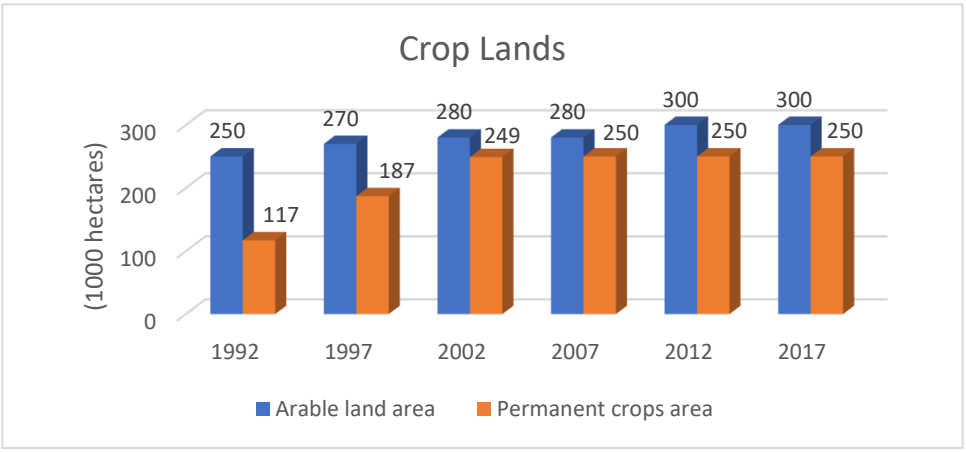


Figure 36. Water Use (FAO Aquastat)

1.4.7 Irrigation:

Definition of irrigation potential in FAO (2005) is the area of land (ha) which is potentially irrigable. Country/regional studies assess this value according to different methods – for example some consider only land resources suitable for irrigation, others consider land resources plus water availability, and others include in their assessment economic aspects such as distance and/or difference in elevation between the suitable land and the available water or environmental aspects (Altchenko et al, 2015). For Oio and Cacheu, there is considerable land available for irrigation. Upland areas which normally depend on rainfed agriculture are also suitable for irrigation using groundwater wells. This is especially true during the dry season and during periods of drought.

As shown in Figure 37, the largest share of arable agriculture lands in the country are under cultivation. As of 2017, over 80% are these lands are farmed with the majority being rainfed. Irrigation, however, does play a major role in agriculture. Irrigation water comes from both groundwater and surface water with the majority being withdrawn from surface water. Figure 38 shows fields equipped with irrigation systems from groundwater,



surface water and mixed sources. Groundwater is used less for irrigation than surface water due to the high costs of drilling wells and pumping costs.

Figure 37. Croplands under Cultivation (FAO Aquastat)

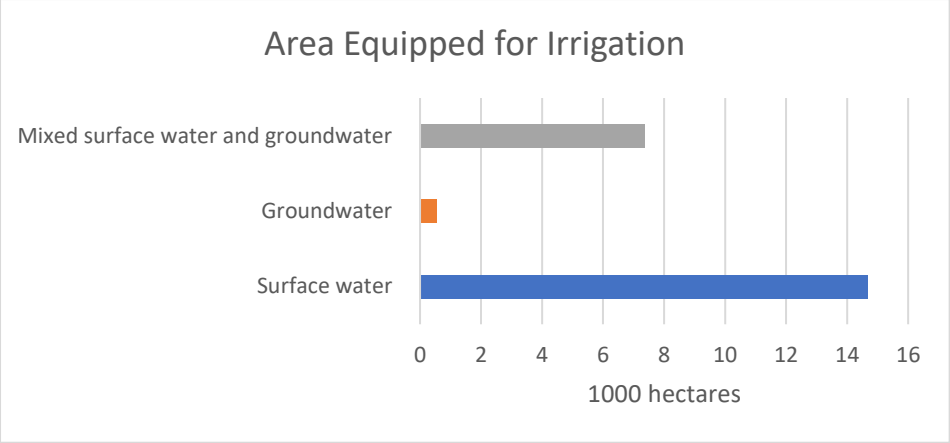


Figure 38. Lands Equipped for Irrigation (FAO Aquastat)

As shown in the two graphs above, lands equipped for agriculture make up only about 9% of the total cultivated lands with the remaining 91% being rainfed.

1.4.8 Rainfed Crops:

Using climate and soil data presented above, crop water requirements for traditional rainfed crops in Cacheu and Oio were estimated using the CropWat 8.0 which is program developed by FAO (2009). Tables 13 and 14 present rainfall deficits and irrigation requirements for Cacheu and Oio. In these calculations, it was assumed an irrigation efficiency of 70% and the growing season was assumed to beginning in early May.

Table 13. Rainfall Deficit and Irrigation Requirements for Traditional Rainfed Crops in Cacheu

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Precipitation deficit												
1. MAIZE	0	0	0	0	34.1	16.3	0	0	2.4	0	0	0
2. MILLET	0	0	0	0	44.3	21.1	0	0	0	0	0	0
3. Groundnut	0	0	0	0	42	2.2	0	0	0	0	0	0
4. Beans	0	0	0	0	59.3	13.8	0	0	0	0	0	0
5. Cassava	0	0	0	0	30.3	0	0	0	0	3.4	39.1	0
6. Cashew	146.2	141.1	154.9	110	26.2	0	0	0	0	8.7	120	139.3
Net scheme irr. req.												
in mm/day	1.2	1.3	1.2	0.9	1.2	0.2	0	0	0	0.1	1	1.1
in mm/month	36.5	35.3	38.7	27.5	37.4	6.5	0	0	0.3	2.2	30.4	34.8
in l/s/h	0.14	0.15	0.14	0.11	0.14	0.03	0	0	0	0.01	0.12	0.13
Irr. req. for actual area (l/s/ha)	0.55	0.58	0.58	0.42	0.14	0.03	0	0	0.01	0.03	0.45	0.52
Irr. req in MCM/ha	0.001473	0.001416	0.001553	0.001089	0.000375	7.78E-05	0	0	2.59E-05	8.04E-05	0.001166	0.001393

Table 14. Rainfall Deficit for Traditional Rainfed Crops in Oio

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Precipitation deficit												
1. MAIZE	0	0	0	0.00	25.8	9.6	0	0	2.4	0	0	0
2. Groundnut	0	0	0	0.00	33.3	0	0	0	0	0	0	0
3. Green beans	0	0	0	0.00	50.1	8.3	0	0	0	0	0	0
4. Cassava	0	0	0	0.00	22	0	0	0	0	2.4	38.3	0
5. Cashew	133.9	127.8	139.5	100.30	19	0	0	0	0	7.7	118.5	135.5
6. Sweet Potato	0	0	0	0.00	20.9	4.6	0	0	0	0	0	0
Net scheme irr. req.												
in mm/day	1.3	1.3	1.3	1.00	0.9	0.1	0	0	0	0.1	1.2	1.3
in mm/month	38.8	37.1	40.5	29.10	26.4	3.6	0	0	0.9	2.3	34.7	39.3
in l/s/h	0.14	0.15	0.15	0.11	0.1	0.01	0	0	0	0.01	0.13	0.15
Irr. req. for actual area	0.5	0.53	0.52	0.39	0.1	0.04	0	0	0.01	0.03	0.45	0.51
(l/s/h)												
Irr. req. for actual area (l/s/ha)	0.5	0.53	0.53	0.51	0.3	0	0	0	0	0.03	0.25	0.42
Irr. req in MCM/ha	0.001339	0.001294	0.00142	0.001322	0.000804	0	0	0	0	8.04E-05	0.000648	0.001125

Most traditional rainfed crops show a slight to zero rainfall deficit during the planting season. Of notable exceptions are cashews and cassava which require additional water throughout the dry season. Cashews don't require heavy rainfall conditions and can adapt themselves to any type of climate without affecting their productivity. The annual rainfall requirement for the cashew crops is 1000 to 2000 mm, however, the plants require substantial water for up to 3 years for newly planted trees and irrigation during the flowering and fruiting increases productivity and quality. Proper drainage must be provided to avoid water stagnation (GoI, 2021).

1.4.8.1 Rice:

Rice fields (bolanhas) are essential for the livelihood and food security in both Oio and Cacheu (OSS, 2021). The main systems used to farm rice in Casheu and Oio are freshwater swamps in the savannah grasslands and mangrove swamp rice. Mangrove rice cultivation involves building earthen dikes to protect the rice fields from seawater ingress. Generally, rainfed cultivation involves planting around the beginning of May and harvesting into January. Tables 15 and 16 present the results of the CropWat Model for rice in Cacheu and Oio.

Table 15. Irrigation Requirements for Rice Production in Cacheu

Month	Decade (10 days)	Stage	Kc	ETc	ETc	Eff rain	Irr. Req.	Irr. Req.
			coeff	mm/day	mm/dec	mm/dec	mm/dec	MCM/ha
Aug	1	LandPrep	1.05	3.14	22	39.9	91.1	0.000854
Aug	2	LandPrep	1.05	3.1	31	58.8	85.4	0

Month	Decade (10 days)	Stage	Kc	ETc	ETc	Eff rain	Irr. Req.	Irr. Req.
Aug	3	Init	1.09	3.38	37.2	57	0	0
Sep	1	Init	1.1	3.6	36	56.1	0	0
Sep	2	Deve	1.12	3.84	38.4	55.4	0	0
Sep	3	Deve	1.18	4.29	42.9	48.3	0	0.000062
Oct	1	Deve	1.23	4.77	47.7	41.5	6.2	0.000163
Oct	2	Mid	1.27	5.19	51.9	35.6	16.3	0.000347
Oct	3	Mid	1.27	5.41	59.6	24.9	34.7	0.00046
Nov	1	Mid	1.27	5.64	56.4	10.4	46	0.000586
Nov	2	Mid	1.27	5.86	58.6	0	58.6	0.000566
Nov	3	Late	1.25	5.67	56.7	0.1	56.6	0.000528
Dec	1	Late	1.2	5.36	53.6	0.8	52.8	0.000506
Dec	2	Late	1.15	5.06	50.6	0	50.6	0.00005
Dec	3	Late	1.12	5.02	5	0	5	0

Table 16. Irrigation Requirements for Rice in Oio

Month	Decade (10 days)	Stage	Kc coeff	ETc mm/day	ETc mm/dec	Eff rain mm/dec	Irr. Req. mm/dec	Irr. Requ (MCM/ha)
Aug	1	Nurs/LPr	1.11	2.32	23.2	56.7	91	0.00091
Aug	2	Nurs/LPr	1.06	3.09	30.9	58.7	85.8	0.000858
Aug	3	Init	1.09	3.34	36.8	56.9	0	0
Sep	1	Init	1.1	3.56	35.6	56.2	0	0
Sep	2	Deve	1.12	3.81	38.1	55.5	0	0
Sep	3	Deve	1.18	4.26	42.6	48.6	0	0
Oct	1	Deve	1.23	4.73	47.3	42.2	5.1	0.000051
Oct	2	Mid	1.27	5.15	51.5	36.6	14.9	0.000149
Oct	3	Mid	1.27	5.38	59.2	25.6	33.6	0.000336
Nov	1	Mid	1.27	5.61	56.1	11	45.1	0.000451
Nov	2	Mid	1.27	5.84	58.4	0	58.4	0.000584
Nov	3	Late	1.25	5.61	56.1	0	56.1	0.000561
Dec	1	Late	1.2	5.27	52.7	0.3	52.3	0.000523
Dec	2	Late	1.15	4.93	49.3	0	49.3	0.000493
Dec	3	Late	1.12	4.78	4.8	0	4.8	0.000048

The results of this analysis indicate that additional water is required for rice throughout the year.

1.4.9 Saltwater Intrusion Impacts on Groundwater Resources

In addition to making water undrinkable, increases in salinity can cause:

- Corrosion of machinery and infrastructure such as fences, roads and bridges.
- Poor health or death of native vegetation, leading to a decline in biodiversity through dominance of salt-resistant species, potentially altering ecosystem structures.
- Reduction in crop yields by impairing the growth and health of salt intolerant crops.

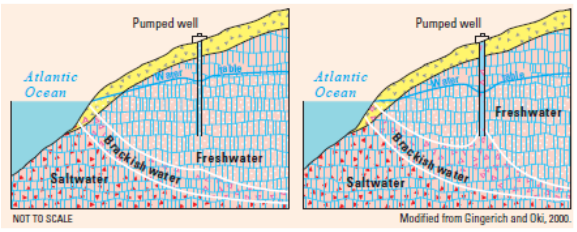
To date, most crops in Guinea-Bissau are rain fed with few areas being irrigated using groundwater. Already in Guinea-Bissau, there is a concern that sea level rise is pushing saltwater farther up rivers at high tide, increasing the potential for saltwater intrusion. The development of new wells in coastal areas will likely accelerate the rate of saltwater intrusion in coastal areas and along rivers (see the text box at right).

Once saltwater intrudes into an aquifer its recovery is nearly impossible. Freshwater demand in coastal areas must be met by abstractions from other groundwater or surface water sources, often over long distances, transferring and increasing the water stress to distant areas. In coastal areas and oceanic islands, saltwater intrusion often occurs due to over pumping.

Saltwater Intrusion (USGS, 2010)

- When water is withdrawn from a freshwater lens, the freshwater lens shrinks, and saltwater or brackish water will intrude upward and landward into parts of the aquifer that formerly contained freshwater. The degree of saltwater intrusion depends on several factors: the hydraulic properties of the rocks, recharge rate, pumping rate, and well location.
- Once saltwater intrudes into an aquifer, pumped water may be unsuitable for consumption or irrigation. The pumped water may have to undergo expensive treatment before use. Otherwise, pumping rates will have to be decreased and (or) other expensive engineering solutions must be used until the freshwater lens recovers over time. It is important, therefore, to protect susceptible aquifers from intrusion rather than to try to remediate groundwater resources once intrusion has occurred.
- Saltwater-intrusion problems can be minimized by appropriately locating wells and by controlling withdrawal rates.
- Saltwater intrusion is a potential problem near the coast. Figure A is a diagram of a well completed in a coastal aquifer in which withdrawal is small. Only limited saltwater intrusion has taken place. Figure B is a diagram of the same well under conditions of large ground-water withdrawal. Pumping has lowered the water table and caused the freshwater lens to thin. Brackish water has reached the well.

A. B.



1.4.9.1 Extent of Saltwater Intrusion

Ferreira et al (2007) defined vulnerability to saline intrusion as "the sensitivity of groundwater quality to an imposed extraction or to the rise of sea level, as determined by the intrinsic characteristics of the aquifer." To assess this vulnerability in Guinea Bissau, Ferreira et al (2011), used the GALDIT method. For this method, the most important factors are:

- Occurrence of underground waters (aquifer type: not confined, confined or semi-confined);
- Hydraulic conductivity of the aquifer;
- Piezometric or groundwater level (above sea level);
- Distance to the shoreline;
- Impact of groundwater withdrawn from the aquifers and
- The thickness of the aquifer.

The spatial distribution of each of these factors and their cumulative affect allows for the development of a weighted index assess the vulnerability to the coastal aquifer system to saltwater intrusion. These values vary between 2.5 and 10 and correspond to between low and high vulnerability. Weighted coefficients vary between 1 and 4 as presented in **Error! Reference source not found.**.

Table 17. GALDIT Parameters (Ferreira et al, (2007)

GALDIT Parameters	Coefficient
G - Occurrence of Aquifers	1
A - Hydraulic Conductivity	3
L - Piezometric level (above sea level)	4
D - Distance to the shoreline	4

I - Impact of the current state of marine intrusion in the region	1
T - Aquifer thickness	2

The vulnerability index is determined by the following equation:

GALDIT = (1*G + 3*A + 4*L + 4*D + 1*I + 2*T)/15

These values are then classified by indices as presented in **Error! Reference source not found.**8.

Table 18. Vulnerability Classes

Class	GALDIT Index
Elevated vulnerability	≥ 7.5
Moderate vulnerability	5 – 7.5
Low vulnerability	2.5 – 5
Vulnerability very low	≤ 2.5

For Guinea Bissau, Ferreira et al (2011) used a relatively simple hydrogeologic model that was composed of two aquifers the most recent the meso-Cenozoic composed of coastal and alluvial sediments and the large sedimentary aquifer of the Senegal-Mauritania Basin. Using water level and water quality data provided by the Director-General for Water Resources of Guinea-Bissau, Ferreira et al (2011) developed the map presented in Figure 39. For this evaluation, the GALDIT Method was applied to the tidal influence zone in Guinea-Bissau, allowing the risk of the coastal strip potentially subject to saltwater intrusion due to a possible rise in sea level 0.25 m, 0.50 m, and 1 m). From the analysis carried out, it was found that the areas potentially most affected by saltwater intrusion are in the region of Cacheu River Mangroves Natural Park.

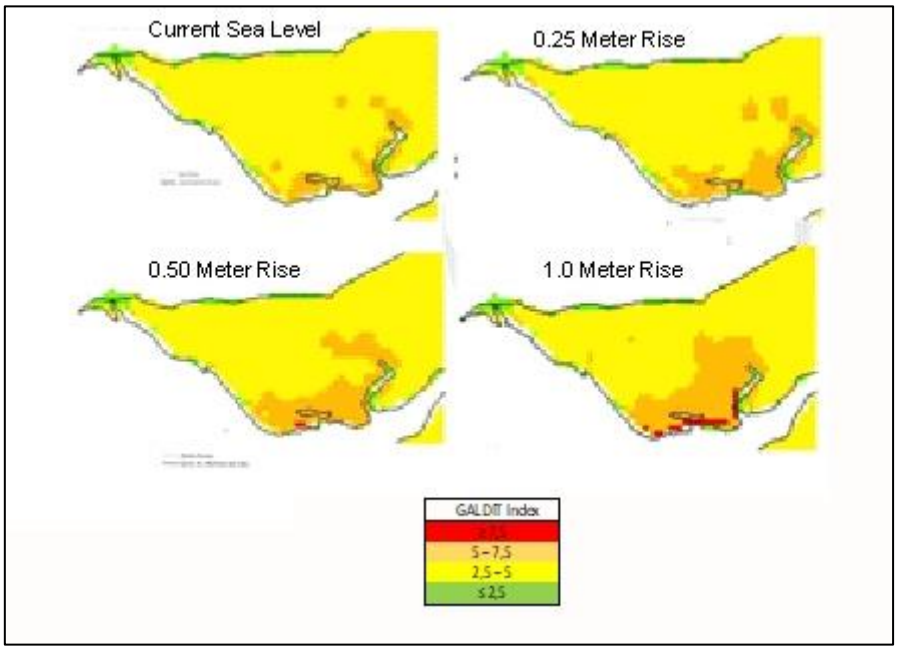


Figure 39. Project Saltwater Intrusion with Sea Level Rise (Ferreira et al, 2011)

In Cacheu as well as in Oio, this can also occur along tidal influenced rivers. The Cacheu River is heavily influenced by tides that bring brackish and salty water inland for over 100 km. A study by Barri in 2017 evaluated the influence of tides in terms of salinity and dissolved oxygen on crustaceans in the Cacheu River. As shown in Figure 40, four stations were monitored on the Cacheu River.

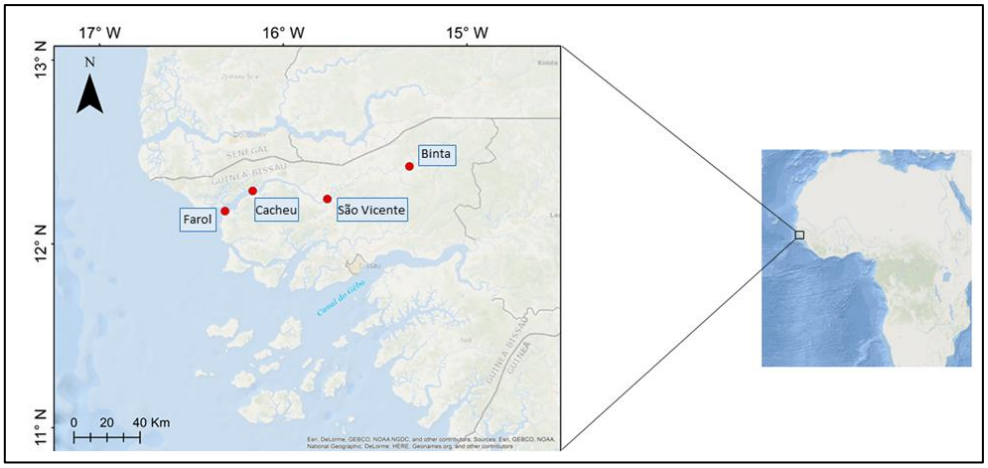


Figure 40. Salinity and Dissolved Oxygen Monitoring Station on the Cacheu River (Barri, 2017)

The results of this study are presented in **Error! Reference source not found.**. This study showed that salinity values were highest in the hottest months of the year, between March and July during low flow with and the lowest salinity values during the rainy season from September to November. During this period, the gradual decrease in the salinity of downstream water was also observed. Salinity values during this period were observed as far upstream as Saint Vincent. During the months of lower salinity concentration (September, October, and November) low lying areas are flooded, effectively reducing salt concentrations in soils and allowing for cultivation of rice.

Table 19. Summary of the variability of salinity, temperature and % oxygen saturation values verified from June 2013 to May 2014 at sampling stations (Barri, 2017)

Table 20. **Parameter**	Table 21. **Binta**	Table 22. **Saint Vincent**	Table 23. **Cacheu**	Table 24. **Farol**
Salinity (mg/L)				
Maximum	11.6	38.0	39.7	39.8
Minimal	2.7	6.9	20.6	27.2
Amplitude	8.9	31.1	19.1	12.6
Average	6.9	19.3	31.9	33.7
Standard deviation	2.87	8.61	5.66	4.04
Temperature (°C)				
Maximum	47.5	29.9	30.3	30.3
Minimal	23.3	23.5	23.5	23.3
Amplitude	24.2	6.4	6.8	7.0
Average	27.7	26.5	27.1	27.2
Standard deviation	3.66	2.20	2.54	2.53
Saturation (%)				
Maximum	83	200	176	112
Minimal	52	34	9	30
Amplitude	31	166	167	82
Average	68	65	87	87
Standard deviation	9.4	39.7	28.5	13.1

One of the major concerns for the utilization of groundwater from both shallow and deep aquifers for irrigation especially during periods when there is a rainfall deficit during the dry season is the potential for saltwater intrusion as well as the depletion of aquifers. In Guinea-Bissau groundwater management is the responsibility of the Directorate General of Water Resources (Direccion Geral de Recurson Hidricos / DGRH), within the Ministry of Energy, Industry and Natural Resources (MEIRN) (Upton, 2018). A national database (MWater) stores

groundwater data, including information on borehole drilling logs, groundwater levels and groundwater chemistry. This database is held by the national water authority, the DGRH. Its development has been supported by UNICEF, including systemizing the database design and operation and updating it with new information (e.g., Fussi et al. 2018). With more than 4000 wells in the database, the information is far from complete with only about 878 wells being entered with monitoring of water levels and specific conductance taking place throughout the country (Figure 41).

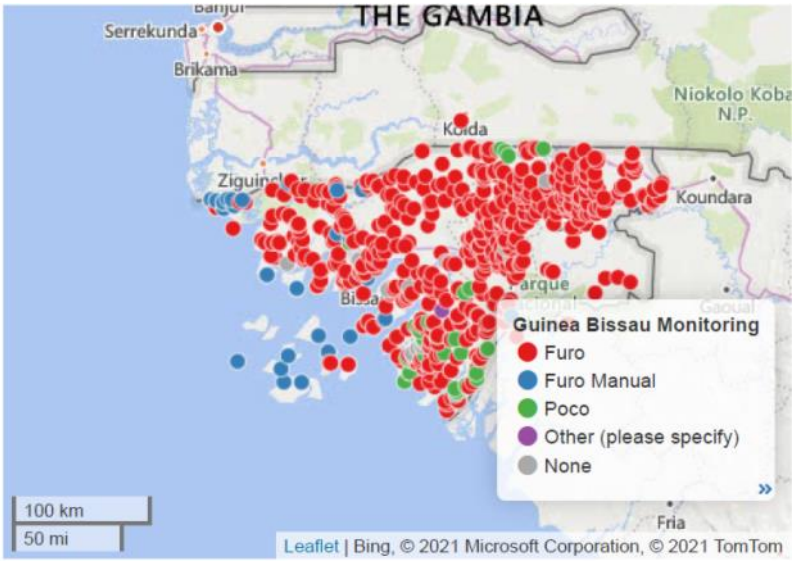
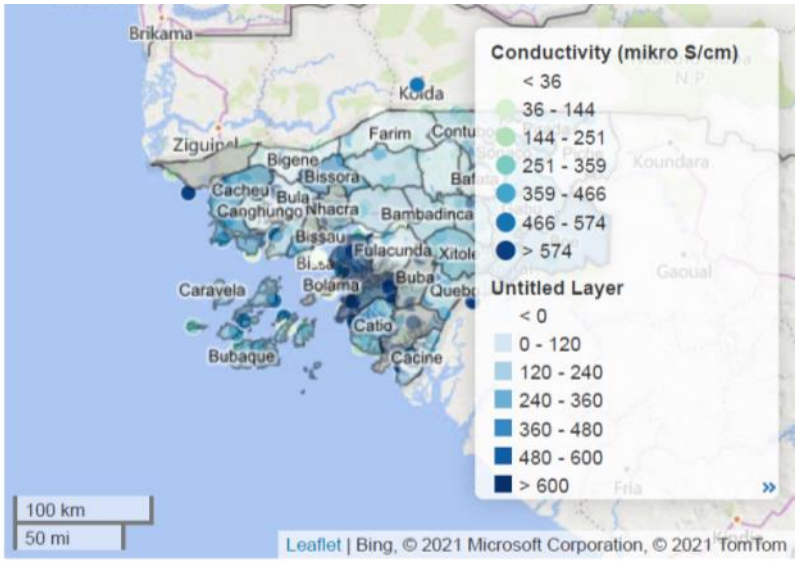


Figure 41. Groundwater Monitoring Points (Fussi et al, 2018)

Output from this database for specific conductance gives an indication where salinity (Figure 42) and Iron (Figure 43) may be problems in wells. The most problematic areas for salinity are indicated by blue dots with the darker blue values showing wells with higher salinity. The main areas for concern are Bolama on the central



west coast of the county and along the western coast in Cacheu.

Figure 42. Salinity Levels in Groundwater (Fussi et al, 2018)

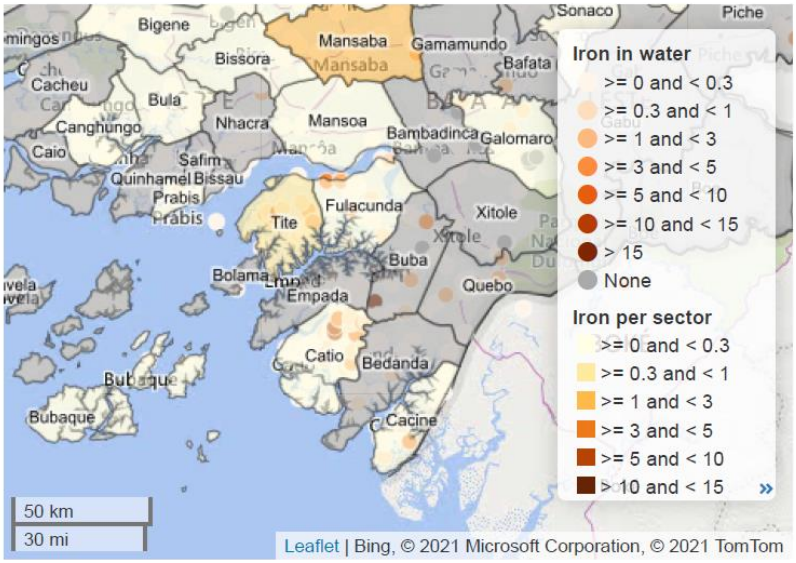


Figure 43. Iron in Guinea-Bissau Monitoring Wells (Fussi et al, 2018)

1.4.9.2 Soil Salination

In Cacheu and Oio, the soils mainly consist of Fluvisols and Acrisols. Key issues are dust deposition, brush fires, deforestation, soil erosion and overgrazing and salt accumulation. High salinity is especially a problem in low lying areas along the coast and estuaries. Accumulation of salts may cause salinity. An excess of free salts (soil salinity) is measured as electric conductivity (in dS/m) or as saturation of the exchange complex with sodium ions, which is referred to as sodicity or sodium alkalinity and is measured as exchangeable sodium percentage (ESP). Salinity classes for soils are presented in **Error! Reference source not found.**. Salinity affects crops by inhibiting the uptake of water. Moderate salinity affects growth and reduces yields; high salinity levels may kill the crop. Sodicity causes sodium toxicity and affects soil structure leading to a massive or coarse columnar structure with low permeability (Jones et al, 2013).

Table 25. Salinity Classes for Soils (https://www.agric.wa.gov.au/soil-salinity/measuring-soil-salinity)

Salinity class	$EC_{1:5}$ range for sands (mS/m)	$EC_{1:5}$ range for loams (mS/m)	$EC_{1:5}$ range for clays (mS/m)	EC_e range (mS/m)
Non-saline	0–14	0–18	0–25	0–200
Slightly saline	15–28	19–36	26–50	200–400
Moderately saline	29–57	37–72	51–100	400–800
Highly saline	58–114	73–145	101–200	800–1600
Severely saline	115–228	146–290	201–400	1600–3200
Extremely saline	>228	>290	>400	>3200

According to Jones et al, (2013), the majority of salt-affected soils develop where saline groundwater rises to the surface and dissolved salts accumulate in the soil through the evaporation of the groundwater. Salinity can occur even when the water table is two or three meters from the surface of the soil. When crops are irrigated by high saline waters or from flood waters, the salts are left behind in the soil and over time accumulate and must be artificially leached out of the root zone by applying additional water. Salination can be increased due to poor drainage or through the use of saline water for irrigation.

Given that the majority of the soils in Cacheu and Oio consist of Acrisols, wind and rainfall erosion is the major problems in upland areas especially in areas of poor agricultural practices (overgrazing and lack of erosion controls) and deforestation. Fertile topsoil if not covered with suitable vegetation is strip away by high winds and high intensity, short duration rainfall events. Leaching of salts from exposed soils can cause salination of runoff water and deposited sediment.

Coastal erosion along the northwest coast related to climate change and rising sea levels is also a concern. Coastal zones have eroded rapidly over the past few decades. In Varela, the shoreline has retreated by up to 700 m inland in the past 40 years. As a result of coastal erosion, trees and infrastructure have been disappearing gradually. Both rising sea levels and loss of mangroves have been cited as the cause of this problem (USGS, 2016). As the shoreline moves inland, groundwater is more exposed to salination.

1.4.10 Mitigation:

There are several approaches that can be taken to mitigate the impacts of saltwater intrusion into aquifers. These include:

- Groundwater management by managing the placement and withdrawal rates from wells located in areas prone to saltwater intrusion.
- Hydraulic barriers which include injection wells, leaky freshwater canals, and recharge basins to rise the water table so that a groundwater mound is formed to prevent saline water from intruding.
- The construction physical subsurface barriers positioned perpendicular to coast made of concrete, grout, bentonite, slurry walls, or sheet piles.
- The construction of barriers along the coast to prevent erosion and sea level rise.
- Desalination of brackish water to improve groundwater quality.
- Use of rainwater harvesting, dams and other structures as alternative water supplies.

Initially, the groundwater management alternative in Oio and Cacheu is the best alternative. Given the absence of large-scale groundwater fed irrigation schemes and withdrawal of groundwater mainly from shallow domestic wells and deeper municipal wells, now is the time to design and implement a groundwater management program. In support of such a management program, a stepwise approach is recommended:

Step 1:

- Working with DGRH, build local capacity within Oio and Cacheu to collect and analyze data collected from the existing monitoring wells.
- Develop a comprehensive understanding of the aquifer systems by analyzing geologic logs within the DGHR database and when possible, conduction aquifer tests to determine the hydraulic characteristics of the aquifer.
- Go beyond the work of Ferreira et al (2011) and through annual monitoring program, identify areas the prone to saltwater intrusion and the rate at which saltwater intrusion is moving inland.
- Working with local resident to develop alternatives to using wells such as roof top rainwater harvesting.
- Work with other nations which share the Senegal-Mauritania Basin to assist in the development of a groundwater management model. It should be noted that Diongue et al (2020) have performed groundwater flow modelling as a decision-making tool for water resource management in coastal areas in Southern Senegal. Extending such a model would be beneficial to both countries. Studies have also been carried out basin wide in the region wide basis by International Atomic Energy Agency (IAEA) (2017). Working with those involved would also be helpful.

Step 2:

In areas where saltwater intrusion is affecting wells, develop a pilot program to evaluate various barrier systems including hydraulic barriers using recharge wells, the use of recharge basins, and physical barriers.

1.4.11 Conclusions:

1. With rising sea level due to climate change, saltwater intrusion is potentially a major concern to the groundwater resources of Oio and Cacheu.
2. Saltwater intrusion can cause:
    - Corrosion of machinery and infrastructure such as fences, roads and bridges.
    - Poor health or death of native vegetation, leading to a decline in biodiversity through dominance of salt-resistant species, potentially altering ecosystem structures.
    - Reduction in crop yields by impairing the growth and health of salt intolerant crops.
3. Besides rising sea level, saltwater intrusion can be caused by overpumping aquifers.
4. At this time, using the GALDIT evaluation system, the main area of high to moderate vulnerability to saltwater intrusion is in the region of the Cacheu National Park along the Cacheu River with the remainder of Cacheu and Oio having low to very low vulnerability.
5. With sea level rise, areas of high and moderate vulnerability will expand to the north.
6. The Cacheu River is heavily influenced by tides that bring brackish and salty water inland for over 100 km. Development of new wells in the alluvial along this river could be subject to saltwater intrusion.
7. One of the major concerns for the utilization of groundwater from both shallow and deep aquifers for irrigation especially during periods when there is a rainfall deficit during the dry season is the potential for saltwater intrusion as well as the depletion of aquifers. A database has been established by DGRH and has been populated with over 800 wells with water levels and chemistry data. Data indicates that salinity values in wells are mainly high along the coast and the lower portions of the Cacheu River with specific conductivity values ranging between 359 and 466 µS/cm which are in drinking water standards.
8. High salinity in soils is especially a problem in low lying areas along the coast and estuaries.
9. The majority of salt-affected soils develop where saline groundwater rises to the surface and dissolved salts accumulate in the soil through the evaporation of the groundwater.
10. High tides and storms causing sea water to breach rice paddy dykes is also a major problem causing the salinization of soils.
11. Upland erosion due to high winds, high intensity short duration storm events, and deforestation can cause exposed soils to leach salts which can cause salination of runoff waters and sediment.
12. Coastal erosion in Cacheu is causing the shoreline to move inland and will eventually cause the movement of the saltwater wedge inland.
13. Approaches to mitigating saltwater intrusion the use:
    - Groundwater management by managing the placement and withdrawal rates from wells located in areas prone to saltwater intrusion.
    - Hydraulic barriers which include injection wells, leaky freshwater canals, and recharge basins to rise the water table so that a groundwater mound is formed to prevent saline water from intruding.
    - The construction physical subsurface barriers positioned perpendicular to coast made of concrete, grout, bentonite, slurry walls, or sheet piles.
    - The construction of barriers along the coast to prevent erosion and sea level rise.
    - Desalination of brackish water to improve groundwater quality.
    - Rainwater harvesting, dams and other structures as alternative water supplies.

1.4.12 Recommendations:

1. Working with DGRH, build local capacity within Oio and Cacheu to collect and analyze data collected from the existing monitoring wells.

2. Develop a comprehensive understanding of the aquifer systems by analyzing geologic logs within the DGHR database and when possible, conduction aquifer tests to determine the hydraulic characteristics of the aquifer.
3. Go beyond the work of Ferreira et al (2011) and through annual monitoring program, identify areas the prone to saltwater intrusion and the rate at which saltwater intrusion is moving inland.
4. Working with local residents to develop alternatives to using wells such as roof top rainwater harvesting.
5. Work with other nations which share the Senegal-Mauritania Basin to assist in the development of a groundwater management model. It should be noted that Diongue et al (2020) have performed groundwater flow modelling as a decision-making tool for water resource management in coastal areas in Southern Senegal. Extending such a model would be beneficial to both countries. Studies have also been carried out basin wide in the region wide basis by International Atomic Energy Agency (IAEA) (2017). Working with those involved would also be helpful.
6. In areas where saltwater intrusion is affecting wells, develop a pilot program to evaluate various barrier systems including hydraulic barriers using recharge wells, the use of recharge basins, and physical barriers.

1.5 Coastal Management and Conservation

Guinea-Bissau's coastal areas are a hotspot of economic productivity. With about 80% of the nation's population and the majority of the food production of the country concentrated on the coast (Plano Director do Gabinete da Planificação Costeira 2011), Guinea-Bissau's economic development puts great pressure on its coastal natural resources. Yet Guinea-Bissau's coastal terrestrial and intertidal areas are ecologically rich and diverse, a habitat for flora and fauna that support local and regional livelihoods and provide resilience to coastal communities. Because of their ecological value at the national and regional level, the Government of Guinea-Bissau has increased its interest over the years in prioritizing initiatives, programs, and legislation to conserve and recover this fragile region while ensuring its economic productivity.

This section describes the current state of mangrove ecosystems in Guinea-Bissau, with a focus on the administrative regions of Cacheu and Oio, including the extent of mangrove protection, trends of mangrove loss, main anthropogenic drivers of degradation and loss, the impacts of climate change, and current mangrove restoration efforts. A socio-economic assessment of important value chains in the coastal areas, including rice cultivation, cashew production, fisheries and coastal tourism, is integrated into the analysis of coastal areas.

The coastal region is dominated by low-elevation plateaus and depositional sediment banks along estuaries partially covered by mangroves, 'bolanhas' (rice farming on former mangrove soils), pastures, and salt flats. Due to their low elevation, extensive areas of the coast are influenced by tidal and saline conditions. Furthermore, the coastal areas not covered in mangroves are typically dominated by unconsolidated sandy soils, being highly vulnerable to erosion without vegetation to stabilize them (NAPA 2006). The coastal region of Guinea-Bissau is therefore susceptive to degradation, a threat that can be exacerbated by the impacts of climate change.

1.5.1 Flooded rice ponds (bolanhas, or mangrove rice):

Bolanhas are flooded lowland rice farming systems in cleared mangrove flats, constructed as a system of small dikes to keep saltwater out of the crop and retain rainwater. The system of bolanhas covers over 19,000 ha of land, 24% of which is located in the administrative regions of Cacheu and Oio. While rice production supports livelihoods, the construction of the bolanhas entails the loss of mangroves and thus of the loss of habitat for local fish and crustaceans, key for the subsistence of local communities. Rice is grown during the rainy season (June to October) when rainwater accumulates, whereas bolanhas are used to grow herbaceous vegetation or for cattle grazing during the dry season (November to May).

1.5.2 Coastal bush savannahs:

Scattered shrub formations on sandy soils along the North-Northwest coastline. These can be mixed with agricultural activities such as oil palm cultivation and sand bolanhas. The extent of savanna vegetation has increased over the years due to landscape deterioration (NAPA, 2006). If land degradation is extensive, coastal savannahs become salt flats or bare soil with low herbaceous vegetation adapted to saline conditions.

1.5.3 Assessment of the mangrove ecosystem status

Mangrove swamps are the most important vegetation formation in Guinea-Bissau's coastal zone (Plano Director do Gabinete da Planificação Costeira 2011). Despite its small surface area, 10% of Guinea-Bissau's territory is covered by mangroves, making it the country in West Africa with the second largest mangrove area (326,087 ha) after Nigeria, conferring Guinea-Bissau's mangrove areas international importance (INDC 2015). These mangroves are a habitat for numerous birds, mammals, and marine species of ecological importance, as well as fisheries that the regional livelihoods depend upon. Mangroves also provide coastal communities in Guinea-Bissau with basic livelihood products such as food (e.g., mollusks and fish, mud for salt production), medicine, energy, and construction (García del Toro and Más-López 2019).

Two main types of mangrove communities can be identified in the country (Correia Jr. et al. 2018): dense mangroves dominated by the genus Rhizophora characterized by their large size and dense crowns, and semi-dense mangroves dominated by the genus Avicennia, small and often shrub-sized mangroves. These two types of mangroves occur in monospecific stands and are mixed with other mangrove species (e.g., Laguncularia racemose or Conocarpus erectus, among others; Catarino 2004). While mangrove trees in the region vary between 0.5 and 13 m tall, the majority of the trees are within the 4-10 m height range (Simard et al. 2019).

1.5.3.1 Historical and recent mangrove deforestation

Cacheu is the administrative region with the largest mangrove coverage in Guinea-Bissau, with 105,442 ha (Global Mangrove Watch 2016) or about 23% of its land coverage, representing a third of the country's total mangrove area. Oio, on the other hand, has 10,919 ha of mangroves, representing 2% of its land surface. Historical mangrove coverage data from FAO (2007) shows a increse in mangrove deforestation trends in the country, with 11% mangrove loss in 1990-2000 and 5% mangrove loss in 2000-2005. In the last 20 years, the country has maintained a balance between mangrove area gains and losses, with a total net coverage increase of just 1% between 1996 and 2016 (Global Mangrove Watch, 2016), suggesting that net gains have occurred in the last ten years that compensate from some of the earlier losses in land coverage. This balance is the net result of (1) losses from land conversion, and (2) gains from natural regeneration of abandoned agricultural lands as well as mangrove encroachment due to climate change (Plano Director do Gabinete da Planificação Costeira 2011). While Cacheu has shown a similar trend in the last 20 years, Oio has experienced a slight mangrove loss of 4% coverage over the last 20 years at an average rate of 0.21% per year. Despite this apparent maintenance of the net mangrove area, a recent Normalized Difference Vegetation Index (NDVI) assessment of the "greenness" of the mangrove coverage reveal that the mangrove forest is undergoing degradation and loss, even within protected area boundaries (García del Toro and Más-López 2019).

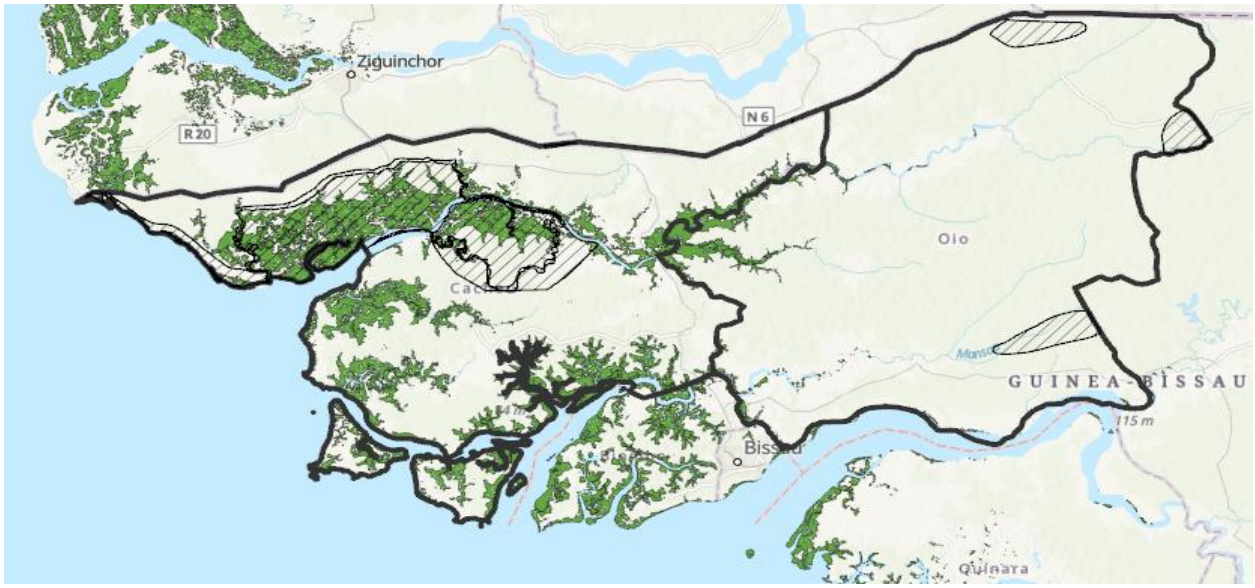


Figure 44. Mangrove coverage (green) in the administrative regions of Cacheu and Oio, delineated in black. Stripes represent currently protected areas in the two regions. Mangrove coverage data from Global Mangrove Watch (2016); delineation of protected areas from Cardoso 2015.

1.5.3.2 Mangroves in Guinea-Bissau are carbon sinks

Mangrove ecosystems store significant amounts of carbon in their biomass and especially in their soil. A recent study on soil carbon stocks in mangrove areas in the Northern region of Guinea-Bissau suggests that mangrove soils in Cacheu might be more carbon-rich than those in Oio (485 ± 33 and 252 ± 38 t CO_2e per ha in Cacheu and Oio, respectively; Andreetta et al. 2016). The degradation and loss of mangrove swamps, therefore, results in the net increase of greenhouse gas (GHG) emissions to the atmosphere. Guinea-Bissau's 2019 Proposed Forest Reference Emission Level estimated that the loss of mangrove biomass through land conversion yields 114.5 tCO_2e emitted per ha, whereas half of the soil carbon stocks can be lost at depth when the mangrove is converted to rice production (Andreetta et al. 2016).

Recognizing the ecological and socio-economic importance of its mangrove ecosystems and their role in supporting coastal stability in the face of climate change, the Government of Guinea-Bissau has included mangrove conservation as a priority action within the Coastal Management Plan. Furthermore, Guinea-Bissau's recognizes in its Intended Nationally Determined Contributions (INDC 2015), Proposed Forest Reference Emission Level (FREL 2019), and National Programme of Action of Adaptation to Climate Changes (NAPA 2006) that its mangrove ecosystems are important carbon sinks in their biomass and soils and a priority climate change adaptation strategy. To date, 86,755 ha of mangroves are protected in Cacheu (
), representing 82% of its current mangrove area. No mangrove areas are currently under protection in the administrative region of Oio. The Cacheu Mangroves Natural Park, established in the 1980s, remains one of the most extensive mangrove areas of West Africa (García del Toro and Más-López 2019).

Table 26. Protected areas in the region of interest with mangrove coverage (Cardoso 2015).

Name of the Protected Area	Designation	Total area (ha)	Mangrove area (ha)
Cacheu Mangroves Natural Park (PNTC) & Rio Cacheu Mangroves	Ramsar Site, Wetland of International Importance and Natural Park	79,150	37,550
Pelundo	Faunal Reserve	37,555	10,159
Varela	National Park	6,692	713
TOTAL		123,397	48,422

1.5.3.3 Anthropogenic drivers of mangrove degradation and loss

Despite the historical rates of mangrove coverage change in the country, the exploitation and degradation of mangrove areas have intensified over the years, particularly in the Northern region (Correia Jr. et al. 2018). These factors are increasing Guinea-Bissau's coastal vulnerability, facilitating coastal erosion, and leading to the loss of vital livelihoods for the local communities.

Collection of fuelwood and other wood products

Households ('moranças') use wood products for fuel and construction. Mangrove wood is one of the most used materials, representing 31% of the house frame construction wood and 43% of the roofing material. The landscape damage caused by wood extracting activities is particularly evident in the lower catchment of the Cacheu River (Plano Director do Gabinete da Planificação Costeira 2011). The collection of mangrove fuelwood, on the other hand, represents 70% of the household's regular fuelwood source and is considered to be sustainable in the region, as the majority of mangrove fuelwood is taken from lying or standing deadwood (Figure 42; Lima de Faria et al. 2014). Mangrove wood is also frequently collected to smoke fish for household consumption and commercial purposes.

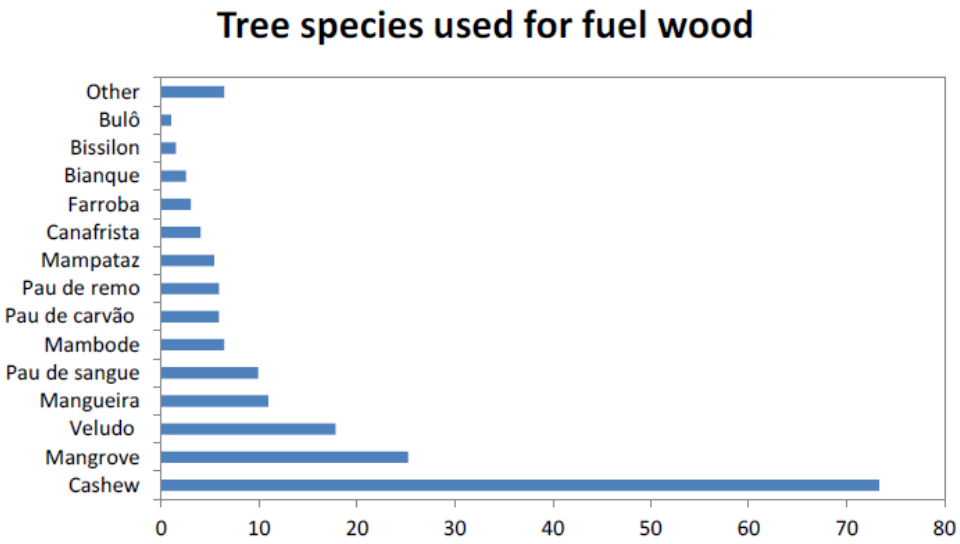


Figure 45. Sources of fuelwood as described in a survey of 195 households in Cacheu, in and around the Cacheu Mangroves Natural Park (PNTC). Graph from Lima de Faria et al. 2014.

Rice

Rice is the most important food in the diets of the population in Guinea-Bissau representing 75% of food intake. Domestic rice production only meets about 55% of the estimated demand of 200,886 tons in 2018, requiring rice imports at a cost of $US 36 million per year (Coalition for African Rice Development, 2019). The National Rice Development Strategy was designed to achieve self-sufficiency in rice cultivation by 2020, but actual production falls far short of this goal. With anticipated population growth driving demand, production would need to be tripled by 2025 to achieve self-sufficiency in rice production. To increase production, attention to several links in the rice value chain is needed: increasing productivity (currently average rice productivity in Guinea-Bissau is 1.7 tons per hectare, compared to productivity in other countries of up to 10 tons per hectare); reducing post-harvest losses; and addressing inefficient rice markets (Coalition for African Rice Development, 2019).

As the Cacheu and Oio regions account for 80% of Guinea-Bissau's rice production (NAPA 2006, BUR 2019), efforts to increase rice productivity will need to be focused in these regions. This will be a considerable challenge, given the condition of the bolanhas and the shifting of cultivation to cashew. The Government estimates that less than 50% of the mangrove area cleared for bolanhas is used for agricultural production (NAPA, 2006), evidence for the need for a more sustainable land use planning that guarantees coastal resilience. Furthermore, the bolanhas in the Northern region have suffered extensive degradation and loss of rice productivity over the last decades due to the impact of the independence war (1963-1974), the rural exodus and the concomitant bolanha abandonment, and the impacts of climate change. The recovery of the bolanhas was pursued after the

independence war with limited success due to poor design and landscape assessment (Plano Director do Gabinete da Planificação Costeira 2011).

In an effort to recover agricultural rice production in former mangrove areas, large-scale dams have been built, yet they often have limited success in recovering or increasing bolanha's productivity due to the inability to avoid saltwater flooding. The two most effective measures for increasing productivity are increased fertilizer applications and augmenting rainfall with efficient drip irrigation during the dry months (FAO, 2019). As discussed in the freshwater assessment, the development of irrigation sources needs to be carefully managed to avoid exacerbating soil salination associated with breaching of dikes with saltwater in adjacent coastal mangroves.

Cashew

While data on hectares planted to coastal areas in Guinea-Bissau are limited, it is useful to examine the cashew value chain for several reasons. First, cashew is Guinea-Bissau's only agricultural export and the value of cashew per hectare far exceeds that of rice cultivation. Revenue from sale of raw cashew nut accounts for 43% of rural household income and 76% of households outside of the capital plant cashews (World Bank, 2019). Thus, as rice productivity declines due to soil salination, farmers may abandon bolanhas to cultivate cashew further inland.

There are a number of problems in the cashew nut value chain that impede its potential to add even more value for farmers and the country. Most importantly, although Guinea-Bissau has the potential to process 25,000 tons of raw cashew nuts, processors lack the financing to buy raw cashews and almost all exports are of raw cashews, a lost opportunity to increase the share of total value earned by Guinea-Bissau farmers and processors. As noted by the World Trade Organization, Guinea-Bissau receives only 1% of the sector's value despite 10% of world installed capacity (WTO citation needed). Cashew is also important from a fiscal perspective as taxes and fees on cashew generate 11% of State revenue. However, the high rates of taxation create incentives for smuggling of raw cashews through ports in Senegal and Gambia.

As noted in the World Bank report, productivity of cashew orchards can be increased through improved management practices such as rehabilitation and renovation/replacement of older, less productive trees, improved management of pests and disease (World Bank, 2019). In addition, cashew producers can build their adaptive capacity to droughts through the development of irrigation to augment rainfall concentrated during the summer months.

1.5.4 Fishing

Guinea-Bissau's numerous estuaries are an important habitat for spawning, refuge, and nursery of regional fisheries in Northwest Africa and near-shore waters are rich with commercial species, attracting a large foreign fleet and providing employment for approximately 255,000 people in Guinea-Bissau (Intchama et al., 2018). The fisheries sector is divided into an industrial sector comprised of foreign vessels and some foreign vessels flying the flag of Guinea-Bissau. The industrial fleet accounts for the largest share of landings but adds limited value to GDP for Guinea-Bissau and limited employment for Guinea-Bissau nationals. The industrial sector is estimated to account for 92% of the total annual catch of 370,000 tons in Guinea-Bissau but only about 2% of this amount is reported to FAO (Intchama et al., 2018).

The small-scale fisheries sector is comprised of artisanal, subsistence, and recreational components, generating 6% of GDP and providing 35% of animal protein intake for Guinea Bissau (Intchama et al., 2018). The artisanal fleet is composed of Senegalese style (nhominka) pirogues and smaller Pailão pirogues and dugout canoes, powered by sail, oars, or small outboard engines, operating primarily in the 12-nautical mile zone designated as national waters by Guinea-Bissau. Most artisanal fishers are engaged in agriculture and fish on a seasonal basis for bonga shad (E. fimbriata), meager (Argyyrosomus regius) and shrimps. The artisanal fleet in 2015 includes 312 Nhominkas pirogues and 573 Pailao pirogues and dugout canoes (Intchama et al., 2018).

Information on the subsistence and recreational components of the small-scale fisheries sector is limited as these fisheries are unregulated. Subsistence fishing includes line casting from the shore and shellfish collection (oysters), conducted mainly by women to supplement household diets. Recreational fishing is focused on sport fishing for species such as barracudas and cobia. Total catch for the small-scale fishing sector, reconstructed on the basis of fishing equipment, fishing effort, and tourist data was estimated at 32,170 tons in 2010, increasing to 44,700 tons in 2013, then declining to 27,800 tons in 2017 (Intchama et al., 2018). The fisheries sector has the potential to add value, employment, and make a positive contribution to food security in Guinea-Bissau but there are three basic challenges. First, the industrial sector is poorly monitored and there is a significant illegal fishing component and violations of the 12-mile zone by foreign fleets which adversely affect catch rates by the artisanal

sector and could lead to degradation of biodiversity-rich fishery (Intchama et al., 2018; Plano Director do Gabinete da Planificação Costeira 2011). The country acknowledges the existence of irregularities in the licensing and control of industrial fishing activities that are severely impacting the conservation of the fishing resource and leading to the potential expansion of fishing into vulnerable coastal areas. Second, the national sector is undercapitalized both in terms of the number of boats and more importantly, equipment such as small motors which allow fishers to cover a greater range. However, investment in the sector is anticipated to exacerbate the potential for overfishing and along with the collection of mollusks and crustaceans, is understood to be a potential driver of degradation of coastal ecosystems, especially when socio-economic pressures and inefficient regulation lead to overexploitation of the mangrove resource. The Government is cognizant of the importance of preserving extensive areas of mangroves along the coast to ensure the prevalence of one of the most important shelters and nursery grounds of West Africa's crustacean population, currently threatened by illegal overfishing activities (Plano Director do Gabinete da Planificação Costeira 2011; NAPA 2006).

1.5.5 Tourism and coastal development

Despite being a rural country, Guinea-Bissau has experienced an expansion of its urban centers in recent decades, leading often to the backfill of mangrove areas to accommodate for urban and industrial (e.g., hydroelectric) development. Urban growth also leads to the expansion of transport needs which, in the case of Guinea-Bissau and especially in Cacheu, includes the expansion of roads and of navigable waterway systems that can impact severely coastal and estuarine mangrove ecosystems. Coastal urban development has also led to the contamination of mangroves nearby urban areas due to the inappropriate dumping of garbage and sewage.

The occupation of areas previously occupied by mangroves to expand touristic activities and development of resorts has not traditionally encountered restrictions in some provinces of Guinea-Bissau (e.g., Biombo and Cacheu). The construction of roads to access these tourism centers have often impacted mangrove hydrology and vegetation cover severely due to hydrological restrictions and/or mangrove clear-cuttings, increasing the vulnerability of the area to coastal erosion.

1.5.6 Weak environmental legislation

Inland and marine protected areas within the National System of Protected Areas of Guinea-Bissau expand to 750,000 ha (BUR 2019). While coastal communities around the Cacheu Mangroves Natural Park understand that the protection of mangroves safeguards fish and abates the erosion of the bolanhas (Lima de Faria et al. 2014), the country needs a robust policy for the use and exploitation of mangroves that includes artisanal and industrial fishing, impoundments that lead to the siltation of watercourses, pollution, logging, and over-exploitation of the mangrove resources (Plano Director do Gabinete da Planificação Costeira 2011). In addition to the enforcement of policies that preserve the resource, Guinea-Bissau's legislation makes mandatory the reforestation of native species affected by logging, which is directly applicable to mangrove swamps. This legislation, however, has been poorly enforced in the country, putting the regeneration of logged mangrove species at risk.

1.5.7 Climate change context

Accelerated sea level rise due to climate change is one of the major concerns for coastal communities. Without appropriate coastal vegetation buffers such as wetlands (i.e., tidal marshes and mangrove swamps), coastal urban and agricultural development is vulnerable to increased flooding and saltwater intrusion. This impact would therefore carry significant costs to households, infrastructure, industry, and food production systems along the coast. This threat is potentially high in Guinea-Bissau, whose coastline is dominated by low-elevation plateaus. The presence of coastal wetlands can mitigate the impact of increasing sea levels in two ways: (1) retaining water and slowing down its flow inland, functioning like a sponge and reducing the frequency and impact of flash floods, and (2) accumulating soil and sediment thanks to their productive biomass, elevating the ground in the long-term as sea level rises (Mitsch and Gosselink 2015). With the expansion of the tidal influence into the upland ground, coastal wetlands are able to "migrate" inland as long as no physical barriers that stop the expansion of propagules and tidal waters exist. When inland migration is not possible, these wetlands can disappear into the open water if the rate of sea level rise is higher than the rate at which these ecosystems are able to accumulate sediment and soil.

Guinea-Bissau has a permanent tide station in Bissau that recorded in the last month[16] a tidal amplitude of 3.8 m, i.e., ± 1.9 m from the current mean sea level. The highest tide registered in that same period was 3.7 m above the

[16] Data accessed on September 15, 2021. Available at: https://www.tide-forecast.com/locations/Bissau-Guinea-Bissau/tides/latest

current mean sea level. IPCC's AR6 sea level rise predictions suggest an increase in 0.3 to 1.2 m by the end of the century in Guinea-Bissau, with a likely scenario of 0.5-0.6 m increase[17]. These projections indicate that all coastal land below a 4.5-5.0 m elevation is at potential risk of regular flooding. The lack of reliable local surface elevation area precludes the accurate assessment of the extent of the area under risk and its current land cover. The presence of mangroves, however, would be expected to mitigate that loss.

1.5.7 Coastal restoration efforts

The 2021-2023 Degraded Area Recovery Plan (PRAD) is designed to enhance the restoration, conservation, and sustainable management of Guinea-Bissau's forests to be more resilient to the impacts of development and climate change. The Plan includes mangrove swamps as a key component of the restoration strategy, as these forests remain in need of protection and restoration despite recent stable mangrove area trends (Global Mangrove Watch 2016) and represent a significant carbon sink within Guinea-Bissau's climate mitigation strategy.

The Plan intends to restore over 3,000 ha of degraded mangrove forests across the country through assisted natural regeneration (i.e., restoration of tidal hydrology) and the plantation of propagules where necessary. The target degraded mangrove areas are the abandoned bolanhas along the coastal region, concentrated in Cacheu and Oio. Restoration activities will begin in July and extend through the rainy season. Restored mangroves will essentially recover the forest community structure of natural mangroves swamps in the region, i.e., Rhizophora sp. in the most frequently inundated areas of the coastal plains and Avicennia sp. upstream (IUCN-GEF Project Document "Protection and Restoration of Mangroves and productive Landscape to strengthen food security and mitigate climate change").

In addition to this initiative, Guinea-Bissau's 2019 BUR lists several coastal projects in Cacheu and Oio that aim to strengthen the national climate mitigation strategy, namely, "Project for strengthening the Capacity for Protection of Mangrove rice fields against high tide Water Invasion", "Coastal Zone Erosion Monitoring Project", "Fisheries and Coastal Resources Protection, Conservation and Valorization Project", or "Project for Rehabilitation of Mangrove plots for rice growing in Tombali, Quínara, Bafatá and Oio". The Cacheu Mangroves Natural Park is also undergoing mangrove restoration to recover mangrove coverage in abandoned or degraded bolanhas within and around the perimeter of the Park (Wetlands International 2021).

1.6 Vulnerability Assessment

This section focuses on one of the three assessments specified in the terms of reference to establish the climate rational for the proposed GCF project: Vulnerability assessment of the target beneficiaries (including their selection criteria). The vulnerability assessment conducted by the Winrock team is structured to assess vulnerability as first defined by the Intergovernmental Panel on Climate Change (IPCC) in the Third Assessment Report – Climate Change 2001: Impacts, Adaptation, and Vulnerability and applied in USAID's adaptation guidance, the Climate Resilient development Framework. Following the discussion of the methodology employed in the VA, the analysis builds on results of the VA conducted for Guinea-Bissau's National Adaptation Programme of Action (2006). Topics covered in the analysis include the selection of climate risks, discussion of non-climate stressors which can exacerbate climate vulnerability, and assessment of exposure, sensitivity, and adaptive capacity.

1.6.1 Methodology

In framing the VA, the following elements are discussed: the definition of vulnerability and its components, the state of vulnerability germane to the proposed GCF project, measurement of vulnerability, and specification of target beneficiaries.

1.6.1.1 Definition of Vulnerability

Climate vulnerability is the propensity or predisposition to be adversely affected by climate stressors. It is a function of a system's exposure, sensitivity, and adaptive capacity. Vulnerability increases with increased exposure, and if exposed, increases with increased sensitivity. Adaptive capacity is a combination of the strengths, attributes, and resources available to an individual, community, society, or organization that can be used to prepare for and undertake actions to reduce adverse impacts. Vulnerability is inversely related to adaptive capacity.

[17] Data available at: https://sealevel.nasa.gov/ipcc-ar6-sea-level-projection-tool

1.6.1.2 Vulnerability in the Context of the GCF Project

Vulnerability assessment can be viewed as the second phase in the development of a project or an adaptation plan:

- Phase 1: Scoping – In the first phase, climate and non-climate stressors are identified and the scope of the vulnerability assessment is elaborated in terms of beneficiaries and economic and social sectors to be evaluated. For the development of adaptation plans, all beneficiary groups and sectors would be included in the scope of the analysis. However, for the purposes of this report, the Winrock team has applied criteria to select beneficiaries and sectors for the analysis.
- Phase 2: Assessment of exposure – For each priority beneficiary group and sector, exposure to climate stressors is assessed. This is a rough screening exercise to narrow the focus of the assessment of sensitivity and adaptive capacity on groups and sectors with non-trivial exposure – if a group is not exposed, there is no vulnerability to that climate stressor.
- Phase 3: Assessment of sensitivity – For exposed groups and sectors, sensitivity determines if the exposure is significant. For example, agricultural and construction workers would be more sensitive to heat extremes than to workers in air-conditioned offices. Non-climate stressors can amplify sensitivity to climate stressors (these will be discussed later in this section).
- Phase 4: Assessment of adaptive capacity – for significantly exposed and sensitive groups and sectors, will adaptive capacity reduce or eliminate vulnerability to respective climate stressors?
- Phase 5: Analysis of impacts – how is vulnerability expressed in terms of impacts? While vulnerability is difficult to quantify (see discussion below), impacts can typically be quantified in physical terms or monetized.
- Phase 6: Analysis of project benefits – project components are specified to reduce adverse impacts of climate stressors on beneficiaries and sectors, mainly by increasing adaptive capacity or reducing sensitivity – exposures are geographically based and can only be addressed by relocating groups and sector activities away from the source of exposure.

The VA presented in this report covers the first four phases described above. In addition, information available in the Simplified Approval Process Funding Proposal (hereafter, FP) and Pre-Feasibility study pertaining to project components, beneficiaries, and potential benefits is used to prioritize beneficiaries for the analyses conducted in Phases 2 through 4.

1.6.1.3 State of Vulnerability

Vulnerability can be specified for analytical purposes in several ways. The most appropriate specification of vulnerability for the climate rationale is vulnerability to current climate, given the timeframe over which climate is expected to change and the structure of the proposed GCF project to generate impact for beneficiaries over the course of the project. However, vulnerability to climate change is also of interest in determining if project investments would contribute to reduced vulnerability over a longer timeframe. In the FP, the stream of potential project benefits is not described beyond the lifetime of the project.

Other options for specification of vulnerability are to focus on vulnerability in the absence of adaptive capacity (essentially, a focus solely on exposure and sensitivity) and vulnerability remaining after adaptive capacity is exhausted (referred to as residual vulnerability). For the purposes of this assessment, the main focus will be on current climate and to lesser extent on climate change.

1.6.1.4 Method of analysis

Four common methods for conducting VA include the following:

- Desk reviews – drawing on existing information and previous Vas
- Consultations with stakeholders and experts – this method was utilized to develop the VA for Guinea-Bissau's National Adaptation Programme of Action (NAPA) in 2006
- Stakeholder workshops
- Community-based analyses combining field research, consultations, focus groups and community stakeholder workshops

This report is based on a desk review of relevant literature, Guinea-Bissau reporting to the UNFCCC (National Communications, the initial Nationally Determined Contributions submission, and the recent Biennial Update Report), and the 2006 NAPA.

1.6.1.5 Assessment

The basic questions to be answered in the VA is how vulnerable are beneficiaries and sectors to climate stressors? Over 20+ years, vulnerability assessments have been conducted in conjunction with NAPAs, national adaptation plans and strategies, sector assessments, and for the design of adaptation assistance projects. Three types of vulnerability outputs have featured in vulnerability assessments:

- Reports on the nature of vulnerability and its components - exposure, sensitivity, and adaptive capacity – these reports summarize information on climate stressors, the analysts' understanding on the level of vulnerability, drawing on local knowledge and literature, as well as international literature pertaining to previous assessments.
- Vulnerability index – the analysis involves the construction of a composite index and requires analysts to determine how to weight different indicators of vulnerability. A vulnerability index is most useful for comparing locations, beneficiary groups, or sectors. However, it is not useful for assessing the impact of adaptation actions on vulnerability.
- Qualitative ranking – this is by far the most popular method for reporting on adaptation. Numerical scales are often employed to rate exposure, sensitivity, and adaptive capacity. Many studies express qualitative rankings in verbal terms – high, medium, and low. All qualitative ranking systems require normative judgment to differentiate different numerical scores or the difference between high and medium and between medium and low. Often, qualitative rankings of exposure, sensitivity, and adaptive capacity are combined to provide a "number" for vulnerability or vulnerability to multiple climate stressors is aggregated to obtain and overall "number" for the vulnerability of a beneficiary group or sector (approach used for Guinea-Bissau's NAPA). In both instances, the efforts to obtain a single "number" for vulnerability require an additional normative judgment on how components of vulnerability and/or vulnerability to different climate stressors are to be weighted. A common practice is to weight components or vulnerability to each climate stressor equally.[18]

For this VA, the Winrock team proposes a simple qualitative approach in assessing components of vulnerability using high-medium-low (H-M-L) judgments rather than numerical ranking systems. In addition, no effort is made to aggregate across the H-M-L scales to obtain an overall vulnerability rating associated with each climate stressor and beneficiary/sector.[19]

1.6.2 Analysis of Vulnerability

The presentation of the VA is organized according the four phases described above.

1.6.2.1 Phase 1 - Scoping

Scoping of the VA includes selection of climate stressors, discussion of non-climate stressors, and selection of beneficiaries and sectors for the analysis

Climate stressors

Vulnerability to a number of current climate/climate variability and climate change stressors is assessed. In the Guinea-Bissau NEPA, the following climate stressors were considered in the VA: 1) seasonal drought; 2) acute drought; 3) intense rains; 4) increase in ocean temperatures; 5) increase in atmospheric temperatures; 6) cyclones (emphasis on high winds); and average sea level. All of the climate stressors with the exception of the increases in ocean and atmospheric temperatures are related to current climate conditions and climate variability.

For this assessment, the following current climate/climate variability stressors will be analyzed as the drivers of vulnerability:

[18] There are two issues at play – the first is that averaging of the three vulnerability components suggests that they are equally important. However, the relationships between the components are not known and likely non-linear. Similarly, if one sector or beneficiary is extremely vulnerable to one climate stressor, averaging that level of vulnerability with its low level of vulnerability to other climate stressors leads its overall vulnerability to be reduced. Furthermore, the averaging of vulnerability across climate stressors is affected by the number of stressors assessed so that serious vulnerability to a single stressor is diminished in importance if more stressors are evaluated.

[19] For a scale of High-Medium-Low, there are 27 possible combinations for exposure, sensitivity, and adaptive capacity. The highest possible vulnerability is associated with High exposure, High sensitivity, and Low adaptive capacity and the lowest vulnerability is associated with Low exposure, low sensitivity, and high adaptive capacity. In general, vulnerabilities where exposure is high or medium, sensitivity is high or medium, and adaptive capacity is low or medium provide the strongest climate rationale for the project.

- Seasonal precipitation patterns – with rainfall concentrated in the months of June through September, seasonal drought may have been the phrase used in the Guinea-Bissau NAPA to describe the wet season-dry season pattern.
- Monthly precipitation variability – based on the trend analysis of monthly rainfall in Section 3, the precipitation variability of greatest concern is for the onset of the rainy season in May-June and implications for cultivation of crops to capitalize on Summer rains
- Intense rainfall – the Winrock team did not have access to daily precipitation data to assess trends in frequency and magnitude of intense rain. However, it was recognized as an important stressor in the agricultural sector in the Guinea-Bissau NAPA.
- Extreme high temperatures – these can affect crop production through increased evapotranspiration rates, livestock by increasing metabolic rates and water demand, and communities in terms heat stroke and exposure and increased water demand.

Storms – while cyclones and other storms are infrequent, the winds associated with them as well as high winds that occur on extremely hot days impact various beneficiary groups. Building on the analysis of climate projections in Section 4, three climate change stressors will be assessed:

- Increases in atmospheric temperatures – projections of average annual temperatures and maximum monthly temperatures
- Increased annual precipitation and changes in monthly precipitation
- Increased sea level rise associated with thermal expansion of oceans and melting of terrestrial ice and glaciers

Flooding can result from intense rainfall and cyclones. Localized flooding can also result during high tides, and over time, sea level rise will increase the frequency and severity of tidal flooding.

The most recent IPCC AR 6 report produces a spatially explicit estimate of sea level rise. It shows an average expected rise of 10 to 15 cm by 2030, 22-32 cm by 2050, and 50-60 cm by the end of the century with a potential range of 30-120 cm. In terms of potential damage, it is difficult to estimate. According to the Globalfloodmap.org, a sea level rise of 0.46 m could affect more than 420,000 people in Guinea-Bissau.

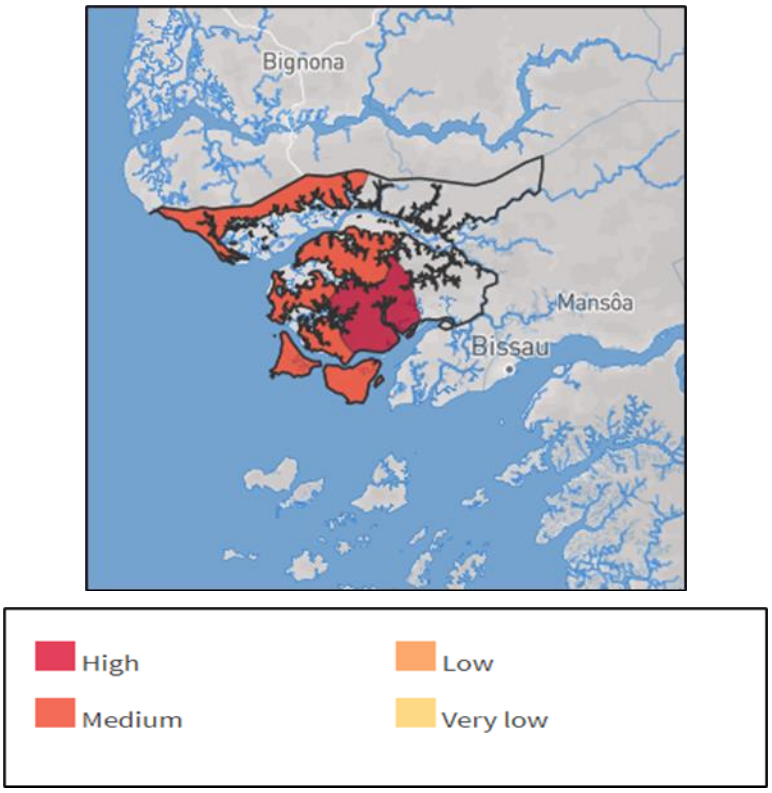


Figure 46. Cacheu River Flood Risk (https://thinkhazard.org/en/report/1388-guinea-bissau-cacheu/CF)

Non-climate stressors

Non-climate stressors are development challenges that can increase vulnerability because they harm the functioning of a system and the achievement of development goals. Examples of non-climate stressors include:

- Economic – rising prices, economic shocks
- Social – increasing crime, population displacement, population growth, urbanization
- Physical – poorly developed, aging, or poorly maintained infrastructure, substandard construction of buildings and roads Political – weak governance, legal or regulatory barriers, lack of investment incentives
- Environmental – unsustainable consumption of natural resources, deforestation, pollution

Selection of beneficiaries for the vulnerability assessment

The Winrock team's selection of beneficiaries for the VA considered three factors: 1) the groups targeted to benefit from project activities; 2) the number of beneficiaries in the target group; and 3) the potential benefits per beneficiary. The groups targeted to benefit from the project by component include:

Component 1 – Development of technical and institutional capacity of government and civil society – small-scale farmers building capacity to implement climate resilient agricultural practices; residents receiving improved climate information and enabling them to better prepare for and cope with climate extreme events.

Component 2 – Adaptation of water management towards climate risk in coastal zones – farmers facing saline water and soil salination, fishermen and tree nurseries, residents potentially benefitting from increased availability of drinking water and firewood-saving cooking stoves.

Component 3 – Building resilience of farming communities toward climate change – small-scale farmers including youths engaged in farming, post-harvest practices, and animal husbandry, entrepreneurs developing new businesses and farm household diversifying livelihoods.

The FP includes an estimate of the potential number of potential beneficiaries of project activities: 40,000 residents benefitting from awareness raising and enhanced preparation for extreme climate events; 8,500 small-scale farmers benefitting from capacity building on climate resilient agricultural practices, improved water management, improved climate information, opportunities to diversify income; 450 youth benefitting from opportunities in agriculture and business; and 110 community members and community based organizations receiving capacity building support on organizational operations.

Activities to support climate resilient agriculture and increase availability of water means will generate the greatest benefits per beneficiary for small-scale farmers. While the benefits per resident are smaller for awareness building, improved drinking water, and climate information, the sheer number of residents indicates that this is an important beneficiary group. While fishermen are not called out explicitly in the logframe or listing of beneficiaries, they could benefit from activities to rehabilitate and/or management mangroves and coastal nurseries. In addition, some project activities will benefit livestock operators.

In summary, the following beneficiary groups will be assessed in the VA: small-scale farmers, fishermen, cattle raisers, and residents.

1.6.2.2 1Assessment of exposure, sensitivity, and adaptive capacity

For ease of presentation, the three components of vulnerability – exposure, sensitivity, and adaptive capacity – are assessed for each beneficiary group. Thus, Phase 2, 3, and 4 assessment results are presented below and overall vulnerability for all beneficiaries groups is summarized in the concluding section.

Small-scale farmers

The table below summarizes exposure of small-scale farmers to the climate stressors selected for assessment.

Table 27. Exposure of small-scale farmers to the climate stressors selected for assessment

Climate stressor	Exposure (High, Medium, Low, No)
Seasonal precipitation patterns	High exposure • 99% of crop production in Guinea-Bissau is rainfed and the concentration of rain during the summer exposes crops to several months of limited rainfall in the dry season when the temperatures are also higher.

Climate stressor	Exposure (High, Medium, Low, No)
	• While farmers in many countries can plant two crops per year, the seasonal precipitation pattern limits farmers in Guinea-Bissau to one crop per year. • Yields of rice are 1.7 tons per hectare compared to 4.0 tons per hectare in Senegal. Similarly, average cashew yields in Guinea-Bissau are 320kg/ha compared to 520kg/ha in Côte d'Ivoire.
Monthly precipitation variability	Medium exposure • The delayed onset of the rainy season and planting of crops can expose crops to threat of lower yields • During the period 1990-2018, rainfall in May – the start of the rainy season – was highly variable. In Cacheu, May rainfall fell below 5 cm in 15 of 29 years and below 2 cm in 8 years. In Oio, May rainfall was less variable but fell below 5 cm in 7 years and below 2 cm in 3 years (see Section 3).
Intense rainfall	High exposure • Exposes coastal rice paddies to potential for lower yields, often requiring breaking of dikes to drain excess water from the fields • Loss of productive farmland due to Increased soil erosion rates and loss of soil fertility. • Potential for damage to dikes and other farm infrastructure.
Extreme high temperatures	Low exposure • High maximum daily temperatures increase evapotranspiration rates and water demand for crops and orchard crops. • Flowering and yields of cashew nuts and other orchard fruit and nut crops are affected by high temperatures.
Storms	Medium exposure • High winds associated with storms (and extreme high temperature can damage orchard crops such as cashew during flowering n January and February and once the fruit has set on trees. • Coastal storms with high winds and waves can result in flooding of rice paddies with salt water and damages to dikes, reducing rice yields.
Increased atmospheric temperatures	Medium exposure • Projected increases in annual temperatures and maximum daily temperatures will contribute to heat stress by increasing plant respiration and evapotranspiration rates and water demand for crops and orchard crops. • Increased exposure to pests and crop diseases • Higher average temperatures and daily maximum temperature could adversely affect flowering and yields of cashew nuts and other orchard nuts and fruits
Increased annual precipitation and changing monthly rainfall	Medium exposure • Projected increases in rainfall, concentrated during the rainy season, will increase incidents of flooding, increased rates of erosion, and reduced agricultural productivity • There is less certainty related to the monthly distribution of rainfall – a shorter rainy season would reduce yields
Increased sea level	Medium exposure

Climate stressor	Exposure (High, Medium, Low, No)
	• Sea level rise will increase exposure of coastal rice to saltwater at high tide and soil salination and increase salinity in rivers and shallow riverine aquifers – potential sources of irrigation • Sea level rise will likely lead coastal farmers to abandon rice production as the frequency of flooding due to storms and high tides increases.

Sensitivity

Current climate is already limiting crop and orchard production and climate change is expected to exacerbate exposure of small-scale farmers. The seasonal pattern of rainfall exposes crops and orchards to 7 to 8 months without rain and variability in the start of the rainy season can jeopardize potential crop yields. Intense rains also expose coastal rice crops to flooding and both short-term and long-term effects on soils.

For most of the climate stressors assessed, exposure of small-scale farmers is high or medium. Except for a few commercial farmers and small-scale farmers who have managed to diversify production to a portfolio of crops, farmers' exposure to current climate and climate change is made worse because of medium to high levels of sensitivity related to the following factors:

- Reliance on a single crop, such as rice, and the low economic margins due to low per hectare yields, increases sensitivity and the potential for major economic losses. Low yields are related to lack of access to fertilizers, cultivation practices, access to drought-resistant seeds and other chemicals, and most importantly lack of irrigation - only 1.38% of agricultural lands are equipped for irrigation.[20]
- Small-scale farmers lack market power as price-takers for rice and cashew and profits can be severely reduced due to market price fluctuations. High taxes and fees on raw cashews depress farm-level payments as buyers adjust willingness to pay to ensure profits.
- Limited ability to recover from flooding due to intense rainfall and high tides due to a lack of knowledge regarding land management and restoration techniques. More than 20,000 hectares of paddy rice have been abandoned to date due to ongoing challenges to maintain dikes and degradation of soil due to salination and erosion. Sea level rise can be expected to accelerate the abandonment of coastal rice cultivation. Rice farmers have increasingly shifted to cashew cultivation, where feasible.
- Cultivation and restoration efforts rely importantly on manual labor. Rural populations are aging progressively as younger populations move to urban areas in search of economic opportunity, reducing the pool of agricultural labor.
- Extreme weather events further weaken vulnerable farm families by destroying their livelihoods, reducing their purchasing power and reducing their resilience capacity already diminished by non-climate stressors such as poverty and limited access to basic services.

Adaptive capacity

Small-scale farmers have limited adaptive capacity to reduce their vulnerability to current or future climate due to a combination of factors specific to the farmers and the support provided by other value chain actors and the government:

- Farmers – limited information and knowledge of improved management practices and cultivation and marketing of alternative crops; limited access to banking or financial resources that would enable investments in climate resilient agriculture and irrigation; limited education and/or skills to diversify employment.
- Value chain actors – lack of high-quality production inputs, including advanced seeds and chemicals; limited capacity to transfer knowledge and provide training for farmers on management practices, technologies, and equipment.
- Government – extremely low investment in rural development, agriculture and infrastructure (irrigation, energy, and transportation) that would benefit farmers; limited agricultural extension services with no known interventions in the project regions – support for farmers reliant on international donors and NGOs; inadequate provision of climate services and early warning systems; lack of programs to incentivize farm-level investments, absence of crop insurance programs.

[20] Climate Smart Agriculture in Guinea Bissau, FAO 2019/ http://www.fao.org/3/ca5406en/CA5406EN.pdf

Fishermen

The table below summarizes exposure of fishermen to the climate stressors selected for assessment. Increased ocean temperatures has been added to the list of climate stressors for this beneficiary group.

Table 28. Exposure of fishermen to the climate stressors selected for assessment

Climate stressor	Exposure (High, Medium, Low)
Seasonal precipitation patterns	Low exposure • Salinity of coastal waters is higher during the dry season than during the rainy season when there are high flows of freshwater from the Cacheu and other rivers but there is no data to support analysis of impacts on fish and shellfish. • Salinity of brackish waters in mangroves will vary between the dry and rainy seasons.
Monthly precipitation variability	No exposure
Intense rainfall	Low-medium exposure • Soil erosion and flooding exposes coastal waters to turbidity that can result in low catch and temporary movement of fish away from the coast. • Intense rains can alter salinity of coastal nurseries for fish and shellfish.
Extreme high temperatures	Low exposure • Potential for curtailed fishing effort due to high temperatures • Potential effects on fish quality and processing.
Storms	Low exposure • High winds associated with storms have potential to temporarily curtail fishing effort and damage mangroves and coastal nurseries for fish and shellfish.
Increased ocean temperatures	Medium exposure • Projected increases in ocean temperatures is expected to alter the marine biodiversity and shift habitats to cooler offshore waters, requiring greater fishing effort (and increased used of motorized craft) to maintain or increase harvest levels • Reduced catch rates for shoreline casting and near shore harvesting of mollusks
Increased atmospheric temperatures	Low exposure • Potential for curtailed fishing effort due to extreme high temperatures. • Potential effects on fish quality and processing.
Increased annual precipitation and changing monthly rainfall	Low exposure • Modest changes in coastal and riverine salinity between rainy and dry seasons.
Increased sea level	Medium exposure • The rate of sea level rise will be critical in determining is coastal ecosystems can adapt – if not, mangrove and fish and shellfish nurseries could be adversely impacted. • Sea level rise will impact coastal housing for fishermen in terms of protection against tides and higher maintenance and repair costs, ultimately requiring relocation to higher ground.

Sensitivity

Exposure of fishermen to current climate is low and low to medium to climate change. However, it is useful to assess sensitivity and adaptive capacity because most fishermen are part-time, participating in the sector during the dry season when not engaged in agricultural activities. Strengthening the sector in terms of catch and its value will benefit farm households with additional income and make a positive contribution to food security by increasing availability of food protein.

Fishermen are sensitive to climate because of the structure of the artisanal fishing sector, with a majority of boats lacking power and size to enable fishing effort at greater distances from the shore to take advantage of the seasonal movement of commercial species and to reduce the number of days when smaller boats are at risk due to winds and fishing is not possible (see Section 2). Limited access to refrigeration and resources for processing reduces quality of preserved fish and its value in local markets.

Adaptive capacity

Current adaptive capacity of fishermen is low, owing to a lack of financial resources to invest to upgrade boats and fishing gear and to develop improved storage and process of the catch. As noted in Section 7, there is a role for government to play in monitoring and enforcement of the 12-mile zone reserved for Guinea-Bissau to enable determination and management of the fishery harvest on a sustainable basis. At present, with the artisanal fishing sector lacking better boats and gear, improved management of the fishery would not produce significant benefits. However, it would be a step in the right direction to protect the fishery to play an important role in the economy and food security of the country in the face of greater exposure to climate in the future.

Livestock operators

The table below summarizes exposure of livestock operators to the climate stressors selected for assessment.

Table 29. Exposure of livestock operators to the climate stressors selected for assessment

Climate stressor	Exposure (High, Medium, Low)
Seasonal precipitation patterns	High exposure • Livestock are highly exposed during the dry season in terms of water requirements In addition, even during the rainy season, rainfall must be captured and stored unless livestock watering is based on groundwater or surface water pumping. • For perspective on the required water intake needed for the growth of livestock, the following comparison to the water requirements to produce a kilogram of cereal (1,644 liters/kg) is as follows: milk (1020 liters/kg); eggs (3,265 liters/kg); chicken meat (4,325 liters/kg); sheep and goats (8,763 liters/kg) and bovine (15,415 liters/kg). https://waterfootprint.org/media/downloads/Report-48-WaterFootprint-AnimalProducts-Vol1_1.pdf. • Land degradation resulting from increased heat and reduced water availability is expected to decrease the quantity and quality of pasture areas available for feeding and watering of livestock, resulting in malnutrition and lower livestock production, as well as increased livestock mortality.
Monthly precipitation variability	Low exposure • A shorter rainy season or lower rainfall levels can tax water storage for watering of livestock.
Intense rainfall	Medium exposure • The primary concern would be drowning of livestock during floods. This would be less of a problem away from coastal and river flood zones.
Extreme high temperatures	Low/medium exposure • Most livestock have been bred and/or selected to survive for the range of temperatures observed. In extreme high temperatures, particularly if sustained for several days, feed intake is reduced, milk production declines,

Climate stressor	Exposure (High, Medium, Low)
	respiratory rates and water requirements will increase, and herds may suffer from lower reproductive performance. [21]
Storms	Low exposure • Storms with intense rains could expose livestock to drowning, similar to intense rains assessed above.
Increased atmospheric temperatures	Medium/high exposure • Projected increases in annual temperatures and maximum daily temperatures will increase water requirements for livestock. • Higher average temperatures could increase exposure to pests and diseases
Increased annual precipitation and changing monthly rainfall	Low exposure • Projected increases in rainfall, concentrated during the rainy season, will increase annual availability of water for capture and/or harvest, as well as enhance groundwater recharge. This could represent an opportunity for the livestock sector to build capacity to water livestock.
Increased sea level	Low exposure • Sea level rise will pose a risk to livestock that are grazed or penned in coastal lands, and lands near to river deltas.

Sensitivity

Exposure to seasonal dry conditions is high for livestock, made more severe because of limited sources of water during the dry season apart from rivers and streams. Where groundwater resources are relied on for watering livestock, conditions for management of livestock are also expected to decline, as groundwater resources are increasingly exploited or exhausted and freshwater aquifers become contaminated by saltwater during floods. In recent years, animal mortality has increased, especially for short-cycle animals in the regions, and local veterinary services do not have the technical capacity to deal with all problems linked to animal health.[22]

Increased heat also reduces the availability of agricultural residues and by-products necessary for feeding cattle. The decrease in natural pastures because of land degradation associated both with precipitation patterns and poor pasture management practices will put more grazing pressure on the remaining areas, contributing to the destruction of herbaceous vegetation and promoting bush development, which further diminishes the availability of forage.

Adaptive capacity

Livestock operators have limited adaptive capacity to reduce their vulnerability to current or future climate due to factors similar to those for small-scale farmers:

- Livestock operators – limited access and financial resources to treat disease and pest issues; limited access to information and knowledge of climate resilient livestock management practices; and limited access to banking or financial resources that would enable investments in irrigation and infrastructure.
- Value chain actors – limited development of veterinary services for livestock and chemicals; limited capacity to transfer knowledge and provide training for farmers on management practices, technologies, and equipment.
- Government – extremely low investment in rural development, agriculture and infrastructure (irrigation, energy, and transportation) that would benefit livestock operators; limited agricultural extension services with no known interventions in the project regions; inadequate provision of climate services and early warning systems; lack of programs to incentivize investments in livestock operations.

<u>Residents in Cacheu and Oio</u>

[21] "Impact of global climate change on livestock health: Bangladesh perspective," Zulfekar, Ali et al., Open Veterinary Journal, May 14, 2020. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7419064/.
[22] OSS, 2021.

The table below summarizes exposure to the climate stressors selected for assessment.

Table 30. Exposure to the climate stressors selected for assessment

Climate stressor	Exposure (High, Medium, Low)
Seasonal precipitation patterns	Medium/high exposure • The level of exposure depends on how residence access water for household, garden, or livestock purposes with households more exposed if they must travel to collect water from streams, ponds, rivers, or community standpipes.
Monthly precipitation variability	Low exposure • The delayed onset of the rainy season may impact the planting of vegetables and watering of livestock. If residents harvest rainwater, delayed start of the rainy season could require alternative sourcing of water.
Intense rainfall	Low/medium exposure • Over the period, 1987-2018, there were 4 major floods in Guinea-Bissau resulting in 5 deaths, and affecting 58,542 people • People residing in flood zones and people without access to flood early warning announcements are more exposed • Flooding can impact water supplies and increase the incidence of water-borne diseases such as cholera and diarrhea and enhance breeding of mosquitoes.
Extreme high temperatures	Medium/high exposure • The level of exposure is differentiated by location (higher maximum temperatures observed in Oio) and mainly affects the health of the population and outdoor workers and water demand as metabolic rates increase with higher temperatures.
Storms	Low/medium exposure • High winds associated with storms and flooding pose risks to people and infrastructure. In the case of flooding, people residing in flood zones will be more impacted.
Increased atmospheric temperatures	Medium exposure • Higher incidence of vector-borne diseases such as malaria and spoiling of food associated with higher temperatures. • Higher evaporation rates for surface water supplies with affect availability for household, garden, and family livestock.
Increased annual precipitation and changing monthly rainfall	Low exposure • The level of exposure depends on how residence access water for household, garden, or livestock purposes with households more exposed if they must travel to collect water from streams, ponds, rivers, or community standpipes.
Increased sea level	Medium exposure • Sea level rise will increase exposure of coastal and river delta residents to damage to dwellings during high tides and storms and ultimately require relocation to higher ground. • 303,307 people in coastal regions of Cacheu and Oio reside in areas less than 5 meters above sea level.

Sensitivity

The exposure of residents to current climate and climate change is highest for stressors related to water availability and high temperatures, given their impacts on health. Indirectly, the low level of productivity in food production associated with seasonal rainfall patterns affects food security in the project regions. Health conditions and food insecurity in the region are already poor because of non-climate stressors related to poverty and instability in food prices and are expected to worsen because of increased exposure to climate stressors.

Exposure is also negatively affected because rural communities of the Oio and Cacheu region have very low access to basic sanitation and health care services. Education and literacy levels are poor across the project regions, leaving little opportunity for economic advancement. Lack of knowledge and information transfer regarding climate change impacts and adaptive responses leaves populations sensitive to changing climate dynamics.

Adaptive capacity

Residents have very low adaptive capacity to address disruptions in the availability of water for household and garden purposes. Most of the wells in the region are shallow; if they are depleted during the dry season beyond recharge rates, they are easily contaminated. It is estimated that only 14% of deep aquifers in the regions have been exploited; however, the local population does not have the financial or technology capacity to access these deep resources.

Rural populations are primarily reliant upon unprotected, hand dug wells which have high rates of contamination, and often require significant travel (30 minutes or more) to access. While only 2% of freshwater resources available within the country are currently being withdrawn,[23] there is significant vulnerability for local populations who are unable to gain access to those resources due to economic challenges and lack of infrastructure for transportation of freshwater.

Adaptive capacity to reduce vulnerability to water shortages will require contributions of households, communities, and the government. The construction of household rainwater harvesting systems are not very high but most residents have no access to banking or financial resources that would enable them to make these investments (see Section 6). Community rainwater harvesting and storage in large tanks or cisterns could enhance adaptive capacity and development of groundwater resources and construction of community-level water catchments and ponds, led by the government would also increase adaptive capacity for residents.

The capacity of local people and the government to deal with natural disasters remains very weak and extreme weather events, which are increasing in frequency and impact in the context of global climate change, represent direct threats to the food and nutritional security of the target populations. Rural people do not have adequate knowledge of climate change or the capacity to prepare for extreme climate events as there is a lack of climate and early warning information.

1.6.3 Assessment of overall vulnerability

The analysis of vulnerability presented above deviates from many vulnerability assessments that focus only on long term climate change. However, in developing the climate rationale for the GCF project proposal, the Winrock team felt it was important to assess vulnerability to current climate and variability, recognizing that the analysis in support of a project is similar to the VAs that were conducted for NAPAs to assess urgent adaptation needs. As noted earlier, the VA conducted for Guinea-Bissau's NAPA in 2006 considered climate variability and climate change. In reviewing the NAPA, the Winrock team felt that the most important climate stressor related to urgent action was seasonal drought, or in our analysis, seasonal rainfall patterns. We observed that the underdevelopment of water resources in Cacheu and Oio regions is the most critical limitation to efforts to increase agricultural productivity and provide safe and sustainable water for residents.

Small-scale farmers are highly vulnerable to current climate and climate change, with medium to high exposure to most climate stressors. Crop production is highly sensitive in addition to being exposed, owing to current management practices and a number of non-climate stressors, while adaptive capacity to reduce vulnerability is low when assessed for farmers, value chain actors, and the government.

While overall vulnerability for two other beneficiary groups – fishermen and livestock operators are low and medium, respectively, these vulnerabilities are important because these production activities and interrelated to crop production as many rural households are engaged in growing rice and cashews, raising livestock, and if located in coastal areas, engaging in fishing on a part-time basis. Investments to increase the value added of the

[23] "SDG6 Snapshot in Guinea Bissau," United Nations, UN Water, 2021. https://www.sdg6data.org/country-or-area/guinea-bissau#anchor_6.4.2.

fishery and livestock sectors, as well as programs to create alternative income opportunities will enhance adaptative capacity of small-scale farmers.

The Winrock team rates overall vulnerability of residents in Cacheu and Oio as medium. While exposure is not as high as for small-scale farmers, medium to high sensitivity and low adaptive capacity suggest that this is an important beneficiary group to which project activities should be targeted.

In concert with this VA, the Winrock team reviewed several sources of vulnerability assessment results and one global study comparing climate vulnerability across selected countries. The pre-feasibility study, prepared by OSS cites two documents:

- The Guinea-Bissau NAPA includes a VA with results based on expert judgment and concluded that the most vulnerable group in Guinea-Bissau was small farmers, followed by cattle raisers, urban dwellers, and fishermen. This VA also assessed vulnerability for selected sectors, concluding that the most vulnerable sector was agriculture, followed by health and livestock, fisheries, and infrastructure.
- The 3rd National Communication on Climate Change referred back to the earlier VA for the NAPA. The report noted seasonal rainfall patterns, increased temperature, and increased humidity as drivers for vulnerability to crops, livestock, and public health.

To close this section, it is interesting to note that in a recent World Bank report, it was noted that Guinea-Bissau ranked second only to Bangladesh in terms of vulnerability to climate change among the 67 countries assessed by Verisk Maplecroft. The Climate Change Vulnerability Index was constructed by Verisk Maplecroft and considered three factors: 1) exposure to extreme climate-related events, including sea level rise and future changes in temperature, precipitation, and specific humidity; (2) the sensitivity of populations, in terms of health, education, agricultural dependence, and available infrastructure; and (3) the adaptive capacity of countries to combat the impacts of climate change, which encompasses, R&D, economic factors, resource security, and the effectiveness of government. https://www.maplecroft.com/risk-indices/climate-change-vulnerability-index/.

1.7 Baseline Assessment in The Pre-Feasibility Phase

The study took place in the Cacheu and Oio regions. Three tabancas were visited in the Cacheu region: Có, João Landim and Pelundo. In the tabancas of the S. Domingos area, also in the Cacheu region, issues were analysed through knowledge that the team of consultants have of the area and in discussions with the partners working in that sector. In the region of Oio, Ensalma, Nhoma, Djugudul, Mansoa, Missira-Manso, Missira-Bissora, Watini, Gã Lomba K3 were visited.

The meetings all took place in the respective tabancas visited. These meetings were attended by women members of the associations of the respective tabancas, young people and traditional authorities. The interviews were conducted in group settings. The introductory part was carried out jointly between men and women. In order to allow women to express themselves freely on the issues that affect them, they were interviewed separately from men.

About 30 people participated in the meeting in each tabanca.

It should be noted that the study was carried out in the context of a calamity due to the coronavirus pandemic. All precautions were taken in this direction, including the use face masks, hand washing, social distance and handshakes were avoided.

1.7.1 Cacheu region

All the tabancas visited in the Cacheu region use natural resources to satisfy basic needs.

João Landim's community does not have access to forests. The community of Có uses forest products to satisfy their needs, while the community of Pelundo uses mangrove, yam, horticulture and cashew crops. The communities living in other tabancas in the Region, such as Elalab, Eossor and Bulol depend heavily on ecosystem goods and services from the mangrove for their food security, income and to guarantee their traditional way of life. The populations of these locations, in a way, already diversify production due to issues related to the scarcity of space for production. This aspect may slightly decrease the pressure on certain ecosystems and could be an asset for the project.

The communities of the southern part of the Cacheu River (João Landim, Pelundo and Có) practice agriculture chiefly for (subsistence) food. The yields obtained from agricultural production are quite low, with the exception of Tabó de Có, where some additional income is obtained through the sale of vegetables in the nearest markets

(lumo de Canchungo and Bula) and locally. In the tabancas in the northern area of the Cacheu River, the income obtained from other economic activities (mainly oyster extraction, firewood and shellfish fishing) is mostly directed towards the purchase of rice to ensure food for the period of the year not covered by own production. Contrary to the rest of the country, in these tabancas (Elalab, Eossor and Bulol), there are no cashew cultivation areas on the plateau. The local communities exploit, to a limited extent, small palm groves to which they have access in order to extract palm oil, above all. Women, who are the main producers of palm oil, can benefit greatly from its extraction, if supported with the provision of equipment for this purpose.

The Elalab, Eossor and Bulol tabancas are located in the north of the Cacheu Region, in the Suzana Sector and in the middle of the mangrove coastal zone. Mangrove rice production systems (annual production) are essential. The tabancas of João Landim, Pelundo and Có are located in the south of the Cacheu Region and use the system of bas-fonds rice production. However, due to the degradation of the bas-fonds rice fields as result of increased salinisation, the populations resort to the production of plateau rice (Có and Pelundo). The seeds are of short cycle and come from farmers' own production of the previous agricultural year.

The immediate effects of climate change are reflected in the increase in sea water levels (the Elalab, Eossor and Bulol tabancas are isolated at certain times of the year when the tide rises), temperatures rise, strong winds and, the variability of the rain regime, with shorter rain seasons and greater uncertainty as to its beginning. All of these factors have led to the progressive abandonment of salted rice production systems and, consequently, declines in the amount of global production and by household in the locations visited. Inhabitants to these tabancas travel to neighbouring tabancas to supply themselves with drinking water, or resort to drinking water from rivers, deemed unsuitable for consumption.

When the bolanhas are flooded, due to an increase in rainwater (as it was this year), farmers break the dykes, opening channels for the circulation of water. It should be noted that all this work is done by hand. This type of action is, however, not always effective and the circulation of water continues.

The temperature variation observed mainly between the months of September and October has has negative effects on crops and on yields of rice, beans and vegetables. Strong winds experienced during the months of January and February cause cashew flowers to fall. In the months of August and September, rice plantations are knocked down. No known alternative (also on the part of the population) exists to protect crops when there is an excessive rise in temperature during the agricultural season.

In all the communities visited, pests have been a problem in the growth and yield of crops. In addition to native grasshoppers, there are several other types of pests that attack mainly rice and mangoes, between the months of September and October, almost every year. Other crops are also attacked in the months of November, December and January. Due to the lack of (technical) support, communities use traditional methods (burning used tires, fire) to combat crop pests.

The adverse effects of climate change have repercussions on economic life and on the health of populations. In relation to economic activities, these effects impact cashew cultures, the production of vegetables, the production of mancarra and rice and the sale of local products. The production of cash crops is increasingly insufficient to ensure the feeding and education of children throughout the year. Alternatives are necessary, especially in terms of income-generating activities. These negative effects may discourage the production of certain crops if the population is not supported. Regarding health, there is an increase in malaria and respiratory diseases.

The communities in these locations currently suffer from reduced rice production and can currently only cover the needs of 2 to 4 months of consumption. Many soils are no longer productive and have been abandoned. In Có, many families have abandoned their fields and started looking for soil in the plateau to produce rice or grow cashew. In the communities of the southern zone of the Cacheu Region, in addition to rice crops, other food crops are cultivated (corn, mancarra, beans). In the communities on the north side of the Cacheu River, only rice is cultivated. The rice varieties used (local variety and Cablack) are usually short-cycle and more adapted to the scarcity of water resulting from variability and reduction of the rainy season due to climatic changes.

Most tabancas store seeds for the production of the following year. The tabancas of João Landim and Pelundo sometimes obtain seeds through NGOs and the Ministry of Agriculture. The Pelundo community also borrows seeds from neighbouring communities that occasionally have certain amounts of excess seed. Working with seed farmers/multipliers on seed spreading adapted to the phenomena of climate change is recommended.

Due to the decrease in rice production, children, pregnant women and the elderly eat one meal a day. In the Có community, these groups eat two meals a day. As food insecurity and the prevalence of malnutrition increases, populations could face serious problems.

Climate change has greatly affected animal production and health. In recent years, animal mortality has increased, especially for short-cycle animals. The veterinary services in the area do not have the technical capacity to deal with all problems linked to animal health.

In relation to initiatives linked to adaptation to the impacts of climate change, the population of the communities of João Landim and Pelundo dig traditional wells without any technical support, nor a management plan for this resource, when water is scarce during the agricultural season. These waters are often unfit for drinking. In other communities, no alternative exists.

Communities in the Pelundo and Có tabancas use (chemical) fertilizers (NPK and urea) to enrich the soil of cultivated land for horticulture. These fertilizers are bought mainly in the lumos/markets, without knowledge of the type of fertilizer being bought. Knowledge regarding the application of fertilizer doses according to soil fertility is scarce.

In terms of capacity building, none of the communities have received training or awareness from the Government, NGOs or grassroots associations on the subject of adaptation to climate change.

Health

In the Cacheu region, the situation is almost identical in relation to other regions in the country, with little or almost no health centres in the local communities. In the tabanca by João Landiim and the tabancas that are north of the Cacheu River, the sanitary infrastructures are mostly in an advanced stage of degradation, without drinking water and electricity. The region's current health situation is characterized by a population affected by enormous difficulties in accessing health care.

In Elia, there is only one basic health unit, which is not functional. The nearest working health facility is about 12 km away in Suzana or São Domingos. This reflects the general isolation of locations located north of the Cacheu River and their limited access to services, including health services. In some communities, there are community health units (K3, Elia, Mansoa, Pelundo, Có, João Landim, Nhacra) and some NGO infrastructure (AD, VIDA, KAFO, AIDA, Evangelical Church) to support the populations.

The diagnosis made during the field mission shows evidence of the prominent weaknesses in infrastructure and sanitary equipment in the region due to several structural factors such as lack of funding from the public health system, lack of maintenance of existing infrastructure, extremely limited access to drinking water and electricity. The institutional capacity of the ministry is weak and inter- and intra-sectoral coordination is fragmented and ineffective.

With regard to the main pathologies in the region, field visits confirm that malaria, diarrhea and pneumonia are the most frequent diseases in the sectors, especially during the rainy season. The population of the region has enormous difficulties in preventing recurrent epidemics of these pathologies. The health situation is very worrying. Certain aspects could be supported by the project, especially with regard to the rehabilitation of infrastructures and the strengthening of the capacity of basic health agents.

Drinking water and sanitation

Access to drinking water is the central element, referred to transversally. In certain areas of the Cacheu region, there are tabancas with some traditional wells that have been improved, but many of them are not operational and are unable to respond to the regular needs of the population (João Landim, Có). In several tabancas (Elalab, Eossor, Pelundo and Bulol), there are no improved sources, only traditional shallow wells, distributed by the bolanhas. Women have to walk long distances for water supply, transported in 25-liter containers between the water point and houses. The excavation of the wells is done without well-defined technical parameters or a hydrology plan.

The use of water by the members of the household is associated with hygiene, food preparation and better health results. However, the task of commuting to collect water is still considered an extremely arduous task. For more than a third of all households, it takes longer than 30 minutes to reach the water source and bring it back, with less and less water being carried each time.

Gender

In the Cacheu region, it is important to address the gender disparity aspect. During field visits, certain complexity was noticed on the part of women in speaking in the presence of men, especially their husbands or the heads of tabanca (tabanca by João Landim, Pelundo). This aspect deserves attention in order to support political, legislative and judicial actions to guarantee respect and rules that favour equality between men and women. The participation of women, at all levels of society, is necessary to consolidate peace and democracy, to manage conflicts, as well as to facilitate the state-building process.

Women's economic empowerment should be seen as an important driver for economic growth that needs to be accompanied by better access to financial services, productive resources such as land with agricultural tools, trade and the creation of micro-enterprises.

When analysing the livelihoods of women, in all neighbouring places, they have shown to develop income-generating activities such as horticulture, salt production, artisanal fishing, fish smoking, the production of roots and tubers, the collection of cashew nuts and the production of wine and brandy, as well as the collection of non-wood forest products. These activities contribute to the family economy and ensure basic needs (health and schooling for children). And this takes place even though women have yet to have the full right to access land, to manage production and redistribute it.

In all of the sites visited, the role and responsibilities of women have increased at the productive level, without a decrease in domestic obligations and accountability for family livelihood. Women have increasingly contributed to the family economy. Women's decision-making power, both within the family and at the community level, is, nonetheless, still weak and limited.

Commonly held beliefs, perceptions and stereotypes related to women in the communities visited are that women should care for the children and the elderly and that they should not be overly educated. Commonly held beliefs, perceptions, and stereotypes related to men in the same communities are that men should take care of their families financially are responsible for controlling their wives. Men are perceived to need more time than women to rest.

During the field mission, the number of women engaged and participating in local meetings was very significant. In all the communities visited, women stated that they participate in large numbers in debates in the different meetings held in the village. Their opinions, however, are often not taken into account in the final decision. In the communities of João Landim, Pelundo and Có, both men and women participate in decision-making. Women are mainly concerned with issues related to the family, the education of children and family health. In the communities of João Landim and Pelundo, there are at least 2 women opinion leaders.

When asked about the mobilization of women in the tabancas, the response in almost all communities was positive. This reinforces their contribution and interest in building a space where they can develop their skills and strengthen their abilities to make themselves present in other spheres of society.

In all the communities visited, the coexistence among the population was good. Women stated that whenever there is conflict, they always try to talk to reach an understanding.

Attending school is the top priority for children in the sectors visited in the Cacheu region. With regard to access to education, no difference between boys and girls was stated. Everyone is entitled to the right to access education. It is girls, however, who tend to leave school earlier. Pregnancy and early and forced marriages are the factors that cause the greatest rates of dropout among girls.

In all sectors in the Cacheu region, it was possible to observe a certain level of social cohesion and autonomy with regard to horticultural production. In addition to horticulture, women also carry out other activities, such as palm oil extraction and rice production, which further contribute to their financial autonomy. This autonomy potentially allows for a certain level of tranquility and peace within the family.

When asked about improvements and development in the community, all women stated that there has been significant development in the area of education, infrastructure, health and sanitation. They pointed out that the number of children in school has been increasing over the years, the number of houses covered with zinc has increased, there is better access to the health centre in São Domingos, with a greater number of health workers. However, they also acknowledged the pervasive deficiencies in many aspects, such as the lack of material and human resources in the area of health and education.

As in the Oio region, the improvement of these indicators may be largely related to the positive impacts of cashew campaigns and remittances from emigrants, which significantly improves the income of rural households and their living conditions.

Usually, women and girls do the collecting of water for the family consumption, with men and boys being the biggest consumers. Although it is hard work for women and girls, there is no focus on the conflict.

The number of female heads of household was shown to be significant. This role entails keeping children in school, providing food, and children's clothing, which is often not an easy task, according to their claims. If they do not have any adult children, when they become widows, the garden that belonged to the husband becomes theirs. Most of the time, however, gardens are inherited by a family member on the husband's side, the eldest son of the husband who died.

When it comes to the right of land ownership, from a social and cultural perspective, men are the sole owners. For reasons of tradition and culture, women are hardly considered owners of the land. In some communities visited, there are women who own land, such as in Bachil, Cacheu sector. In terms of deciding how the money earned from selling the products, the main executors of this task are the women.

In the 6 tabancas visited in the Cacheu region, it is women who decide on the fate of the money they earn from selling vegetables, cashews and palm oil, lemon vinegar and others. This further reinforces the importance of the role of women in organization, development and security in rural communities. However, their financial autonomy is still seen as a challenge, as this is only possible when they are successful in selling their products.

Although most women do not own land, they are not restricted from access and use. And as for the exploration of natural spaces and resources, women need no authorization. As a rule, they own all the goods extracted from such space. In all the tabancas visited in the Cacheu region, women are the main users and beneficiaries of the exploited goods of the mangrove ecosystems (fish, mollusc, firewood, seafood and salt). They can freely decide on their final destination (consumption, marketing), and the results of their marketing belong to them.

Despite the difficulties caused by climate change, growing vegetables remains a sought-after resource to cover family expenses related to school, clothing and food for children. In relation to the management of agriculture, production is often managed in partnership. Men separate the rice for the next crop and for consumption, and the rest is left to the women/wives. In the Cacheu region, more precisely in the Có community, men have greatly improved his participation in horticulture, helping prepare the field and supporting in the construction of fences. The rice produced locally, currently only covers the needs of 2 to 3 months of consumption. In the other months of the year, imported rice is consumed.

Women from communities in the Cacheu region need training and support to carry out activities that can raise their income. They are need more opportunities to lead. Access to potable water, closing of the bolanhas, electricity in the tabancas and the development of horticulture are additional needs raised by them.

Men from the tabancas visited are mostly farmers, and most of the leaders are male. Some are also teachers, especially in the João Landim tabanca. Men also need training, especially in the production of agricultural products and aspects related to health and to the well-being of their families.

In the communities visited, climate change affected women and men mainly in terms of reduced incomes. For women, difficulties in accessing drinking water and increased stress in family life increases. Due to several problems related to climate change, food consumption has been significantly reduced, with families starting to eat only two meals a day. In most communities, this decision was made by the women, with the exception of the Pelundo tabanca where, in most families, the decision was made by the men and women together.

1.7.2 Oio region

All tabancas in the Oio region use natural resources to satisfy basic needs.

In the tabancas of Gã Lomba and K3 (Farim sector) of Nhoma and Ensalma (Nhacra sector), Watini and Missira (Bissorã sector), the main resources used to satisfy basic needs are rice, okra/soup, corn, mancarra, manioc, beans, and taro. In the Gã Lomba tabanca, and in the other tabancas visited, the production is entirely destined for food and in the K3 tabanca, cashew, watermelon and sesame are sold. The diversification of production is extremely important to mitigate situations linked to climate change.

The most used agricultural production system in the K3, Missira, Ensalma, and Mansoa tabancas is the saltwater bolanha. In the Gã Lomba, Watini, Nhoma, Mansoa and Djugudul tabancas, mainly freshwater bolanha are used.

In the communities of K3, Nhoma, Missira-Mansoa, communities also make use of plateau rice production systems.

The cultivation of mangrove rice is dominant and practiced mainly by men, but women play an important role in all tasks associated with rice cultivation. Other economic activities include the production of salt (K3 tabanca), small-scale fishing of coastal channels, small-scale production of vegetables, practiced by both women and men.

In the Oio region, in recent years, several bolanhas have been invaded by saltwater as a result of rising sea levels. As the land became unusable after such flooding, people had to change their activity. This is, however, not the only consequence of climate change in the region. Aquifers have less and less water and are also more easily flooded with saltwater. Additionally, the amount of rain per season in the past 5 years has not been enough for the cultivation of crops. Combined, the situation has contributed a significant reduction in agricultural production. The cultivation of staple foods, such as rice, has declined sharply. The production of cashew nuts, responsible for the income of the population of that region, has also suffered.

Bolanhas are “sacred spaces”. In addition to their protective role during floods, they also allow for the possibility of social cohesion around commitments related to social and environmental responsibility.

To prepare the land for agricultural production, dykes are built (Gã Lomba and the other visited tabancas) or forests are cleared before the rains (K3 tabanca). In the Nhoma tabanca, traditional bridges have been built. In Watini tabanca, each farmer cultivates a parcel of about $10m^2$. The Balanta, the main ethnic group visited in the Oio region, uses mainly mangrove areas for production, as they have strong knowledge of mangrove rice cultivation.

Some bolanhas are located near the rivers. These bolanhas are flooded whenever there is an abnormal increase in precipitation. When this phenomenon occurs, the population of Gá Lomba breaks down the dykes to open the channels. Sometimes there are discussions between the producers who use the plots in the high part and the producers who are in the low part of the bolanha. In the Watini tabanca, where the bolanha is inclined, communities are exempted from such concerns.

In addition to the issues of flooding and salinisation, variation in temperature and strong winds have also affected crops and yields. Between the months of March to June, there has been a great increase in temperatures in all the tabancas visited, sometimes burning the crops. In the K3 community, this phenomenon is also felt in August and September. Temperature variations and water stress mainly affect rice and, in certain cases, cashew. In the Nhoma and Ensalma tabancas, the temperature increase is felt in the months of March and April, reinforcing water scarcity. In the tabancas of the Mansoa sector (Mansoa, Missira and Djugudul), temperature variations did not affect crops.

Pests have also been a problem in crop growth and yield. The attack of local grasshoppers and other pests that are not known in the rice culture are quite evident, in rice panicle growth and in the watermelon and cashew flowering phase. However, in none of the tabancas visited were any techniques used to combat these pests. In the Nhoma, Ensalma and Missira-Bissorã tabancas, pests are also a problem in the cultivation of maize, attacking the leaves of the crop. In Watini, pests spoil pam-pam rice and corn. In the communities of the Mansoa sector, pests appear in maize, mango during the months of June and July, rice (drying of leaves) in the months of September and October. Cashew flowering is affected by similar issues in the months of March and April.

Like in the Cacheu Region, the adverse effects of climate change have had repercussions on the economic life of populations. In the tabancas of Gã Lomba, Nhoma, Ensalma, Missira-Bissorã, Mansoa, Missira-Mansoa, Djugudul, for example, it has affected rice production, the production and marketing of cashew and watermelon and the production of vegetables. The production of cash crops has not been sufficient to ensure children's food and education. The average consumption of local rice production is about 2 to 6 months, per year. And because the production systems are linked to rainfall, the population can only harvest once a year. The seeds they use are local varieties that are kept after harvest for the following year's Agricultural campaign

In Gã Lomba tabanca, horticulture is not practiced due to lack of water. The population is, however, interested in practicing it. In the K3, Djugudul and Missira-Mansoa tabancas, horticulture is already practiced, but generates little income due to lack of knowledge of production techniques. In Missira-Bissorã, horticulture is also practiced, but yields are low due to the lack of seealing in the perimeters. In Missira-Mansoa, horticulture is not practiced due to lack of space.

In addition to plant production, climate change has affected animal production and health. In all the communities visited, there was an increase in the mortality of animals, especially pigs, birds and large cattle.

With regard to the number of daily meals, children, pregnant women and elderly women eat two meals a day. In the Nhoma, Ensalma and Mansoa tabancas, these groups eat only one meal a day.

The populations of the K3 and Missir-Mansoa tabancas use chemical fertilizers to enrich the soil of the lands destined for horticulture and watermelon. They are not, however, aware of the application of fertilizer doses according to soil fertility. In the other communities, chemical fertilizer is not used.

These tabancas in the Oio region depend heavily on mangrove ecosystem services and are strongly aware of associated ecological problems such as climate change, impacts of coastal erosion and sedimentation of rivers and drainage channels. All these phenomena, aggravated by the average tides and the expansion of mangrove cultivated lands, are threatening the mangrove ecosystems and, consequently, the different livelihoods of the riverside populations.

The communities visited have never received any training or awareness from the Government, NGOs or grassroots associations on the subject of adaptation to climate change.

Health

In the Oio region (in all tabancas visited), health infrastructures present a very worrying situation due to several structural factors such as lack of funding in the public health system, lack of maintenance of existing infrastructures, access extremely limited to drinking water and electricity, weak institutional support from the Ministry of Health in the region, and weak inter- and intra-sectoral coordination.

Regarding the main pathologies in the region, field visits confirm that malaria, diarrhoea and pneumonia are the most common diseases in the sectors, particularly during the rainy season, and especially in children and women.

Drinking water and sanitation

In terms of drinking water supply, the situation in the Oio Region is poorer than in other regions. Access to drinking water is one of the biggest problems of the tabancas visited, with communities indicating general water shortages. When water is scarce, animals drink water from the bolanhas and traditional wells are dug by the populations for drinking water. Some tabancas have inoperative wells (Missira-Bissorá, Djugudul, Watini) and some only a single well for drinking water (Missira-Mansoa, K3, Nhoma). In Gã Lomba tabanca there is no well or water hole. Women often travel to neighbouring tabancas to obtain supplies.

In the visited rural communities of the Oio region, only the administrative structures and some houses have latrines. The bush is the main place for meeting such needs. Some environments are characterized by unsanitary and unhealthy conditions that testifies to the failure of the waste management system, greatly impacting the quality of life of citizens.

Gender

Commonly held beliefs, perceptions and stereotypes related to women in the communities are that women should care for the children and the elderly, should not speak too much in public, contradict their husbands, control money or goods, or be overly educated.

Commonly held beliefs, perceptions, and stereotypes related to men in the communities are that men should take care of their families financially, should not get sick, are responsible for controlling their wives and need more time than women to rest.

In Gã Lomba, community members reported that men and women share tasks.

Although most communities do not have a formal and legal association, those that do exist are a space where women discuss their problems openly. Asked who the opinion leaders in the community are, most women said they that the men were. In the Mansoa tabanca, however, there are women opinion leaders who have a very important role in making decisions related to the life of the village.

Women considered to be opinion leaders in the community are older women, who have no academic qualifications, are sometimes illiterate, but who have skills and experiences acquired over the years in mediation and counselling. The only compensatory measure that exists for these women opinion leaders is the respect that is reserved for them in the tabanca. Women in the communities stated that they participate in decision-making, above all linked to the financial aspects of the tabanca, as well as to family, income generation, education, health and tradition.

In all the tabancas visited, women stated that there is a certain level of social cohesion and that there are few situations of conflict. If there is a conflict situation in the community, it is resolved on the basis of dialogue through the council of elders. In some tabancas (K3 and Mansoa), the interviewees mentioned the existence of a protection committee (against gender-based violence), which is usually made up of men and women. The participation of women in protection committees facilitates their affirmation in the community in terms of voice, defence of women's rights, and social protection of women and girls.

In the communities visited in the Oio region, especially those of the Balanta ethnic group (Nhoma, Djugudul, Watini, Missia-Bissorã), the power of decision, organization and management, as well as judgment of disputes, belongs to the chief of the morança (within the extended family) and to the head of the tabanca and/or the tabanca committee (within the tabanca). The most relevant or controversial issues are taken by them to the council of elders for a final decision. The council of elders can be convened to analyse and resolve conflicts between traditional authorities (Balanta) who have the power to organize the life of tabanca and to judge the problems that occur in it.

The predominant activity sectors in most of the communities visited, especially in the Farim and Mansoa sectors are horticulture, rice cultivation and cashew production. Communities also practice production of palm oil, roots and tubers, and salt extraction. All of these activities have been affected differently by climate change. These phenomena of climate change have given women fewer opportunities for income and have made access to drinking water more difficult.

In addition to production activities, women in the family are responsible for household chores (cooking, looking after the children, washing, fetching water and firewood). Due to the volume of work, on average, women spend about 1 to 5 hours a day taking care of the family.

In recent years, when harvests have been poor due to drought or floods, families have reduced food consumption. There has also been a large number of family members emigrating, especially young people, to find work in urban centres and abroad. This decision is usually made by the husband and wife within the family.

In communities, women and girls travel long distances in search of water for family consumption, with men and boys being the biggest consumers. Within the family, no problems with regard to water consumption was made apparent. The points of water collection can be vectors of conflicts about water collection priorities. It is also a place where women talk about family and community problems.

There was a significant number of tabancas where women are heads of household. In the Mansoa sector, about 10 women are heads of household, and in the Farim sector, more than 10. Their role is to work to keep children in school, provide food, and clothing, which is often not an easy task, according to their reports. Despite this, when the husband dies, the wife is not entitled to the property of land left by the husband. These are generally inherited by the eldest son of the deceased husband (in the context of polygamy), the brother or other family members on the husband's side. The issue of land tenure for women not only contributes to social inequalities at the community level, but also has negative impacts on women's sexual and reproductive health.

In the communities interviewed in the Oio region, land is always owned by men, with no inheritance of land for women. However, in the Missira-Mansoa and Mansoa tabancas, there are women who have their own land/garden donated by her husband or father. Although the properties of their land are not legalized, they have been recognized by the committees (this represents an intermediary between the traditional system and the state system).

With regard to access to education, those interviewed stated that there is no long any difference in access between boys and girls (boys were given preference in the past). Both boys and girls are equally entitled to access to education. Although this equality exists, girls are the ones who leave school earlier in the interviewed communities due to early marriages and pregnancies. This behaviour was verified in all communities, but field visits showed this to the case mainly in the K3 tabanca.

During the interviews, in all tabancas, women stated that they are the ones who decide on the fate of the money they earn from marketing agricultural products. Usually, they use this money to pay for their children's school, to buy seeds, food, clothes or loan it to their husbands, for example. They expressed that they always communicate with their husbands about such things and show them the value earned, but that they are the ones who keep the money.

In lumos, women have control, above all, over the sale of products that are their initiative (agricultural and forestry). In general, men supervise but do not have full control over the income generated by women. The

income from collective or household production belongs to the household, even if it is paid by women (in the case of the harvesting and selling of cashew nuts).

The management of agricultural production is carried out, most of the time, by the woman (Nhoma and Ensalma tabancas). Women decide what to cultivate, when to cultivate and where to cultivate.

The preparation of the land for rice cultivation is carried out by women, as well as sowing and harvesting (in all communities). Usually, it is the man who decides how to share the produced rice for consumption, for the ceremonies and for the next sowing. Rice production never yields enough for sale. Production covers only 2 to 3 months of the population's food needs. As for the domestic consumption (household) of rice, the quantities used daily are determined by the women (housewives).

As for the needs of women, jobs, training and support for care delivery were highlighted, in addition to more opportunities to lead and carrying out activities related to horticulture and extraction of forest goods. Most men in the visited communities are farmers, some are teachers. Climate change is decreasing income and increasing family life stress.

In general, in both regions, rice fields (bolanhas) are essential for the livelihood and food security of local communities, and are threatened by several factors due to climate change, as described in the table below.

Table 31. Threats to rice production systems due to climate change

Threats	Causes	Consequences
Dykes built around the rice field to prevent seawater intrusion are weak	Rising sea levels; lack of knowledge/loss of adequate techniques; shortage of young and qualified labour; lack of access to qualified technical guidance and economic and technical means	Floods of saltwater due to rupture of the waist dykes and consequent loss of crops in their different phases
Increased soil acidity	Oxidation of the bolanhas during the dry season	Soil acidification often causes the soils of important agricultural areas to become infertile and sterile
Soil salinisation	Accumulation of soluble salts on the surface after evaporation	Soils in bas-fonds rice fields are often degraded through salinisation processes that can render the land completely sterile
Sediment deposits from plateau areas along rice fields	Forest degradation and deforestation upstream of bolanhas	Silting of drainage channels, cyclic flooding and the appearance of aquatic plants and weeds in rice paddies directly threatening bas-fonds rice fields
Lack of maintenance of water management infrastructures such as dykes and drainage channels	Lack of young labour available in rural areas	Affects the integrity and productivity of rice paddy
Delays in the beginning of the rainy season and irregular precipitation	Rainfall variability, including reduction and sudden increase in precipitation	Decreased levels of productivity and extension of rice fields to intact mangrove areas
Shortage of young labour in rural areas	Lack of alternative livelihood/economic opportunities in rural areas contributing to the exodus of young people to urban centres	Difficulties in maintaining the productivity of mangrove and bas-fonds rice systems
Relative loss of traditional knowledge linked to rice cultivation in mangrove soils	Lack of transmission of traditional knowledge between generations	Poor management of rice field agro-systems
Increased pressure in forest areas	Reduced productivity of mangroves and bas-fonds rice fields	Plateau rice cultivation by communities using cutting and burning techniques
Development of cashew plantations as the main national commercial crop	Absence of investment and access to agricultural credit	Deviation of interest and efforts by rural communities from rice production to cashew production contributing to the gradual replacement of forest areas with negative environmental impacts

1.7.3 Mangroves:

It is one of the priorities of the Strategy and National Action Plan for Biodiversity to: promote and to improve the traditional techniques of conservation and sustainable management of the mangroves ecosystem and their sources; intensify and improve the use of the best management practices for mangroves ecosystems through the research, education, training and incentives for the fulfilment from the communities and other intervening actors and; improve the opportunities and to promote alternative activities of income generating associated with the mangroves ecosystem and to intensify training and sensitization sessions and environmental education on the durable use of mangroves products.

Guinea Bissau has 338.652 hectares of mangrove, 2.5% of the world total. The mangrove ecosystem is the most representative vegetable formation on its coastal zone, covering 9% of the national territory. Guinea-Bissau is the second country in Africa, after Nigeria, with larger mangrove surfaces (GIRI, C. et al., 2011). This places it, proportionally to its size and coastline, among the first countries with the largest vegetation of mangroves in the world. The Cacheu River delta (project target area) has the most diverse mangrove cover on Africa's west coast, hosting about 60% of Guinea Bissau's mangroves. Between 1975 and 2013, mangroves decreased by 6.4%. In north-western Guinea Bissau (the project target area), coastal zones have eroded rapidly over the past few decades. The shoreline has retreated by up to 700 m inland in the past 40 years. Both rising sea levels and the destruction of mangrove forests, which act as natural barriers, have been blamed for the loss of land. Towns and villages located close to the shoreline, where most of the economic activity takes place, are likewise threatened. “Hence, preparedness — protection of existing natural barriers, monitoring of the coastline, and creation of alternative income opportunities is paramount” (Nicholls and Cazenave, 2010).

This ecosystem is essential for the rural communities and their preservation is imperative. More than 80% of Guinean people depend on agriculture for survival, and 45% of the rice-cultivated surface is mangroves rice (salty rice paddy) (MARD 2002). The women, while they fish or collect molluscs in mangrove forests, collect mangrove logs and/or the branches to be used as a source of energy for lighting and food preparation. Traditionally, the branches of mangroves are for fencing around houses and orchards. Honey extracted from mangrove forests is highly appreciated. Several other products of the mangrove ecosystem also appear among the most traditionally used resources in the Guinean coastal zone. The “madeira-de-sangue” blood wood (log and branches) is used regularly as construction material and fencing of the houses and yards and to make domestic furniture and workmanship; it is also used to produce salt and to transform fish. In the aerial roots of Rhizophoraceas, regularly submerged by the tides, grow the settlement of oysters and other molluscs, such as “Combés” (Anadara sinilis), “Ligron” (Tagelus adansonii), “Gandim” (Pugilina morio) and “Cunthurbedja” (Cymbuim spp.) emerge from the sandy and muddy substratum of the mangrove embroideries and in the sandbanks. Additionally, the mangrove ecosystems that populate the whole coastal zone are important hard winter places for many species of birds that come from the Northern Hemisphere. A well preserved and managed mangrove area represents a potential tourist pole as additional income generating activity for the communities.

The roots system of the mangroves forest is very dense and it fastens sediments, limiting coastal erosion and offering an ideal shelter for organisms of small dimensions. This ecosystem of great biological productivity still plays an important role in the food chain and in the repopulating of the marine and coastal resources.

Local traditional use of mangrove resources is implemented with specific management rules, including some that implicate the alternate exploitation of different margins according to reproductive calendars.

1.7.4 Firewood and charcoal saving cooking stoves:

The firewood saving cooking stove activity (Activity 2.2.2) focuses on acquisition, sensitization, and distribution. Improved cooking stoves (that meet established criteria) produced by community entrepreneurs outside the project will be acquired by the project. Their use will be introduced and the stoves will be disseminated in the project target communities.

The project team will create synergies with other ongoing initiatives implemented by CSOs/CBOs external to the project that are active in the target areas. This collaboration will contribute to the economic and social development of other communities, as project communities purchase and distribute their product, rather than compete. This, in turn, will reinforce the firewood saving stoves value chain in the target region.

In consultations with the National Institute for Applied Technology Research (INITA), the project team identified "Pobreza Zero" as being a reliable partner. Pobreza Zero is a small national Non-Governmental Organization (NGO) registered as Associação Pobreza Zero. It was established in 1/2/2009 by a group of then–young, newly graduated technicians of various specializations. They have thus far implemented social programs in the Quínara, Tombali, Cacheu and Oio Regions, as well as in Bissau. Their projects have been financed by UNDP-SGP, UNFPA and the EU through the EU-PAANE project.

They implement environmental projects (firewood and charcoal saving cooking stoves), community development projects, and awareness and sensitization campaigns to populations that are under stress as a result of industrial initiatives (phosphate in Farim and heavy sands in Varela); they also implement projects related to sexual and reproductive health.

Their target beneficiaries are local communities, especially women and youth.

In their experience with improved cooking stoves, they have mobilized women groups to produce 1.000 to 2.000 cooking stoves per year. Under a range of initiatives - between 2012 and 2019 - they organized the production, distribution and introduction sensitization of 7.000 cooking stoves.

"Pobreza Zero" was contacted by the project team and demonstrated willingness and availability to participate in this initiative, organizing the community-based cooking stove producers from their previous projects and supporting the project team on the related introduction/sensitization/follow-up actions.

1.7.5 Conclusion

During the study and analysis, it was concluded that most communities do not have basic health units. The few that are in place, are not very function and do not have agents to lead awareness campaigns related to health, community hygiene, vaccination and breastfeeding. In the Cacheu region, it can be deduced that the health centres in some of the visited communities were built with the support of emigrants' income or with the support of NGOs. Difficulty in accessing health services, and their generally low quality, puts the population, and especially women, in a situation of great vulnerability.

Access to education is a cross-cutting problem in all regions visited, aggravated in the case of girls, for whom the dropout rates are higher. All interviewees highlighted the importance that academic training represents for the development of a community. Women demonstrated a strong desire to improve the level of school knowledge of their children and to take advantage of the few opportunities that exist locally, in the field of training. All of them also expressed an interest in participating in literacy programs in the community. The low level of literacy among women represents a conditioning factor for their role and should be an element to consider in an empowerment strategy for this social group, ensuring literacy and minimum education programs.

The main social problems specific to women in the regions covered by the study are related to the number and diversity of tasks and responsibilities assigned to them. This is the main factor of overload for this group and, as a large part of their routine activities is related to the availability of natural resources, the reduction and/or the disappearance of these resources in the vicinity of the tabancas overburdens them even more. The task of collecting water for domestic consumption, another responsibility of women, obliges them to travel long distances to obtain supplies since sources in the communities are absent or inoperable. Water scarcity also greatly affects horticultural work. Women are forced to look for alternatives to ensure household food security and the traditional way of life. The fact that they generally do not inherit the land owned by their husbands is an additional hurdle and another experience of social injustice.

In the meetings held in all tabancas and with all social groups (women and men), it was clear that among all the different groups there is a strong aspiration to improve the well-being and conditions of the housing environment. Women highlighted the improvement of basic social services (water, health and transport) and the creation of economic opportunities as the first steps to overcome the state of poverty prevailing in the tabancas and to achieve their well-being and that of their families. At all meetings, the request for support for the facilitation of access to health services and to reduce the isolation of the tabancas visited was common.

The men expressed their aspiration to improve their condition and the living conditions of their families and are aware of the necessary efforts to achieve this. However, men showed a more resigned attitude towards the social and economic difficulties of their tabancas. They did not seem to place themselves at the centre of the dynamics nor did they see themselves as the main actors and promoters of the improvement of the socioeconomic conditions of their communities. They especially emphasized the need for support to promote an increase in rice production and to develop agricultural production.

There were no signs of emerging or existing conflicts between different ethnic groups and social strata regarding the use and sharing of spaces and resources.

The increase in emigration of young people to the capital is weakening the continuity of cultural practices in the communities. Women attempt to maintain cultural wealth through songs and dances.

In general, all populations are aware and show strong recognition of the impacts of climate change on the ecosystems of bolanhas. They see the need to take corrective measures to minimize the damage caused to the environment so that they can continue to enjoy these goods and services in the present and future.

In the regions of Cacheu and Oio, according to the field visits carried out, it was found that dozens of associations existed, formed mostly by women. However, most of these associations have very weak organizational dynamics. The main problems of these associations are:

- Lack of their legal recognition;
- Non-functional organs of the associations;
- Inexistence of statutes and internal regulations;
- Lack of knowledge of members concerning their roles and responsibilities;
- Savings banks that are not regularly available;
- Absence of a functional registered office;
- Difficult access to finance;
- Weaknesses in member capacity building;
- Weak support in production and marketing;
- Lack of technical and financial partnerships;
- Lack of administrative support from sectors.

In general, a certain social cohesion in the organizational and productive plan was observed in the meetings with the communities of both regions.

PROJECT

1.8 Introduction

Climate change is a global phenomenon. The particular situation in West Africa is grave and accompanied by additional crises of a very different nature. The sub-region's economic resources are still heavily dependent on the climate. Up to 70% of Sub-Saharan Africa's population lives off of agriculture. The sector is heavily dependent on rain for subsistence production and income generation. Even so, financial and technological resources are still lacking to mitigate or adapt to climate change. Countries in the sub-region, including sub-Saharan Africa, are among those to be severely affected if global climate change trends do not improve. For many development actors, adapting to climate change would be costly and stifling for developing countries. Therefore, inaction towards climate change cannot be an option for the state and its development partners.

Guinea-Bissau is considered the second most vulnerable country to climate change after Bangladesh. It ratified the United Nations Framework Convention on Climate Change in October 1995, the Kyoto Protocol in 2005 and the Paris Agreement in 2015 (COP 21).

The North and Northwest regions of Guinea-Bissau are currently subject to land degradation phenomena that are harmful to agricultural activities and water scarcity, negatively effecting populations and agro-forest-pastoral activities. Likewise, wetlands and coastal areas are increasingly subject to saline intrusion and silting of rivers, resulting in land degradation and leading to loss of biodiversity.

All of these facts have led to the progressive abandonment of salted rice production systems and, consequently, falls in the amount of global production and by household. The communities in these locations currently suffer from reduced production of bolanhas, which can only cover the needs of 2 to 4 months of consumption.

In response to the challenges mentioned above, the objective of the project is to reinforce the resilience of the populations and ecosystems of the target areas. In general, the project aims to tackle the identified challenges, developing the technical and institutional capacity of the government and civil society to address the increase in climate risk in planning adaptation to climate change (Component 1), increasing the resilience of existing agricultural production systems and diversification of production and income (Component 2) and promoting the dissemination of knowledge from lessons learned on climate resilient agriculture and adaptation planning to other coastal regions of the country and other West African countries (Component 3).

The results (R) of the projects are as follows:

- Result 1.1 A water and soil quality and quantity monitoring system is created and operational;
- Result 1.2 Technical capacity and integrated knowledge about low-emission and climate-resilient agricultural practices are strengthened among family farmers, development professionals and government experts;
- Result 2.1 The capacities of beneficiaries and CBOs related to climate change and agricultural production systems are strengthened;
- Result 2.2 Climate-resilient agricultural and livestock activities are promoted;
- Result 3.1 Communication and information on the water and soil quality and quantity monitoring system are disseminated;
- Result 3.2 Sustainable climate-resilient agricultural practices promoted by the project are systematized, known and capitalized and disseminated.

Cross-cutting method of implementation, inclusive and productive M&E:

The project is implemented according to management principles based on results, the lessons learned are disseminated and applied to future operations.

The project has a duration of 5 years.

1.9 Theory of Change Narrative

The theory of change (ToC) is a planning and evaluation tool, which allows: to involve the various stakeholders in the planning of change; to shift the focus of intervention from what has already been done to what needs to be done; to represent change processes based on what really happens and on evidence; to integrate activities and strategies; and finally, to attribute the effective impact to the intervention performed.

The theory of change explains how changes in the life of one or several groups take place over time and are related to each other along these paths, further identifying what interventions are necessary for the paths to be taken, as well as what evidence or indicators are used to measure the change that occurred during and after the journey. It shows how a vision or purpose inspires long-term change and how it guides a set of paths composed of intermediate changes.

It comprises four steps: once the vision is established and also the long-term goal or change, the preconditions (changes) necessary to reach that goal will be deduced, a process called chronologically inverted mapping of changes. Only after these two steps will the ToC be operationalized, associating indicators to the selected changes and defining intervention strategies. The final step is to summarize the TC in a narrative, which presents the map of changes, explains its rationale and assumptions and sets out the arguments for the intervention logic.

The ToC includes: the change map, a visual representation of the ToC, built from long-term vision and change and drawing chains of intermediate changes (preconditions); the rationale, which explains the relationships between changes, especially because each needs another as a precondition to take place; the monitoring grid, which associates indicator(s) with each change, to measure its evolution; the intervention plan, which indicates which intervention strategies are applicable (and eventually the specific activities and achievements) for the changes to take place; and the narrative, a document that gathers, around the map of changes, the explanations (assumptions and rational) with the operationalizations (monitoring and intervention).

The vision is situated in the long term and reflects an aspiration or purpose, formulated in a comprehensive way. Change, although intended to be long-term, is formulated in a specific, measurable, attainable and delimited way.

The key question when it comes to listing the changes is “shat has to happen in the context of the target audience of the intervention for the intended long-term change to take place?”. Changes are sought at all levels: society; institutions; relations; capabilities; attitudes and behaviours, among others. In relation to communities, the long-term change is related to the improvement of people's lives, the reinforcement of the communities' resilience in the face of climatic changes. At the level of government institutions and civil society, there will be a better technical and institutional capacity to deal with increased climate risk in planning adaptation to climate change.

When it comes to intervention strategies that can influence the succession of changes, it is important to start with strategies and only later, if conditions exist, detail specific activities and achievements. Although an intervention can causes a “domino effect” of successive changes, each sequence of changes usually requires a specific intervention.

Taking into account the main risks linked to the sustainability of the project's results, requires developing a theory of solid change for the future of the program.

This work must be done at three different levels in order to avoid weakness. The first level involves finding appropriate answers to the problems that will be raised. At the second level, it is imperative that ADPP-GB and its intervention partners reflect on the assumptions on which the theory of project change will rest. Finally, at the third level, it is critical to verify that the project is focused on the themes of adaptation to the effects of climate change and the resilience of rural populations in Guinea-Bissau, which convergences several themes (civil society, social cohesion within communities and between different communities and conflict transformation).

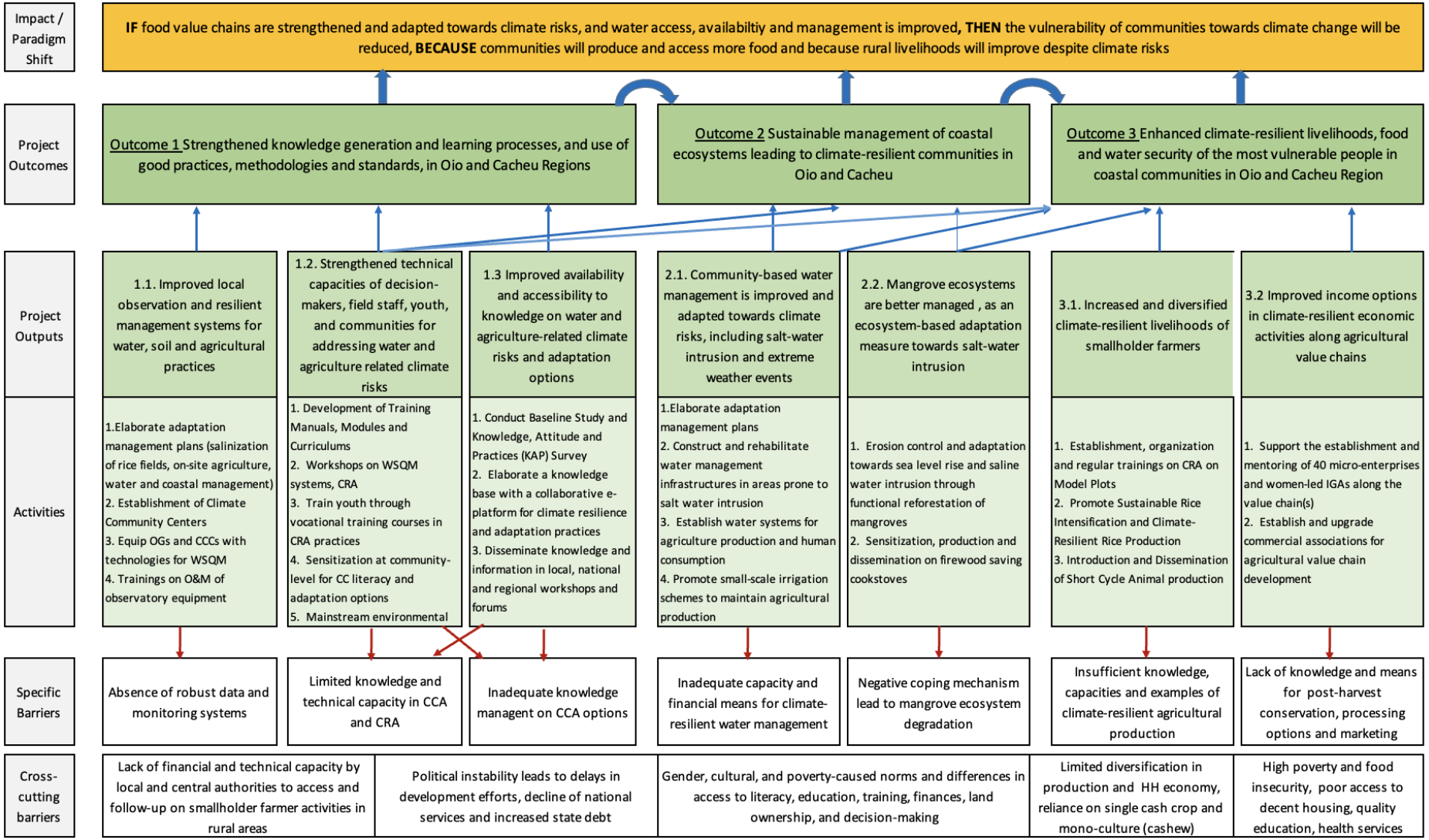
This approach reinforces the need to think about the theory of change while taking care to articulate and justify the changes that the program believes it will help to achieve, while specifying strategies to increase the likelihood of sustainability of the results.

A more particular effort should be made in four dimensions:

1. A more detailed understanding of structural constraints (cultural norms, real capabilities of decentralized and deconcentrated structures to perpetuate or publicize the project's achievements, etc.);

2. The implications of these constraints on the likelihood of moving from one level of result to another (between direct and objective results, between objectives and impact);
3. Monitoring the potential evolution of the hypotheses, because, although structural, they are no less dynamic;
4. The strategies to be implemented to minimize the potentially harmful consequences on the project, that is, on its ability to produce the expected results, in case certain assumptions prove invalid during implementation.

Present Project's ToC



1.10 Detailed Activity Description

The project "Adaptation of agricultural production systems in Coastal Areas of Northwest Guinea-Bissau" is composed of 3 components and will be implemented according to results-based management principles. Lessons learned will be disseminated and applied to future operations through an inclusive and productive M&A system.

Component 1 - "Development of technical and institutional capacity of government and civil society"

The Component is justified by state institutional and economic fragility, which hinders access for main, active stakeholders in the country to updated technical knowledge, technical support and orientation, data collection/processing and access to complementary information and tools to address Climate Change Impacts and Adaptation to Climate Change Impact solutions.

It is important to highlight that, apart from the project EE and EA expertise and the Technical and Management Units that will be set-up as a response to specific ToR requests of new perspectives and knowhow on the target subjects, by partnering the central government technical body, the project will provide a unique opportunity for discussion and systematization of existing knowledge (peer-to-peer model). The project will further promote actions, based on this systematized knowledge, to build the capacity of local technical staff, both in the private and public sectors.

All the work to be done under this component's output activities will be led by the project team, which is the Project Management Unit (PMU), with the technical orientation led by the Technical Support Team (TST), and executed by the project field teams in each target region. Project partner also include specific technical departments from the MoEB and MoA. Government institutions such as the Meteorology Institute and the National Institute for Agricultural Research (INPA) will be invited to participate, give technical advice and inputs to guarantee the alignment and appropriateness of the activities with national policy, legal framework and proven techniques and technologies at national level. Local authority extension workers will be invited to participate in the selected field to work side by side with the project's field team. Their involvement will contribute to build their institutional capacity, and to strengthen and reinforce ownership and responsibility of the project outputs and outcomes. For the partners' collaboration, per diems, transport fees and basic equipment will be provided by the project. ADPP-GB, as the EE and through its permanent staff, will oversee the project team (PMU and TST) performance, and be responsible for providing all necessary means to facilitate the project. OSS, as AE, will visit the project sites on a regular basis and will be regularly informed by ADPP-GB on the project evolution throughout M&E tools. OSS's technical expertise will be requested whenever necessary and constructive.

This component strengthens technical and institutional capacity while addressing key barriers to climate–resilient development. The component is aligned with GCF's RMF Outcome "A5.0 Strengthened institutional and regulatory systems for climate-responsive planning and development".

Outcome 1. Strengthened capacity and knowledge management to monitor and address water and agriculture-related climate risks in Oio and Cacheu Regions

Output 1.1. Improved local observation and resilient management systems for water, soil and agricultural practices:

Key Aspect	Description
Climate Problem to be addressed	This Output supports the enabling environment for addressing climate change adaptation in the target Regions, and thereby to any climate risk that manifests. A specific focus is on the key challenges in the area, being salt water intrusion (SWI) in the mangrove-rice ecosystems, and addressing adaptation and resilience building of subsistence agriculture practices.
Baseline situation	There are no mechanisms in place, nor being developed, at sub-national level for the capture, systematization and dissemination of data and knowledge on climate change impacts and adequate adaptation options.
Barriers Addressed	A. Absence of robust data and monitoring systems; B. Lack of financial and technical capacity by local and central authorities to access and follow-up on smallholder farmer climate change responses in the target area;

Adaptation Benefits	1. Improved data collection, which will lead to better informed CCA planning and interventions; 2. Enhanced cooperation among key stakeholders across sectors for CCA;

The EE's Project Team (PMU, TST, Field Teams) leads the activities under this output. Project Partners involved: OSS, IBAP, Ministry of Environment and Regional Offices, Ministry of Agriculture's technical General Directorates and Regional Offices, Meteorology Institute, INPA – National Institute for Agriculture Research, National Civil Protection Services. [24]

Activity 1.1.1. Conceptualization and operationalization of The Observatory Group* (OG) for climate-resilient agriculture (CRA) practices and technologies and water and soil quality monitoring (WSQM and integration of the OG activities in the national monitoring system):

*The Observatory Group's core function is to organise, monitor, collect and process water and soil quality data, salinity levels and climate trend data in the target areas and with the target communities.

The basic idea for the creation of the two Observatory Groups is to set up a regional mechanism, composed of technical expertise and equipped with basic tools, that will be dedicated exclusively to the coordination of data collection and processing at regional level and its connection/reporting to the central authorities. The data to be collected includes climate data collected which will contribute to specifically adapted technical solutions/responses to CC impact adaptation. These two regional groups will work together to coordinate methodologies and actions. They will communicate closely with local authorities at the regional level, work with the Meteorology Institute and National Civil Protection Services and connect the regional work- both agricultural and environmental data- with Central Authorities. The OG will coordinate the set-up of the "front line" or proximity monitoring stations within the Climate Community Centers (CCCs) structure. They will train and coordinate the work of the Community Observers (COs).

The COs are a group of farmers, working in the Farmer's Clubs, who will receive special training on data coaction and equipment management. Under OG supervision, they will collect selected data on the ground on a regular basis and report it to the OG. Simultaneously, they will act as Climate Focal Points in the community, disseminating climate warnings and recommendations as instructed by the project staff and the OG. They will participate actively in sensitization and awareness actions at community level (activity 3.1.1).

Their action will be part of the project, thus under the coordination of the Project Management and Technical Units.

In the project scope, and starting the OG and CO function, as soon as the proximity monitoring stations in the Climate Community Centers (CCC) are operational, the data analysis and conclusions will be shared/explained with/to the project target communities on a regular basis (how often will be defined as part of OG's conceptualization work). This sharing/explanation work will take place in the CCC, and the information will be repeated by the EE's project team and applied by the target farmers, with the support of the team, in the project's 170 community model fields (Activity 3.2.3.) on a day-to-day basis.

The EE's project team will be responsible for the establishment and provision of equipment and necessary assets for the 2 OG and the Proximity Monitoring Stations. Acquisitions by the EE team will be procured following the AE's procurement rules, policies and procedures, foreseen in the AE and EE grant agreement. Equipment will include, among others: office and IT equipment, vehicles, technical equipment for monitoring of water and soil quality and salinity levels; sets of Soil Quality Monitoring Kits. Equipment will be provided for each of the targeted communities.

[24] See table Chapter 5.2.

The conceptualization of the Observatory Group (OG) for climate-resilient practices and technologies and water and soil quality monitoring will cover the design/definition and development – led by the EE's project team in coordination with key stakeholders and Project Partners (technicians from the Min. of Environment, IBAP, Meteorology Institute, Min. Agriculture and the General Directorate of Water Resources – Energy and Natural Resources Ministry) - of an Observatory Group (OG); this will include the definition of both technical aspects (needed infrastructure – minimum place and transport means requirement, tools, required equipment, etc.) as well as operationalization (personnel, Operation and Maintenance Manual [MO&M], long-term sustainability, methodologies and operation). Systems for overall management and monitoring of data collected will also be included (at community-level as well as at CCC's level; more information in Activity 3.1.1). Although the detailed scope of the OGs and its mandates will be defined during and as a part of the project implementation process and in a participatory way, the OG's focus areas will include monitoring of water, soil quality and salinity levels, as well as defined local climate trends which are greatly impacted by climate change in the targeted coastal areas.

Two OGs will be established, one per target region: OG-Cacheu and OG-Oio. The main scope of work and focus of the OG will be developed under the coordination of the EE's project team (PMU), by the project TST (EE) and the previously mentioned Executing Partners, and will be defined in a ToR.

Special attention will be paid to ensure that women and/or people living with disabilities (PWD) are mobilized to form part of the OG teams. The mobilization and enrolment of these sensitive groups will be made through sensitization and awareness actions, identification of potential candidates in the target communities, meetings with the families, community and religious leaders. In these meetings, information will be presented on the value of their enrolment for the household, community and project outcomes, as well as the personal advantages of empowerment and capacity building. PWD will be assigned functions according to their individual capacity. The OGs will consist of two technical cells on climate trends, observation and monitoring, data collection and analysis. Each regional OG will train, manage and oversee the field observation, monitoring and data collection that will take place at the Proximity Monitoring stations which are connected to the project's 20 CCCs. The 20 CCC will be located strategically in the target regions; their exact locations will be defined according to data confirmation in the baseline study, which will take place during the project's inception phase. The OGs' work will be coordinated, from its inception, with the efforts of National Authorities, and will be integrated into their operations during the final two years of project implementation.

The validation of the Observatory Group for climate-resilient practices and technologies, water and soil quality monitoring, member composition and scope of work will include two OG ToR validation workshops, organized by the EE project team, that will be held with key stakeholders and experts - from both the government and CSOs - at national and sub-national level. The members of the validation group will be selected by the EE's project team (TST) and Executing Project partners involved in this activity and listed above. It is foreseen that the validation group will include an official/senior representative from the MoEB, MoA, Meteorology Institute, Directorate General of Water Resources, 2 or 3 representatives of prominent CSOs working in the same area, and, potentially, technical representatives from UNDP and the EU.

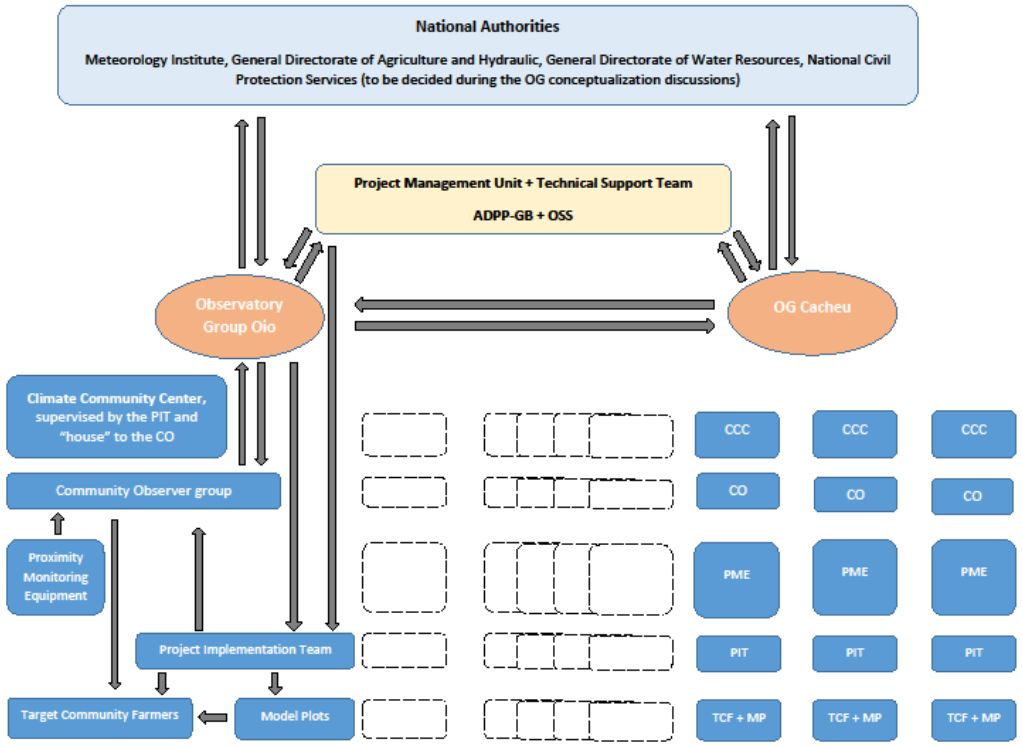
OG members/staff will be recruited by the EE's project team (following the approved ToR in a public recruitment process). As part of the project's inception phase, seminars will be held to officially present the OGs, the EE project team and the project Executing Partners' representatives in both target regions.

Although to be defined and confirmed within the project scope and in a participatory way, at this stage, it is envisioned that the OG will be composed of an OG coordinator supported by the OG team member (1 senior and 1 junior per region). The coordinator and 1 team element per region will be paid by the project during the implementation period, to be defined and confirmed with the working group, and be incorporated in the Government structure after the project, including the ownership of the equipment purchased.

Integration of observatory activities in the national monitoring systems will promote alignment of the operational strategy for the regional OG into the national monitoring system. The data to be collected, and measuring parameters and methodology of analysis will be defined together with the authorities. This will support the OG's work outcomes to be integrated into a broader state monitoring system. This activity will involve the National Authorities of interest and target all sectors involved (water, soil, seeds, environmentally sensitive agricultural practices and technologies). As there is no National Monitoring System or National Early Warning System at this stage – as described earlier, there is no inter-ministerial coordination for this information – the present project represents an additional element to this joint effort. The project will participate in the establishment of those systems and be integrated under the Ministry/Institute that will be defined; this will be done in a participatory way, listening to all involved authorities, as part of the OG's conceptualization process and it will then be

consolidated and/or adapted during the project's implementation. There will be continuous collaboration with the target authorities from year 1 of the project and throughout implementation.

Figure 47. Flow of OG data – Diagram:



Sub-Activities	
i.	Participatory development of the ToRs for the Observatory Groups;
ii.	Validation of the ToRs by key stakeholders;
iii.	Establish the OGs, including recruitment of OG leader, mobilization of community observers, provision of equipment;
iv.	Support the OG implementation throughout the project;
v.	Develop partnership agreements with the national monitoring system for continuation of the OGs;

The EE (ADPP-GB) Project Team (PMU, TST, Field Teams) leads the activities under this output. Project Executing Partners involved: IBAP, Ministry of Environment and Regional Offices.[25]

Activity 1.1.2. Establishment of 20 Climate Community Centers (CCC):

The activity will be implemented by the EE's project team[26]. All the trainings to take place under this activity will be undertaken by the EE's project team – regional field team with technical inputs from the TST and supervision of the PMU. The OG will participate in the activities concerning the CO and the Proximity Monitoring Station. The training beneficiaries will be the community, for the CCC construction, the CCC's management committee and the CO groups – according to each specific action to take place in the activity as described below.

The function of the CCC – Climate Community Center is to support the project's climate change adaptation connected activities' implementation in the target communities. The CCC will host multiple sub-functions in support of the project activities, as described below, and, during the project implementation period, will be co-managed by the centre's management committee and the EE's project team as part of a capacity building action. It will thus become a resilient community-based structure that will support the long-term sustainability of the

[25] See table Chapter 5.2.
[26] See table Chapter 5.2.

project assets and main outcomes. Each CCC will cover 1 to 3 project target communities (by proximity – see criteria below), each CCC will have its own management committee elected by the target community in a participatory way, and each CCC will have its own management plan set up with the support of the EE's project team and following a common line defined by the project.

This activity will involve the creation of community-based climate centers to promote meetings, seminars, workshops, trainings, bootcamp sessions and technical assistance for the target communities on climate change related subjects under the project activities. 20 CCCs will be established and equipped in strategic geographical sites to cover the needs of all 34 target communities. They will cover the needs of a front-line observatory center and the Proximity Monitoring Stations, and will host the Community Observer teams (CO). They will cover target household and community needs to address climate change impacts and adaptation related activities, based on the project outcomes and priorities. The CCCs will be especially relevant for farmers and community members to access climate information that is locally generated (primarily by the project itself, but including, as well, information from other local initiatives taking place in the target area – to be gathered by the EE's project team and the OG) and also received from national systems, after project completion. (The local, regional and central authorities do not have financial means to reach the isolated rural populations, so the CCC will serve as a receptor and a contact point between the authorities and the communities in the future; this will be a capacity developed during the project implementation period). The CCC concept is based on a previous initiative in the EE's Renewable Energy project (EU funded). The added value of the existence of such a Center in the communities was visible and is well documented. The CCCs represent a gathering and activity generating hotspot in the communities, providing renewable energy for community activities, including individual income generating activities, functional literacy classes, childcare etc. (The target communities do not have access to electricity [light, refrigerator, TV, water pumps, mobile charger] basic sanitation assets [running water, plumbing system], and the people are illiterate)

The CCC construction: The CCC are conceptualised according to ADPP-GB's previous experience in the scope of the EU financed Energy Facility project successfully implemented in Oio Region, Bissorã Sector. The buildings consist of simple constructing structures and are built by the target communities themselves with support from the EE's project team[27]. The project will secure the purchase of imported material as well as its transport and subsidies for related work. Each community will organize small work groups, identify were to pick good quality sand and gravel as well as cibe palm wood. They will produce clay blocks themselves without any cost for the project. This procedure worked well in the previous experience and contributed to the ownership of the Centers by the community. The material to be used is mainly local materials such as: "cibe" palm's wood (Borasusaethiopum), clay block, zinc, nails and cement for concreting and plastering the walls. The power equipment are 240W solar panels, 195ah batteries, parabolic antenna and accessories, 32p TV and DVD player. Each CCC will be equipped with one individual household roof top retention system, including a locally made tank/cistern, set up as example and for the target community to use for freshwater access. The CCC management committee will be capacitated on the construction of this system and be available to support, at first together with the EE's project team and gradually independently, the community members in the individual rainwater harvesting system construction.

The CCC location: The criteria for the location and land choice is: land availability and suitable size, owner's availability to dispose of the land for community use, accessibility for the community to participate in construction works and to use it; namely its proximity/centrality and its strategic and "weather safe" proximity to the fields and watercourses that will be monitored by the OG and CO. Agreements and copies will be signed between the land owners and the community in general, represented by the community leaders, alongside testimonials (a representative number of young adults chosen by the community to provide long term testimony) and representatives of the local State Committee. The terms for the land concession are infinite, i.e. the land will be allocated for an indefinite period of time. This is a legal procedure reproducing the exact procedure done in previous projects for the establishment of "Community Model Plots" and other assets of common interest. It was done in the EU Renewable Energy project for the construction of the Community Centers and the Community Processing Centers. In Guinea Bissau there is an "informal/complementary" Lei da Terra (law of the land) applicable to the rural areas and still in force, that calls for respect for traditional procedures and community leadership; testimony of the local State Committee (Local Authority's representative) will also validate the arrangement. The exact geographical location will be defined at the project inception phase, according to the Baseline assessment findings and the above-described criteria. All the 34 target communities will be covered by

[27] See Figure – Chapter 5.2.

the 20 CCC. The small size of some of the target communities does not justify the investment in an "individual" CCC.

The CCC management: During the project implementation timeline, the CCC will be managed by the center's management committee with support from the EE's project team, and gradually, as part of the exit strategy, the responsibility will be passed to the management committee. The definition of the management committees and their members will be made by the communities, with support from the EE's project team. The committee members are elected by the communities themselves under orientations from the EE's project team. They are elected for a mandate of 3 years, with the possibility of re-election. The mobilization of the committee members will be gender-sensitive. A management and sustainability plan will be set up by the project team and the management committee and followed up during project implementation. The management committees will undertake regular trainings in management and administration of the centers by the EE's project team. This aims to guarantee the organizational and operational capacity of the created structures, so that they are coherent, functional and sustainable. It includes the participatory definition and planning of the activities that will be held at the CCCs, adapted to community needs and goals. Trainings will be promoted to promote the sustainability of the assets and services provided, including for the Observatory Group and Early Warning System activity provided by the CO. This will optimize their operation, increase their reach and expand the quality of services offered by the Proximity Monitoring Station. Furthermore, the CCCs management committee work will be connected and aligned with the 2 project-created and strengthened regional Cooperatives/Commercial Associations (Activity 3.3.2. – part ii). The 2 Cooperatives will be responsible to oversee the CCC's functioning and work together with the CCC's management committees after project completion. This management model/methodology was applied in the EU Renewable Energy project. The EE's (ADPP-GB) Oio regional office and EVB school, both based in Bissorã – Oio Region, in the proximity of the previous project's Community Centers, testifies to its continuity after project terminus and its collaboration with the EU project created Association – ACACB, which will be further reinforced as part of the present project. The EE (ADPP-GB) locally based permanent teams' remains available to support, when required, the previous project beneficiaries and follow up the previous project's assets.

The CCC financial sustainability: The CCC's have low maintenance costs and can be easily managed by the community-based management committee; they will also be long term self-financed by small income generating activities set up by the project, such as: the provision of small services such as cell phone charging, TV access, rental of rooms for meetings, night workplace, a minimum fee for the childcare system and/or for the setup of a rainwater harvesting system, etc. as part of the economic sustainability, to provide minimum security and maintenance costs, as well as the continuity of available economic support to some project activities. The use of part of the center to host the proximity monitoring station will provide a minimum revenue stream from the state authorities who will undertake the OG and its work after the project is finalised. The CCC fund will be managed by the Center's management committee, according to the CCC action plan decided together with the community members. As a first priority, it will be used for the CCC maintenance, including equipment. The committee works on a voluntary basis, mostly motivated by the village "prestige" of being part of the committee. If and when it is decided by the community in the action plan, a small regular fee is paid by the community members to support the community member's work and dedication. Other project generated funds, such as (for instance) the cooking stove fees, will be added to the CCC fund to provide support and continuity in the work of dissemination and people's access to enhanced cooking stoves.

The CO – Community Observers – are a group of farmers, working in the project's Farmer's Clubs (Activity 3.2.3.), that will receive special training on data collection and equipment management by the OG and the EE's project team. Under OG supervision and the EE's project team, they will collect selected data on the ground in the Proximity Monitoring Stations - including watercourses, wells, and surrounding soil - on a regular basis and report it to the OG. Simultaneously, they will act as Climate Focal Points in the community, disseminating climate warnings and recommendations as instructed by the EE's project staff and the OG. They will participate actively in sensitization and awareness actions at community level. Their member's selection criteria is primarily based on individual motivation and willingness to participate/voluntary basis, then, additional selection criteria will be established by the EE project team together with the OG teams and the members' of the FC – to guarantee the representativeness of all the project's established FCs and a minimum defined capacity to perform the various tasks required. The CCC's will be equipped by the project with required monitoring material and tools for the Proximity Monitoring Stations.

The Proximity Monitoring Stations: The project will undertake the integration of the CCC's Proximity Monitoring Stations in the operation system of the Ministry of Environment & Biodiversity (MoEB). This will be done through alignment with MoEB & IBAP for the use of the CCCs and their respective Proximity Monitoring Stations, including

the trained and experienced CO teams, as tools for the operational strategies at local, regional and national levels. This activity will take place continuously after inception of the OGs and the COs, with the relevant project Executing Partners, to align its practices and outcomes in order to become a resilient asset for the national climate change monitoring system.

The use of part of the Center for Monitoring purposes and CO will be stated and guaranteed in the Center's statutes. The Observatory Station in the Center and its CC focus will be defined together with the communities and "Climate" Authorities. After the project ends, the centres will be owned by each community and the communities will be responsible for them through the elected management committees, with the support of the created regional cooperatives/Commercial Associations (Activity 3.3.2. – part ii) and with support from the local authorities; this will be part of the project's exit strategy.

The project will establish, under the CCC's multi-functions, a community-based, rotating childcare system for children from 2 to 5 years, connected to each CCC. Training of community child caring groups – elected by the community and according to availability of community members. The activity will increase the availability of women to actively participate in the project CC adaptation activities and allow elder siblings (especially girls) to attend school. Moreover, the trainings will improve community care for children, create didactic tools to stimulate their cognitive growth, promote games on environment protection attitudes and sensitization. This organization provides a better control over children's care and early development, preventing accidents, child trafficking and child abuse/mistreatment. In addition to the social impact and gender inclusion effect of the activity at community level, the CC oriented childhood care cements the basis of a future CC adaptation understanding from children to the households, schools and community.

Based on the EE previous experience, all the participatory process of the CCC set-up until the end of the process guarantees the ownership, interest and active participation of the target communities. All the community centers set up by EE in the past are the most used assets by the target population.

Sub-Activities	
i.	Participatory identification of sites for CCC with the community;
ii.	Construction and equipment of the CCCs;
iii.	Mobilization of CCC management committees;

Pictures of CCCs:

Picture 1. Outside the CCCs (pictures from 2021 and 2019

Picture 2. ***Inside the CCCs***

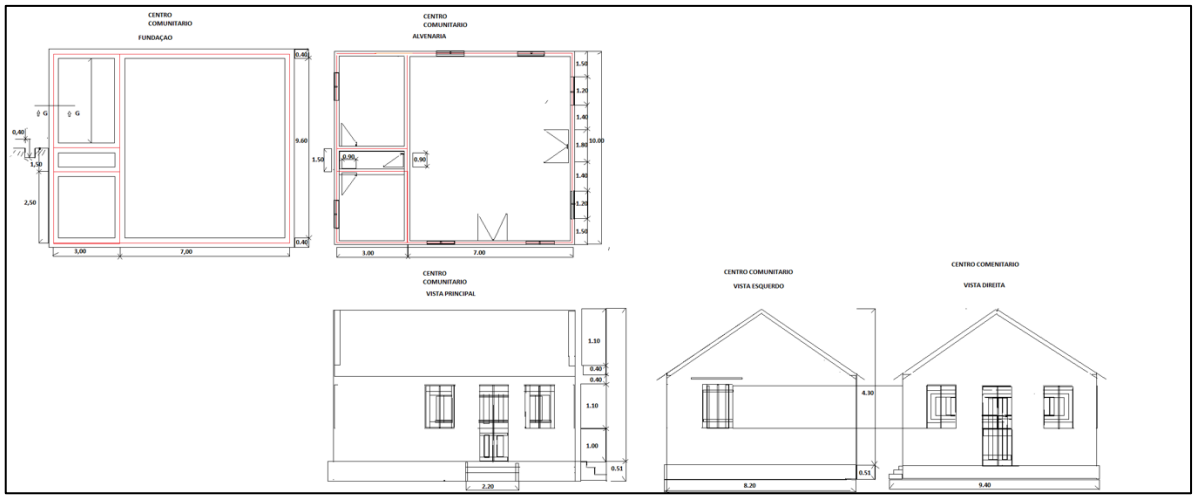


Figure 48. Design of the CCCs

Activity 1.1.3. Equip OGs and CCCs with technologies for WSQM.

The EE will be responsible for the establishment and provision of equipment and necessary assets for the 2 OGs, as well as the connected CCCs and Proximity Monitoring Stations. Equipment will include, among others: office and IT equipment, vehicles, technical equipment for monitoring of water and soil quality and salinity levels; and sets of Soil Quality Monitoring Kits. The ownership of the assets and equipment will be handed over to the local government upon project closure. Acquisitions by the EE will follow the AE's procurement rules, policies and procedures, as foreseen in the AE-EE grant agreement.

Activity 1.1.4. Training of OG members, including community members and individuals on O&M of observatory equipment:

The development of a Manual of Operation and Maintenance (MO&M) for observatory tasks will entail the creation of guidelines for the MO&M. This will include observatory tasks and equipment, including: monitoring the correct functioning of each piece of equipment to promote preventive and corrective maintenance; repairs; inspections; and cleaning, among others. This activity will include the training of the OG teams on the MO&M content and functional use. It also includes the MO&M printing and distribution to the target stakeholders, including project Executing Partners and target beneficiaries.

Training of the key stakeholders/people* involved in the OG's operation and maintenance will utilize a community-based approach and will be done with the Proximity Monitoring Stations (hosted by the CCCs.) Training sessions will be provided to*: the EE's field project team, the COs members, and the CCCs' management teams; representatives from the MoEB, MoA Regional Office, and from the MI will be invited to attend the trainings. Special attention will be given to promote gender-balanced working groups.

Sub-Activities	
i.	Develop O&M manual for Observatory equipment;
ii.	Provide trainings for OG members and COs;

Output 1.2. Strengthened technical capacities of decision-makers and field staff in Oio and Cacheu Region for addressing water and agriculture related climate risks:

Key Aspect	Description
Climate Problem to be addressed	This Output supports the technical capacities needed for addressing climate change adaptation in the target Regions, and thereby to any climate risk that manifests. A specific focus is on the key challenges in the area, being salt water intrusion (SWI) in the mangrove-rice ecosystems, and addressing adaptation and resilience building of subsistence agriculture practices.
Baseline situation	Capacities in CCA, and specifically in CRA and water management, are very limited. Especially at sub-national level, capacities are lacking, due to the underdevelopment of the education sector in the country, and the country as a whole. As a result, there are also limited technical capacities and knowledge at community-level. Due the malfunctioning state, bottom-up initiatives, in which capacities at local level are strengthened, are proving tobe the most effective method for building resilience of the most vulnerable populations.
Barriers Addressed	A. Limited technical capacities at regional level for CRA and WSQM, and CCA in general; B. Inadequate knowledge on CC and CCA;
Adaptation Benefits	1. Enhanced technical capacities for climate change adaptation interventions; 2. Availability of locally adapted training manuals and modules for climate-resilient agriculture practices, and adaptation guidelines to address salinization of water and soil in coastal mangrove-rice ecosystems;

The activities under Output 1.2. develop tools and provide capacity building actions that promote adapted solutions that address water and soil salinization and CRA practices. The activities are specifically directed to Local and Central Authorities and decision makers. The EE's Project Team (PMU, TST, Field Teams) leads the activities under this output. Project Executing Partners involved: OSS, IBAP, Ministry of Environment and Regional Offices, Ministry of Agriculture's technical General Directorates and Regional Offices, Meteorology Institute, INPA – National Institute for Agriculture Research, National Civil Protection Services.[28]

Activity 1.2.1. Development of Training Manuals, Modules and Curriculums for Environmental Education, CRA practices and technologies, adaptation towards water and soil salinization.

This activity consists of the development of training materials to serve the project's capacity building and education activities. Training materials will be directed to serve the objectives of the project in CCA, and hence will be targeting CRA knowledge and practices, and adaptation towards water and soil salinization in coastal farming communities. Materials will include (a) training manuals for workshops and trainings of national- and local-level decision makers (serving Activity A1.2.2), (b) training manuals for extension workers, field staff and farmers in CRA and water management (A1.2.2; A2.1.3; A3.1.1), (c) updated curriculums for vocational training courses in climate-resilient agriculture, livestock management and post-harvest practices (A1.2.3), (d) modules for environmental education for youth (A1.2.5), and (e) materials for sensitization of the communities on climate change (A1.2.4) and mangrove restoration and management (A2.2.1).

For each of the materials to be developed, small working groups will be established consisting of consultants, technical staff from the EE, and technicians from Executing Partners IBAP, the MoEB and the MoA. For each of the working groups, consultants and technicians will be recruited and appointed according to the specializations required for the materials. Defined in their ToRs, the consultants will be tasked to consult with relevant stakeholders and take stock of existing materials and experiences, including on traditional knowledge and practices, and present findings, reports and final materials to the working groups, who will validate the final products. A gender expert will review all materials to assure their gender-responsiveness. Representatives and/or

[28] See table Chapter 5.2.

technicians from other ministries or institutions may be invited to participate in the validation of materials. Table 4 below depicts the entities involved in the working groups (lead entity stated first).

Table 32. - Materials to be developed within the scope of the project

Material	Entities involved in development
Training manuals for workshops for decision-makers (A1.2.2)	ADPP, IBAP, MoEB
Technical manuals for trainings of extension and field staff (A1.2.2)	ADPP, MoA, IBAP
Technical manual for training of Farmers' Clubs (A3.1.1)	ADPP, MoA
Technical manuals for communities on management of water resources and systems (A2.1.3)	ADPP, IBAP, MoA
Updated curriculums for 6- and 11-month vocational courses in CRA, livestock management, post-harvest practices (A1.2.3)	ADPP, EVB, MoA, MoE
Sensitization materials on climate change, CCA, and the environment (A1.2.4)	IBAP, ADPP, MoEB
Sensitization materials and manuals for mangrove restoration and management (A2.2.1)	IBAP, ADPP, MoEB
Modules for Environmental Education in post-secondary institutions (A1.2.5)	IBAP, MoE, ADPP, MoE

All the materials will be made available to all interested stakeholders, including public and private entities, CSOs, donors, and potentially entities in neighbouring countries, and will equally be shared through the e-platform established by the project (A1.3.2).

Activity 1.2.2. Workshops for national-level and local-level decision-makers, and field staff on WSQM systems, CRA practices, and adaptation towards water and soil salinization.

This activity consists of compiling and validating collected and piloted CRA experiences, including management of autochthonous species and adapted secular techniques, to facilitate the dissemination of locally adapted good CRA practices. The activity will be developed by the EE's project team, including project Executing Partners and capitalise the experiences from this and other ongoing initiatives – synergies with past and ongoing projects. The manuals will be used in the present project by the field team and farmers, and be made available for all interested stakeholders – meaning other CSOs and private or public entities working in agriculture and CCA, including the partner organizations, donor and sub-regional entities – namely CSOs, private sector and governmental entities from neighbouring countries.

This activity will also provide, through workshop and webinar training, capacity building for decision makers at national and regional/local level. Training will target climate-resilient practices, technologies, water and soil quality monitoring systems. The training will also address other capacity gaps in sectors related to the main training contents. The EE's project team will organize the workshop and precede it with public announcements (via communication channels) of the activity, as well as direct invitations to key stakeholders/target groups, which will include: Local and Regional Authorities, Region Governors, Regional Deputies/representatives, and key stakeholders working on agriculture at regional/local level. The training contents will be worked out with the project Executing Partners, and each partner will lead the workshop based on and most suited to its expertise.

Responding to the generalised lack of information regarding CC, CC impacts on the population's lives, the need for adaptation to CC measures to be framed in policies and in the regulation and supporting mechanisms created at central level, it is imperative to involve and inform decision makers, including parliamentarians and regional governors, as a means of building political support for future initiatives.

This activity will also support capacity building the professional skills of government extension workers, CSO field staff and other public structures in the target sectors on adaptation regarding water and soil salinization and CRA practice.

The content of the training will be set up by the EE's project team in collaboration with the project Executing Partners.[29] The government extension workers as well as employees from other public structures will be selected by their own employers according to a priority calendar. The training will be publicly announced, as will the training calendar and the number of places per training that are available for CSO and the private sector. The interested trainees and employers must announce their interest in participating and will be scheduled according to the availability of the trainings.

It will strengthen the technical capacities of producer organizations - and/or those related to production to use climate-resilient farming practices (conservation agriculture, agroforestry, etc.) Specifically, it will build their adaptive capacity regarding water and soil salinization. The project will train 30 people per year, and women's participation will be encouraged. The project will train 30 participants per year, and women's participation will be encouraged.

Stakeholder workshops and trainings on agro-environmental practices, technologies, water and soil quality monitoring will be an ongoing activity, and it will promote regular information and training sessions for key stakeholders. Topics covered will include monitoring processes for climate-resilient and low-emission practices and technologies and water and soil quality control systems. The activity includes training/information/recycling sessions for the OC and project team, as well as gender sensitive awareness-raising activities amongst the communities and CSOs in the target area.

Activity 1.2.3. Train youth through vocational training courses in CRA practices, including specializations in livestock management and post-harvest practices:

This activity will involve the training of youth (50% women) on climate-resilient agriculture and ecological and climate-resilient productive techniques. This will be executed through the promotion of a technical and professional TVET course at a vocational training school (EVB, which is a EE's TVET boarding school), and will be for young people from rural areas, including the target communities. Special emphasis will be placed on girl's/women's mobilization and enrolment. The mobilization and selection of the youth will follow the EVB's usual procedure of disclosure in youth forums, high schools and communities; this will then be followed by written tests in key subjects, individual interviews and then final interviews that include the students' families. It will be led by EVB school staff and followed up closely by the EE's project team to guarantee alignment with the project's goals and priorities and to ensure enrolment of youth from the project's target communities. The training will include an 11-month agro-pastoralism course, plus 6 months of specialisation in climate-resilient agriculture and nutrition and a 3-month intensive community internship (subsidised). The total target is 115 students, at least 50% of whom will be women. These courses are primarily targeting youth from the project's 34 target communities; they will then, according to the vacancies available, target a broader group to include youth from the 2 target regions, and, finally, from the rest of the country. (NOTE: All the EVB TVET school courses will require an updating to their existing curricula, as necessary, and refresher training will also be provided for teachers. The updated CVs will be further used by the school after the project's completion, upscaling this project's impact in the country regarding CC adaptation in rural areas)

A course on specialisation in livestock and short cycle animal husbandry will also be provided at the EVB TVET school. It will be a 3-month intensive course for 2 people from each of the 34 target community, 50% women, in the 1st year of project execution. The EE's project team will ensure the selection and enrolment of these beneficiaries with support from the EVB school. This course will be delivered by the EVB school in the target communities.

The integration of trained youth in the Farmers' Clubs (during training and post-graduation) will be undertaken over a 3 months' internship period, and after they complete their technical and professional training, youth will be integrated into the productive groups in their communities of origin. This activity will strengthen the students' capacities while providing technical assistance to producers and disseminating knowledge. The students will be mentored by the EE' project team animators (DOs) and supervisors of the productive groups, as well as by their trainers. Following the experience from previous EE projects, it is anticipated that part of these students will remain in remunerated positions in the targeted communities after the project's completion. Their work during the project lifetime is included in the project's financial planning. After project completion, those who stay and work in their communities of origin will be paid by the community farmers themselves for the services provided and - in some cases - by the CCC's, if agreed with the community.

[29] See table Chapter 5.2.

Trainings for youth (70% women) on post-harvest practices and the use of technologies will also be delivered to the project beneficiaries. This will include promoting the development of agricultural value chains, specifically in conservation, transformation and commercialization techniques. This activity will generate resources to improve and advance appropriate technologies for value-addition of agricultural products. The trainings will take place in the 2nd, 3rd, and 4th years of the project, and will be provided to a total of 115 students, at least 70% of whom will be women.

Activity 1.2.4. Conduct sensitization campaigns and address concrete barriers at community-level for climate change literacy, adaptation options, and other resilience-building topics:

The activity comprises 3 actions: (i) awareness and sensitization campaigns; (ii) functional Literacy with CC adaptation contents and (iii) access to documentation for women from the target communities. The activity targets the 34 project communities. The CCC's management committee members will actively participate in the activity as part of its capacity building and resilience for future initiatives.

(i) This activity will involve the promotion of different awareness actions on climate change and climate-resilient agriculture. It will be led by the EE's project team (including TST guidance) with specific inputs from the EP,[30] and with the active participation of the CCC's management committee.

The activity will particularly focus on water and soil quality monitoring system, sustainable climate-resilient agriculture practices and management, benefits of diversified food products' consumption and increased nutritional quality. Illustrative awareness-raising materials will be produced by the EE's project team and made available for other stakeholders' (CSO, LA, private sector external to the project) use. The campaigns will be organized by the EE's project team and will include actions targeting specific groups within the 34 target communities (women, youth, children, elder, schools, churches, mosques, community and religious leaders, amongst others to be defined in a participatory way in the project scope). The campaigns will be developed together with the CCC's management committee and with the EVB and Teacher Training Schools (they will involve the schools, the students, and the wider community by engaging graduated students).

(ii) This activity will also address some specific barriers for women to participate in the project's activities, including (among others) the high illiteracy rate in the country, especially in rural areas and in the female population. Through Functional literacy classes, the activity provides women with the necessary tools to better understand the CC impacts in their lives, and to better understand informative material, manuals and warnings. They will build their capacity to voice their needs and rights regarding adaptation to climate change impacts. The literacy material is functional based on CC impacts specifically on women and children, who will gain skills both in alphabetization - both reading/writing – as well as CC and women's/children's rights awareness.

This activity contributes to women's direct access to information, training materials and knowledge on climate change adaptation options and alternative income generating activities. This will promote greater economic empowerment via climate change Adaptation based activities, more active and informed participation in CC forums and greater realization/knowledge of to their basic rights. This will be done through Functional literacy classes in the context of climate change adaptation and mitigation content (agriculture, health, nutrition, gender equality inter alia) to be defined by EE's project's technical team (TST) in collaboration with the EPs MoEB and the Ministry of Education. The functional literacy contents will be made available to the government institutions, other CSO and multilateral organizations to be used in future climate change adaptation and mitigation initiatives in the country.

20 spaces/places for participants will be made available per CCC per year, from the 2nd year onwards. A total of 1,360 spaces/places for adult functional literacy will be made available, given the fact that some literacy students will need more than 1 year to complete this task. It includes training manuals and necessary teaching materials. The training is open to both adult men and women, with priority given to women, and schedules will be adapted to women's availability, with specific sensitization/mobilization attention directed to women, as they have very limited access to any kind of capacity building. The EE's project team will help the CCC's to set up a ToR for the profile of the 2 literacy teachers per class and assess their capacity accordingly. The teachers will be selected in the target community where they will work. Preference will be given to women teachers despite the low availability of sufficiently literate women in the rural areas. The selected teachers will undertake an intensive training by the EE's project team and will be familiarised with the teaching materials before starting to teach. The EE's project team will organise, together with the CCC's management committee, and set up the literacy classes

[30] See table Chapter 5.2.

and the enrolment of the interested beneficiaries. The EE's project team will closely follow and support the work of the literacy teacher and the course management of the CCCs.

(iii) The EE's project team, with the participation of CCC's management committee, will support in the registration and issuance of identity cards for women beneficiaries (500 per region). This activity is crucial for the economic empowerment of women and their access to basic rights as well as access/application to any external support to adaptation to CC initiatives. This set of activity contributes to the project's inclusiveness and wider outcome impact.

Sub-Activities
i. Awareness campaigns in the communities on CC; ii. Functional literacy classes; iii. Support in the registration and issuance of identity cards for women beneficiaries;

Activity 1.2.5. Mainstream environmental education in the young adult education system in the target areas:

This activity will be executed through the introduction of the Environmental Education (EE) subject at the Bachil Primary Teacher Training School (TTSB) – Cacheu region and the EVB TVET school in Bissorã – Oio Region. The collection and adaptation of the existing materials on environmental education will be done by the EVB and the TTSB teaching teams and be reviewed and adapted in collaboration with IBAP (IBAP possesses and/or have knowledge of most of the existing material, nevertheless a work of compilation, synthetisation, standardization and update has to be done). The subjects will be aligned with the Ministry of Education's plans and strategies regarding EE. The produced material will be made available to the Ministry of Education as a contribution for the Education System at country level.

TTS-Bachil's students have curricular periods of practice/internship in local rural primary schools. Training and practice of beneficiary students will take place during their internship activities in local primary schools, in community awareness raising activities within the project scope, and in similar projects being implemented in the intervention area by other stakeholders (CSO, CBO, public and private sector stakeholders managing environmental, CC and education activities in general).

All the TTS-Bachil's and EVB current and future students will have Environmental Education added to their CV. All of the TTS-Bachil's internship students and future graduated students will use the acquired knowledge and informative material in the local primary schools.

The activity will be led by the EVB and TTSB schools under this EE's project's PMU and TST supervision.

Output 1.3 Improved availability and accessibility to knowledge on water and agriculture-related climate risks and adaptation options

Key Aspect	Description
Climate Problem to be addressed	This Output supports the knowledge management and systematization needed for addressing climate change adaptation in the target Regions, and by extension the country. A specific focus is on knowledge management regarding the key climate challenges in the area, being salt water intrusion (SWI) in the mangrove-rice ecosystems, and addressing adaptation and resilience building of subsistence agriculture practices.
Baseline situation	There is limited to no awareness on climate change or its impacts, and subsequently also very limited awareness on adaptation options in the main affected sectors. Due to political instability, and continuous changes in government and ministry staff, there are as good as no sustainable initiatives at national level to increase levels of awareness or to provide access to knowledge on adaptation options. Low levels of awareness obviously result in limited adaptive capacities at all levels.
Barriers Addressed	A. Lack of awareness on CC and adaptation options; B. Inadequate knowledge on CCA Options; C. Inexistent access to CC information and training for communities
Adaptation Benefits	1. Better and wider informed general public about climate change and adaptation responses; 2. Systematized knowledge on climate risks and CCA options;

Output 1.3's set of activities has the objective to synthetize existing knowledge regarding CC and make it available to active stakeholders in the country. The project team has identified a significant number of CC related initiatives taking place and in preparation in the country, hence it has confirmed the need to create platforms and forums where these initiatives can be consulted, lessons learned shared and synergies created to enhance successful solutions and to increase the impact of such initiatives. There is a lack of dialog opportunities to strengthen the capacity of active stakeholders and to coordinate the individual efforts towards addressing CC impacts.

The EE's Project Team (PMU, TST, Field Teams) leads the activities under this output. Project Executing Partners involved: IBAP, Ministry of Environment and Regional Offices, Ministry of Agriculture's technical General Directorates and Regional Offices, Meteorology Institute, INPA – National Institute for Agriculture Research, National Civil Protection Services.[31]

Activity 1.3.1. Conduct Baseline Study and KAP Survey:

As part of the project development phase, a pre-feasibility study, led by external national experts, took place. Based on the assessment and the target area knowledge, ADPP-GB's team led a participatory pre-selection of possible target communities in both target areas. Nevertheless, the lack of available data and national expertise hinders the team's full access to necessary technical information. Thus, an external/international consultancy office was also hired by GCF to complete and complement the technical information, especially regarding the climate rationale and water availability. These assessments done during the project development phase will feed/complement the M&E process, namely the baseline study that will take place at the project inception. They do not, however, substitute the need for the baseline study, as it will cover all the project details according to the final selected/approved project Logical Framework and Gender Action Plan indicators and it will also confirm all project assumptions, confirm the pre-selected target communities' availability and motivation to join the programme and, consequently, select and measure the "bolanhas" (mangrove rice fields), adjacent mangrove forests and other project details to be considered for an accurate project implementation and follow-up process. The Baseline study covers all of the project activities, beneficiaries and stakeholders involved in the project implementation, as it is a project definition and follow-up tool.

This activity will include conducting an exhaustive baseline survey and report will be developed during the project inception phase as part of the project management and M&E Strategy. The baseline study will respond to all the indicators of the project activities, outputs and outcomes. The data will be collected in a manner that it can be disaggregated by gender, identified vulnerable groups, and age groups – all at the local level, and assess specific environmental and social parameters that assist in the monitoring of the ESAP. This baseline information will be used as the starting point for the M&E system. It will also serve the project's annual planning and the progress evaluation of project implementation. During the study, a Knowledge, Attitude and Practices (KAP) survey will be undertaken to measure the KAP of the project Executing Partners and project beneficiaries through the application of both qualitative and quantitative methods using data collection tools such as focused group discussions inter alia. The KAP study focuses on behaviour and practices changes; it thus focuses on people to measure the behaviour changes in the beneficiary target groups. The main parameters to be measured by the KAP are the CC impact adaptation knowledge, awareness and adaptation methods covered in the various training sessions, sensitizations, workshops, seminars, webinars and other informative sessions included in the project activities.

Generated data will identify new parameters and relevant indicators to be added to the M&E follow-up system. The log frame and other M&E tools will be updated accordingly. Throughout the project implementation period, the identified parameters, both quantitative and qualitative, will be measured and analysed and implementation plans will be updated accordingly.

The full M&E methodology and specific actions are further described in section D4 of the GCF-FP-Doc and in the 5.4 section of the Prefeasibility study. The full M&E process is considered part of the Project management activities, under Activity 0.0.0.

Beyond serving the project's implementation management purpose, the collected data will be made available to the wider public, thus informing the efforts of public and private stakeholders at national level.

[31] See table Chapter 5.2.

Activity 1.3.2. Development of a collaborative e-platform as a knowledge base for climate-resilience and adaptation practices

This activity will also include the development of a collaborative e-platform as a knowledge base for climate-resilience and adaptation practices. The creation of a collaborative database (e-knowledge) with existing information and mapped knowledge, both produced/under investigation, related to the climate resilient agriculture sector. Georeferenced assets and agricultural perimeters, management and remote access to the agricultural value chain (quantities, species, techniques used, applied agricultural products, etc.) will be included, as will systematizing information on cultivation, harvest, post-harvest, processing and marketing, agriculture calendar, climate change main impacts and solutions for their mitigation at local level. The collection and treatment of this data will allow for the establishment and dissemination of dashboards with the compiled relevant information. This will support future actions with an evidence-based and integrated intervention (from the sectors of agriculture, environment and biodiversity, water, soil, health, accessibility, among others) and considering the compiled best practice bibliography. It will be connected to other existing tools and fed by early warning mechanisms identified at national and regional level. By incorporating the project's collaborative e-platform with other ongoing websites of executing entities, the initiative will ensure that useful tools and experiences are replicated and that new data is permanently incorporated by external projects and programmes.

Due to internet, electricity and technology access limitations, as well as high illiteracy rates in the country, especially at rural level, it is foreseen that, although open to the public, the e-platform will be more directly accessible to CSOs, private and public stakeholders, who will serve as representatives of the rural communities. The rural communities will benefit from the contents/recommendations/lessons learned/ongoing initiatives/new adaptation technologies and other relevant information posted on the e-platform through projects/initiatives led by national authorities, CSO's, CBO's, the private sector, and cooperatives, including other local initiatives to take place in the rural areas. These will be the main direct users of the e-platform due to the described constraints. Nevertheless, the project will guarantee that its existence, content and access is made known at the community level, as well as among local authorities, local TVET schools, mosques, madrassas and other rural structures. Its access and use will be encouraged and its existence broadcasted in all available means, including radio broadcast, which has the widest reach at national level.

The EE project team will lead the set-up of the e-platform and procure a development and operationalization specialized team for it. Intellectual property and IP rights will be registered, since its inception, under MoAB, with a clear signed agreement on management and use by the project itself during project's implementation period. In the final project year and - as part of the Exit Strategy - the management of the e-platform will be officially transferred to a chosen entity. Being interactive, well established and widespread, the e-platform will sustain itself in the future, needing minimum overall management. The Exit Strategy will assess and decide, in a participatory way involving all the Executing Partners, which of the public and/or private stakeholder will be available, the most committed and suitable to follow up on this technology. Nevertheless, it was agreed that the MoAB, the IBAP and ADPP will assume this tool's management jointly, bundling its access most likely through the IBAP or the MoAB official website for wider outreach. However, through the e-platform activity development and other project implementation activities, other stakeholders will reveal their commitment, capacity and willingness to assume this task; its feasibility and sustainability will be evaluated by the project team and partners.

Activity 1.3.3. Disseminate knowledge and information in local, national and regional workshops and forums:

The development of knowledge management and dissemination strategy will aim to build coherence, collaboration and trust amongst civil society to work together to demand access to and improved quality of climate-resilient agriculture in Guinea-Bissau. It aims to create a local, regional and national strategy, at the civil society level, to promote platforms and forums for the dissemination and management of existing and generated knowledge linked to the climate-resilient agricultural value chains by and for key actors and stakeholders in the environmental and agricultural sector. A strategy will be devised to create a "space" where stakeholders can concentrate concepts and experiences to learn, teach, discuss and contribute to overcome challenges through innovative approaches. The initiative will be developed by the EE's project team, with the project Executing Partners and other relevant stakeholders in the country. It will be coordinated with other projects, initiatives and schools operating in the country, and will also facilitate the exchange of experiences.

Information will be continually assessed as part of project monitoring and evaluation (M&E). Project management tools will also serve to measure project, and will include the Baseline survey, KAP study, Prefeasibility study and Communication Plan, amongst others. Executing Partner will also provide continual inputs, thus further deepening project knowledge and learning. The activity will therefore include the collection, discussion and

validation of knowledge linked to climate-resilient agricultural value chains by the EE's project team and Executing Partners. Once the information and knowledge is compiled, it will be disseminated to key actors and stakeholders at local, regional and national level, as well as to the public in general, following the set-up strategy

The initiative targets the private sector, civil society organizations, community-based organizations, and agriculture, environment and education stakeholders, among others, which will be involved actively throughout the workshops and other initiatives outlined by the strategy.

The findings will be shared in partner media, including OSS and GCF, as well as in radio programmes and through other channels. Seminars and workshops at national, regional and local level will also take place to share experiences, lessons learned and to create tools to produce information and compile additional knowledge.

The project will also hold a virtual sub-regional level seminar, which will be organized by the EE's project team, with the support of the AE and the Executing Partners, which will facilitate access to their peers in neighbourhood countries, and, through them, to existing sub-regional networks and relevant stakeholders, including the private sector.

By using wider outreach media, such as radio broadcasting, internet and virtual tools, the EE's project team can estimate that the general information will reach at least 120,000 adult people, of whom 70% will be women, from both target regions, as well as users of the mentioned institutions. This total represents approximately 11% of the country's total population and is captured in the Log frame under Objective Indicator 3. Number of indirect beneficiaries.

Sub-Activities	
i.	Development of a knowledge management strategy;
ii.	Development of communication strategy and action plan;
iii.	Implementation of knowledge management and communication strategies;

Component 2: "Adaptation of water management towards climate risks in coastal zones"

Outcome 2. Sustainable management of coastal ecosystems leading to climate-resilient communities in Oio and Cacheu

Output 2.1. Community-based water management is improved and adapted towards climate risks, including salt-water intrusion and extreme weather events.

Key Aspect	Description
Climate Problem to be addressed	This Output targets climate change challenges related to water, being (i) salt water intrusion (SWI) in agricultural fields alongside the coast and estuaries, and (ii) increasing rainfall variability and more frequent extremes (floods and drought);
Baseline situation	Communities in coastal areas of the country are facing severe challenges of saline water intrusion resulting from sea level rise. Mangrove-rice paddies are increasingly abandoned due to decreasing levels of productivity, and due to the consequent ineffectiveness of investing in the labour-intensive rice production. Water provision and management in general are underdeveloped, and only few communities have access to safe water for human consumption or to support agricultural production. Rainfall variability, without access to irrigation, is negatively affecting crop yields.
Barriers Addressed	A. Limited access to potable water, that has historically led to misuse of harvested rainwater, which has among others limited the potential for backyard farming; B. Insufficient adaptation planning; C. Inadequate capacity and financial means for climate-resilient water management; D. Inadequate financial means for climate-resilient water management;
Adaptation Benefits	1. Farmland in coastal mangrove-rice ecosystems is better protected from salt water intrusion induced by sea level rise; 2. Enhanced water availability for horticulture production during prolonged dry spells induced by increased rainfall variability;

Activity 2.1.1. Elaborate concrete plans for adaptation towards salinization of rice fields, on-site agricultural and water management adaptation, and coastal management in the target areas:

Prior to proceeding with concrete field interventions regarding water management in the target area, this activity intends to develop adaptation plans and contingency plans on a regional level, scaled for the intervention areas and the target communities. These plans will be further integrated into government plans at regional and central level. The tools and methodology applied will serve as a model for broader planning in the remaining regions of the country.

The EE's Project Team (PMU, TST, Field Teams) leads the activities under this output. Project partners involved include: Ministry of Environment and Regional Offices, Ministry of Agriculture's technical General Directorates and Regional Offices, Meteorology Institute, National Civil Protection Services, General Directorate of Water Resources, Maritime, Port Institute of Guinea-Bissau and General Directorate for Traditional Fishery.[32] The specific plans regarding the project target areas will be developed with the support and technical input from the key General Directorates as part of the present project. To integrate the work developed under the project in the wider government plans, at regional and central level, the project plans will be officially validated by the Ministries; this will be necessary despite the direct support and follow-up that will be provided by the Ministry's technical staff, as it is an "external" initiative complementary to the Ministry itself. No special endorsement by the authorities is necessary, as the authority's technical directorates will be participating in its elaboration and implementation.

The project area is facing saline water intrusion and soil salinization due to the sea level rise, extreme CC weather events and coastal erosion. This is impacting water quality during the dry season and affecting yields. This activity will design and develop adaptation and contingency plans to identify the best water management interventions in rice fields, and to counter salt water intrusion (including salinized groundwater). It is planned to developed two contingency plans, one per each target region. These plans will take into account the OG activities and the monitoring of water and soil quality system.

The project area is located in the northern coastal zone of Guinea Bissau, which is benefitting from the National Coastal Management Plan. The project area is located near mangrove ecosystems, which require special attention to ensure their conservation and sustainable management. The mangroves play a crucial role in reducing coastal erosion and saline water intrusion. To this end, the project - under this activity - will promote the integration of the adaptation and contingency plans/measures developed in the Coastal Management Plans. It will also ensure the advocacy/dissemination of these measures with the National Authorities, as project partners, who will be involved in developing the plans. Given that the current Coastal Management Plans at Regional and National Level may require an update, the project will contribute with the support of the involved parties with the newly gathered data and developed platform.

These adaptive actions will revitalize field production with improved and adapted techniques that are in use and can be further introduced by the project. The project will only encourage soft techniques (encourage/use local and adapted cultural experiences in smallholder agriculture) that will not have negative impact on water resources nor on soil resources. A comprehensive monitoring tools will be developed and a consultative approach with the relevant stakeholders including women with their valuable knowledge in these areas, will be put in place for an efficient management of saline water intrusion in the project area. In addition, this will be linked to the EWS that is being developed by UNDP project (see project description and synergies in the chapter 6.2: Synergies' with other projects/initiatives.

Furthermore, this activity will include the creation of 68 plans for agricultural adaptation and water management on site (34 bolanhas and 34 croplands and horticulture), one per target community. There are no standards/benchmarks to be used for the development of the project plans. For this reason, the plans and the solutions will be elaborated/decided upon by the EE's project team, namely the TST team, with the collaboration of the technicians from the General Directorates from the Ministry of Agriculture and Environment.

To execute this activity, the project will organize meetings with the target communities to identify the most viable and suitable practices for water management and agriculture, tackling salinization, rainfall variability and extreme weather events (droughts and floods). Various sensitization sessions will be organized to develop the on-site adaptation plans. This will include the operationalization and monitoring of plans to improve water management,

[32] See table Chapter 5.2.

introduction of adapted and improved environmentally sensitive and climate-resilient agricultural techniques. These plans will be developed for selected rice and crops and gardening/horticulture fields.

Sub-Activities	
i.	Participatory site selection for SWI management;
ii.	Development of 34 SWI site-specific adaptation plans (1 per community);
iii.	Development of 34 agriculture and water management plans (1 per community);
iv.	Integration of findings and lessons learned into two Coastal Management Plans;

Activity 2.1.2. Construct and rehabilitate water management infrastructures to prevent salt water intrusion in mangrove-rice paddies

The activity will be implemented by the EE's project team with support from the EP MoEB-RO, MoA-GD, MoA-RO.[33]

At country level, "of the 50.000 ha of rice field complained by the farmers, it is estimated that about 20.000 ha have been successively abandoned or never used entirely, due to broken dikes or inappropriate land preparation. The abandonment of these rice fields without their respective planting for mangroves has been provoking acidification and salinization of the soils. Although the rehabilitation of these areas can be made manually, it seems to be little probable that there is available agricultural labour in enough quantity to satisfy the needs, due to the costs of opportunity of such labour(…)." Without use of mineral fertilizers, the cultivation of rice in the hydromorphic soils of mangroves presents higher revenue in relation to other systems, and it is also the most demanding in terms of water management. This traditional system involves the construction and maintenance of salt control dikes, with manual labour used to execute all practices, resulting in a very labour-intensive system.[34]

As described in the climate rationale, the main cause of these fields' abandonment is due to sea level rise and the subsequent destruction of dikes. Guinea Bissau has internationally and sub-regionally recognized traditional knowledge and expertise on rice fields (bolanhas) water management engineering, including the construction of resistant belt gated dikes/mini dikes for field protection and salty and rain water balance (land wash), using local material – mud and vegetable fibre, and field partialisation mini gated dikes - for rain water control and maximum use of the fields. The calendar of works is well defined to permit soil washing using the first rains and crop maintenance well beyond the last rain, on the whole extent of the sphere (upper and lower part). This approach, slightly different but equally efficient by both Balanta[35] and Felupe[36] ethnicities, acknowledges the use of the existing mangrove belt in the field protection, and respects the existing ecosystem. For reasons outlined in the project rationale, these techniques are being abandoned and forgotten, due to their hardship, demanding workmanship, and lack of promotion and support. The project intends to revive and boost this approach, enhance it with modern means whenever possible, introduce CC variables to improve its efficiency and make it more appealing for the younger generations (see photos in annex).

The works to be done will mainly use local materials and techniques, except for some smaller support material – such as PVC tube, tools and eventually access to some machinery work - if found necessary during the water management project development for each field. All the procurement and acquisition procedures will be carried out by ADPP-GB as EE, and approved by OSS as AE.

The "bolanhas" targeted by this activity belong to the 8.500 families and/or the 34 communities targeted by the project. Part of the criteria for pre-selection of the target communities was the existence of available fields and their need for improvement intervention. The fields exist around and in the proximity of the project target communities. From previous ADPP interventions and according to the field pre-assessment done, the majority of the target family has from 0,2ha to 2ha of available field, with a few exceptions who have up to 3ha and more. It is thus estimated that this activity could reach 7.000ha by the end of the project. These numbers are to be confirmed in the baseline study.

The criteria to select the targeted fields are:

[33] See table Chapter 5.2.
[34] Strategy and National Action Plan for the Biodiversity (2015-2020)
[35] Dynamique el usages de la mangrove dans les pays des rivières du Sud, du Senegal à Sierra Leone – La riziculture de mangrove de la société balant dans la región de Tombali (Guinée-Bissau) – Éric Penot
[36] Felupe society: disintegration or social transformation?- Lúcia Bayan

- Community or individual ownership written+ and confirmed by the community leaders and local authorities (*as part of the project following the Land Law);
- Availability and willingness of the owner/owners to participate in the initiative;
- Availability and willingness of the target farmer's families to join efforts with the rest of the target farmer's families with contiguous fields for a common goal;
- Proximity to the target communities;
- Proximity/contiguity between selected fields, in order to optimise the water management interventions;
- Abandoned/non-used bolanhas that are recoverable using traditional means;
- Poorly developed/water managed and under productive bolanhas that would benefit from infrastructure and management intervention;
- Fields near existing mangrove belt (damaged and/or partially damaged but still existing) to reinforce the field protection and stop further coastal erosion and consequent shoreline retreat and greater groundwater explosion to salinity;

The number of new infrastructures and infrastructures to be recovered, disaggregated by type of intervention and equipment needs, is not possible to determine without having the final selection of bolanhas, which will be done in a participatory manner with the target communities, according to the baseline study findings and analysis, which will take place during the project inception phase.

Conducting hydrological and agricultural technical measures for water management in plots identified as prone to flooding by this activity will strengthen water retention systems and control saline water intrusion in water brakes and plots.

The activity includes:

Action	Resilience features to climate impacts
Conduct hydrological/agricultural needs identification and intervention planning including in-site water management plan for each site/filed.	To define/personalize and optimize the cost/effectiveness of the intervention. It will make the intervention more resilient and adapted to the expected climate impacts on the field and/or several interdependent field complexes.
Construction of traditional improved belt gated dikes/mini dikes	For field protection from salty water intrusion due to rising sea level and including extreme climate change-exacerbated weather events and salty and rain water balance necessary for land wash. Although based in traditional local techniques, they will be improved by introducing CC impact connected weather trends in the belt dikes dimensioning, the gating will be upgraded using modern materials and systems, making it more efficient and resilient to CC impacts. This will improve the water resources' control and guarantee and expand the scale and calendar of sustainable production in rice sectors.
Field partialisation traditional mini gated dikes for inter-field water management	For inter-field rain water control and maximum use of the fields/parcels on the whole extent of the sphere (upper and lower part). Although based on traditional local techniques, they will be improved by introducing CC impact connected weather trends in the mini dikes dimensioning, the gating will be upgraded using modern materials and systems, making it more efficient and resilient to CC impacts. This will improve the water resources' control and guarantee and expand the scale and calendar of sustainable production of rice all along the target fields.
Capacity building of the target farmers on new introduced techniques and the reasons for the innovation approaches as opposed to their traditional practices.	Upgrading the local knowledge on water management of the rice fields, more adapted to the CC growing impact's reality, promotes better resilience and sustainability of the project outcomes.

Working sessions with project partners will identify and plan interventions. Intervention will be done by the farmers themselves organised in intervention groups monitored by the EE project team and Executing Partners. The project will purchase basic materials, equipment/inputs.

The EE's Project Team (PMU, TST, Field Teams) lead this activity. Project Executing Partners involved: Ministry of Environment Regional Offices, Ministry of Agriculture's technical General Directorates and Regional Offices[37].

Pictures:

Picture 3. Flooded Bolanhas

Picture 4. Bolanhas abandoned due to SWI

Picture 5. *Example of dykes / water management structures to be introduced (in rainy and dry season)*

[37] See table Chapter 5.2.

Picture 6. *Traditional water management system (left); mangrove ecosystem and dike (right)*

Picture 7. *Mangrove rice seedlings – transport from nursery (left); nursery - transplanting in the family plot (right)*

Activity 2.1.3. Establish water management systems to address water shortages for production and consumption during prolonged dry spells

The farmers referred to, in this activity, are the same target farmers from the 34 project target communities. The selection criteria is described in activity 2.1.2 and in the sections: "Pre-established criteria for target community selection" and "8,500 small-scale farmers", end of chapter B2 of the FP. They are further described in the prefeasibility study – chapter 2.4 selection of beneficiaries.

The 34 target communities are located in coastal areas. For most, CC impacts (increasing of sea levels and a longer dry season) affect their fresh water access. As assessed in the "Draft freshwater provision baseline assessment"[38], and in the field assessment of the target communities' needs for the pre-feasibility study, the CC impacts, along with the low quality of the existing water points (improvised non protected and shallow wells) are hindering the target communities' access to freshwater, especially in the last months of the dry season. Community rainwater harvesting and storage in large tanks or cisterns could enhance adaptive capacity and development of groundwater resources, and construction of community-level water catchments and ponds would also increase adaptive capacity for residents.[39] This justifies the inclusion of an activity for fresh water improvement of access/management. It is thus considered necessary to include an activity for water collection and to ensure that retention systems are used for agriculture and livestock. This activity also includes the establishment and/or revitalization of water points for human consumption.

(i) The hydrological planning concerning drought and salinized groundwater, to be developed by the EE's TST project team with the support of the Executing Partners as part of the activity[40], will include

[38] See full report by Winrock in attachment to the pre-feasibility study.
[39] Vulnerability assessment – Winrock, in attachment to the pre-feasibility study.
[40] See table Chapter 5.2.

identification/mapping and proper management of existing water points, as well as an analysis of water quality and needs for rehabilitation. It will also identify new structures to be constructed, or differently managed, to increase and enhance access to quality water and properly separate human consumption from animal husbandry in the project's target area. Alternative solutions will be implemented for access to quality water, recovering and improving wells and boreholes whenever necessary. More efficient systems of access to water will be promoted, preferably through renewable energy powered water pumps in wells, lagoons, rainwater retention tanks, and other necessary means to enhance water access.

This activity consists of conducting hydrological and agricultural planning of plots including the construction of rain and storm water retention systems. This will allow the dynamics between water resources and agricultural campaigns to guarantee and expand the scale of sustainable production, both agriculture and livestock through the year, despite the evident and identified impacts of climate change. The activity includes working sessions to identify and plan interventions. The production of a basic manual for farmers, in general, on current solutions to current problems concerning access to water resources, as well as entities to be contacted for technical support – the "Basic Manual for the Farmer on Access to Water Resources in a Climate Change Scenario". The project's targeted farmers from the 34 target communities themselves will establish the systems with the support of EE's project team and Executing Partners[41]. The project will provide basic and mechanical/specialized material and procurement of specialized services whenever needed. All procurement and acquisition by the EE project team, in this project's scope, will be done following the AE's procurement rules, policies and procedures, foreseen in the AE and EE grant agreement.

The activity will include and always prioritise the improvement of existing water points for human consumption: drinking water with access to water analysis systems and treatments and tanks for treatment. This is not a first choice option, but considering that some of the accessed target villages did not have any access to fresh water during long periods of time through the year, the project has included, for budgeting purpose, the construction of 10 new boreholes or wells; this will be confirmed/defined by the hydrological assessment/plan.

The activity planning will be made by the TST, the Min. of Agriculture (General Directorate of Agriculture and Hydraulic Engineering) and the Min. of Natural Resources (General Directorate of Water Resources), namely on the additional needs and sustainability of operationalization of new water access points.[42]

(ii) Despite the favourable climate and the increasing need for water supply in the "dry" season to address growing drought and water salinization, rainwater retention systems are not deployed in Guinea-Bissau. Exceptions are small projects piloted in the Bijagós islands, as assessed in the freshwater provision baseline assessment. Although successfully implemented since 2003, using local materials and with very low and affordable costs – individual household roof top collection system using Balanta Tank or Calabase Cistern – it was not disseminated nor replicated country wide. The main reason is the political and economic instability that hinders innovation (at country level), as well as access to yet unknown technologies, supplies, equipment and other basic (in other parts of the world) assets. Using OSS expertise in other Sahel countries as well as experiences gained in Malawi by ADPP's network partner, and the recommendations set by the "Freshwater provision baseline assessment", the project will analyse available rainwater retention technologies for community use, to choose the technology best adapted to Guinea-Bissau's reality and with the capacity to cover the small farmer's needs (see examples in annexes).

The prioritised systems will use local material, with a minimum of imported supplies. The collected water will be used in the model plots mainly for garden irrigation and livestock consumption to release the additional pressure in the existing water access points. The techniques will be simple, affordable and feasible to be used by the targeted populations. The EE's project staff and farmers will establish one rain and storm retention system per target community, and one individual household roof top retention system, including locally made tank/cistern for each CCC, as an example to be reproduced by the communities themselves using the produced manual. The surplus of rainwater, retained by both systems, will be directed for recharging groundwater initiatives throughout recharging wells and/or simple water retention barrier and recharge basin systems – to be defined by the hydrological plan.

The above-mentioned rainwater retention system will be made known to the target communities as an affordable complementary means to meet the household's need for fresh water and the community's needs for irrigation and livestock all year long. During the project implementation period, the EE's project team will technically

[41] See table Chapter 5.2.
[42] See table 3 below and section B3.

support the community and individual initiatives to reproduce these new systems, closely working with the community water management committee to sustainably build the capacity of the committee to further support these initiatives – both technically and financially through the community water fund*.

(iii) Applying ADPP-GB's long used and proven locally efficient methodology, the water supply will be organised with water management committees elected at community level, with EE project team orientation. The criteria for the election of the committee members is decided in each community, in a participatory way, with orientation provided by the EE's project team, who establishes a basic criteria of gender balance, inclusivity and minimum literacy and numeracy capacity, in addition to the individual's voluntary willingness/commitment. To promote inclusiveness and gender balance, the EE's project team organises sensitization and awareness initiatives previous to the election. The committees will be regularly trained, by the EE's project team, on water quality control, equipment maintenance, water supply and conflict management amongst other water-connected crosscutting issues (such as waterborne diseases, hygiene and hand washing etc.) They will periodically organise, with the support and orientation of the EE's project team, water connected awareness actions. All their work will be followed up/oriented by the EE's project team during project implementation. Basic guidance for activity development and action plans will be established by the EE's project team and each water management committee will adapt these to its community's situation and needs. A minimum community adapted fee will be introduced by the EE project team together with the water management committee and regularly explained to the community. The amount of the water fee will be decided together with the community, in a participatory way, and will depend of the financial capacity of the community members; it will vary from community to community, according to each community's situation and availability of funds. The fee will be managed by the water management committee and will be used to cover the security of the systems and their maintenance. Other uses can be defined in a participatory manner by the community and the water management committee, with the support of the EE's project team, according to the user's availability to contribute to the "community water fund"* and the decided priorities. ADPP-GB's experience shows that, generally, the community elected water committee leader is a woman, regardless of the ethnic group.

The activity comprises: 17 rainwater retention systems by target region, for a total of 34 - one per target community associated to each of the Model Fields; and 20 individual household roof top retention system, including locally made tank/cistern, one for each CCC. Access to freshwater will thus be improved in all 34 target communities;

Sub-Activities	
i.	Establishment of rain and flood water retention systems;
ii.	Identification of needs for hydrological planning, and existing water points;
iii.	Revitalize water points and/or establish new ones;

Potential designs of water retention systems

To be adapted to local context:

Picture 8. *Examples of water collection systems*

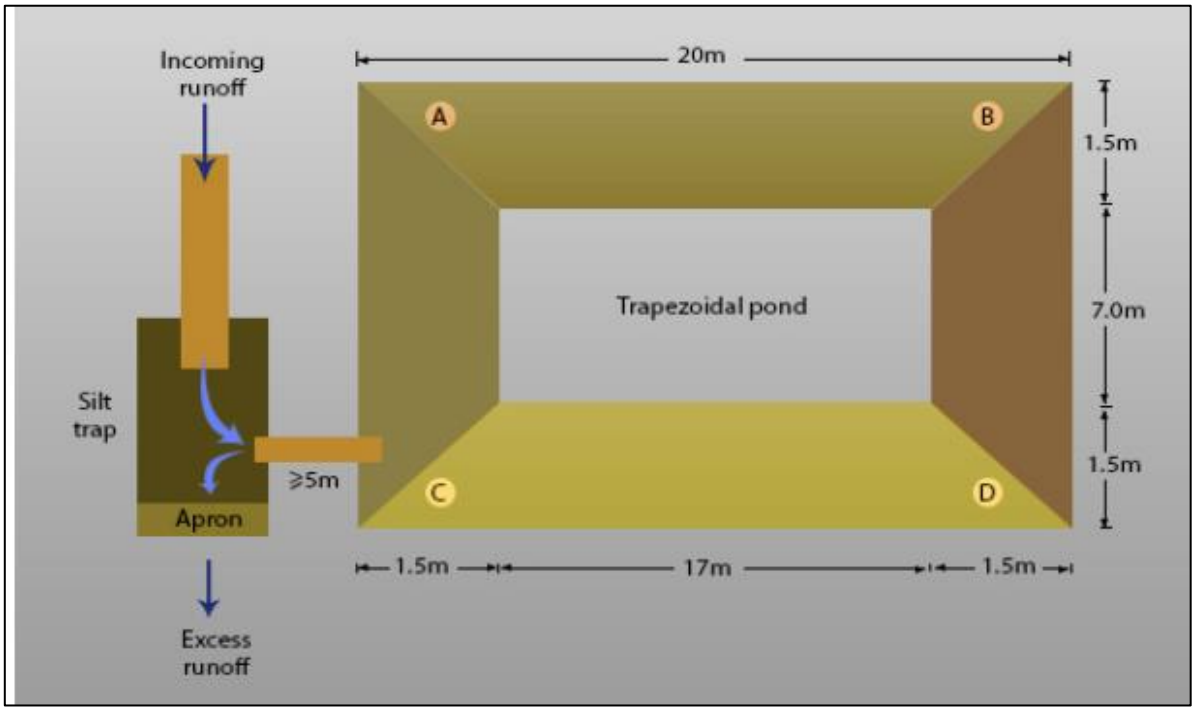


Figure 49. Water pond sketch, to be lined with plastic sheets

Pictures of water points

Picture 9. *Traditional water points (left) and improved water points with solar pump (middle and right)*

Activity 2.1.4. Promote micro-scale irrigation systems to maintain agricultural production:

Regarding underground water, there are poor levels of knowledge regarding aquifer formations, confirmed by the"freshwater provision baseline assessment"[43] . Surface water is used to supply the population, for livestock watering and for irrigation, and irrigation use is still very limited in relation to potential, since it is carried out in a very traditional way. The most intensive uses for irrigation are still very localized and cover very limited areas, as they imply investments in equipment and hydro-agricultural works that are not within the reach of most farmers.[44]

The activity will primarily address rainfall variability (including extreme weather conditions) in the rainy season and during a drought and salinization prone dry season. It will reduce crop loss and provide year-long agricultural production by promoting gardening.

The rice production in the project scope, mangrove rice, is rainfed, water management based. Being a seasonal activity, by improving the water management in the rice fields, the rice production period is extended without foreseen additional irrigation needs.

The irrigation techniques to be applied will result from the assessment of the needs and the planning work done in the project scope by the EE project team, in coordination with the hydrological planning in the activity 2.1.3. Nevertheless, the foreseen irrigating systems are directed to gardening activities in the model plots and are

[43] Freshwater provision assessment - Winrock in attachment to the pre-feasibility study.
[44] Quinto Relatório Nacional da Convenção sobre a Diversidade Biológica (2014)

adapted to the local reality, including the limitation of access to technology. They will generally be basic and adapted to community needs and replication capacity, such as planed watering using weather information, controlled channelling and localised retention and land levelling, reduction of over watering through soil moisture monitoring and root's natural sun protection, use of organic manure to improve soil water retention, planning and directing rainfall events. Solar powered drip irrigation systems will also be applied, as will techniques such as direct rain storm protection and excess water control/channelling. The rain retention systems to be set up in the model plots under activity 2.1.3. will help manage the additional need for irrigation water in the dry season. Wells are regarded as a last resource. Most techniques to be applied require mechanical means, and when necessary, the energy to be used will be renewable – solar energy. No back-up non-renewable energy generators are foreseen in the project scope.

The micro-irrigation activity will take place in the gardening model fields (Activity 3.2.3), in a total area of approximately 2,25ha.

The beneficiaries targeted by this activity are the same 8.500 farmers from the same 34 target communities. The activity implementation will be led by the EE project team with the technical support from the Executing Partners. The farmers will be trained in the set-up and adequate use of the new implemented irrigation techniques by the EE project team. The in-field set-up of the systems will be done by the farmers themselves with support from the EE's project team.[45] Purchases and procurement will be led by the EE project team and will be done following the AE's procurement rules, policies and procedures, foreseen in the AE vs EE grant agreement.

Picture 10. Successful drip irrigation systems in Oio Region

Output 2.2. Mangrove ecosystems are better managed, as an ecosystem-based adaptation measure towards salt-water intrusion.

Key Aspect	Description
Climate Problem to be addressed	This Output targets climate change challenges related to water, being (i) salt water intrusion (SWI) in agricultural fields alongside the coast and estuaries, and (ii) increasing rainfall variability and more frequent extremes (floods and drought);
Baseline situation	Mangrove ecosystems in the target areas are degraded and at risk of further degradation, due to poor natural resourece management, and due to deforestation. The main driver of deforestation is firewood. Being the country with the lowest access to energy, and total absence of a national grid, firewood is the main source of energy in the country.
Barriers addressed	A. Overuse of mangroves for firewood leads to mangrove ecosystem degradation; B. Lack of environmental awareness;

[45] See table Chapter 5.2.

Adaptation Benefit(s)	1. Enhanced ecosystem services of the mangrove ecosystem as a natural barrier towards sea level rise and storm surges / floods that cause SWI in the bolanhas;

The EE's Project Team (PMU, TST, Field Teams) leads the activities under this output. Project Executing Partners involved: IBAP, Ministry of Environment's Regional Offices, Ministry of Agriculture's technical General Directorates and Regional Offices.[46]

Activity 2.2.1. Implement erosion control and adaptation actions towards sea level rise and saline water intrusion through functional reforestation of mangroves:

The activity comprises 3 sub activities: (i) nurseries; (ii) recovery and protection of mangrove forests; and (iii) functional tree planting.

(i) The project will establish 4 mangrove and coastal trees nurseries (2 per target region). (For sustainability reasons, the EE team, in consultation with IBAP as EP, has readjusted the initial number of nurseries from 17 to 4 nurseries, as 4 was assessed as being sufficient to respond to the project's 34 target communities needs regarding the present activity. It was also evaluated as more realistic and effective as a foreseen business model to cover the needs of the 2 target regions.) The activity will be implemented by the EE project team with the support from IBAP as EP and will include the communities in a participatory way, particularly youth and the elderly. The activity comprises species identification, acquisition (both nature-based collection as acquisition when necessary) establishment of a community-based nursery perimeter, development of a management and a business plan, access to plants and training for the target beneficiaries on nursery sustainable management, plant acquisition, caring, multiplication and maintenance/follow up after replanting.

At country level, the mangroves are represented by three main families: Aviceniaceae, Combretaceae and Rhizophoraceae, which include a total of six species (Adam, 1968). Rhizophora racemosa are observed in the coast edges and river margins; geographically behind these are the Rhizophoras mangles. Avicennia germinans occupy the highest and most flooded part due to semi-diurnal tides. There are also Laguncularia racemosa in Cacheu region[47].

The mangrove nurseries will be established and maintained by the communities, with the EE project team support and guidance. It was agreed by the EE and IBAP as EP that, in Oio region, 1 of the nurseries will be established near the EE' EVB-TVET school and the second nursery will be established in one of the project's target communities, strategically chosen (in the project's inception phase) to fully cover the 17 target communities by proximity. In the Cacheu region, 1 of the nurseries will be established near the EE's TTS-Bachil and the second will be established in a project target community near the EP's IBAP managed Cacheu River Natural Park. These locations will contribute to the sustainability of the nurseries after project completion, as EE and EP-IBAP will continue to provide close supervision. The 4 nurseries will be established according to a business model to be set-up by the project, targeting the project's beneficiaries (graduated project students – Activity 3.2.2. and micro-enterprises – Activity 3.3.1. beneficiaries) and cover the mangrove and coastal tree nursery needs of the 2 target regions in general. The "community based mangrove protector groups" (mobilized on a voluntary basis from the target communities – described in (ii) of the present activity) - which will be set up, trained and followed-up with by the EE's project team will help to establish the "nursery group" and support their related activities in the target community. The group is expected to be formed by children and youth and led by elders from the target village. Invasive species are not expected to be problematic since the soil is partially/temporary submerged in salty water, nevertheless they will be handled manually by the community itself.

This activity will provide a good opportunity to include vulnerable groups - including women, the elderly and PWD - in the action.

(i) Recovery of damaged mangrove swamps and protection of existing mangrove forests in the intervention area. This activity will take place in all the 34 project target communities. "Procedural Manuals for Mangrove Management" will be developed and will include mangrove recovery, as well as "Good Practice Manuals for Anthropogenic Activities in Natural Mangrove Areas", fishing, rice, oysters and others. The procedures will be created by the EE project team in collaboration with Executing Partners and aligned to other mangrove initiatives in the target area. The activity will be implemented in the target communities and in coordination with other mangrove initiatives taking place in the target area, including the "Project for Protection and Restoration of

[46] See table Chapter 5.2.
[47] Strategy and National Action Plan for the Biodiversity (2015-2020)

Mangroves and Productive Landscape to strengthen food security and mitigate climate change" (IBAP / IUCN - GEF; 2018/23) and the "Cacheu River Mangroves National Park (PNTC)" (IBAP/IUCN). The team will set up and train "community-based mangrove protector groups" to protect and restore mangroves in the target communities; this activity will be associated with the permanent activities of the CCCs. The activity includes yearly awareness-raising and information campaigns on the importance of mangroves to respond to climate change impacts, as well as main issues regarding mangrove conservation and biodiversity protection.

The EE, based on previous local experiences, will mobilize the target beneficiaries to form the "community based mangrove protector groups" using the sensitization and awareness work to be developed, by proximity and in a daily basis, in the target communities. This work will include explaining and demonstrating, in place, the impacts of climate change and anthropogenic pressure on the mangrove forests and its biodiversity. It will also include the promotion and demonstration of the benefits of alternative approaches and practice by effective community based ecosystem management, to both the ecosystem and the population. Using the Peer to Peer approach - sharing experiences and participatory selection of the actions to be undertaken by the community for the community and for the mangrove ecosystem - will facilitate the "ownership" of the activity and its outcomes by the target communities' throughout the project implementation lifespan; this will contribute to its long term resilience. The technical inputs from EP MoAB and IBAP, specifically the sharing of the Cacheu Mangrove Natural Park experience, will reinforce the message transmitted by the EE's project team amongst the target group.

The project budget will finance the activity set-up and development during the project's implementation. As part of the exit strategy, the EE's project team will implement with the target communities - as part of the project scope (Output 3.3) - sustainable income generating activities and entrepreneurship initiatives connected to the mangrove ecosystems. This will include a sustainable business model for the management of the nurseries.

It is foreseen that the project will protect/restore 250ha of mangrove forest as follows: each Farmer Club (Activity 3.2.3.) of approximately 50 members will undertake the responsibility to oversee approximately 1.5ha of mangrove forest. This calculation was made based on previous experiences on community managed MPA in Mozambique by ADPP-GB's network partner. Since the mangrove restoration activity is not the main activity in this current project, but rather a complementary action to reinforce the field protection, stop further coastal erosion and consequent shoreline retreating and saline water intrusion, the mangrove restoration capacity of a community was proportionally adjusted for the beneficiaries to be able to fully participate in the remaining project activities. Each community will thus be responsible for approximately 7.5ha of mangrove area. These numbers are set up at project level as a necessary minimum to respond to the mangrove belt functionality in the target communities.

In the field visits made by the prefeasibility study for the pre-identification of the possible target communities, the nearby mangrove areas were visited and a rapid assessment was made by the team to confirm that the mangrove belt exists- The degree of damage varies from minor to quite advanced, but most of them need minor to moderate recovery and/or expansion work, and above all, an active management protection and maintenance plan.

No available map on the mangrove forests is available at this stage; the project numbers are to be adjusted according to the baseline assessment identification/confirmation and measurement of the mangrove areas to be restored. Two examples of mangrove belts from 4 preselected target communities – two in Cacheu and two in Oio – are presented in the prefeasibility study.

Figure 50. Example of project mangrove belts – communities of Pechilal and Tchurbrick, Cacheu region

Figure 51. Example of project mangrove belts – communities of Imapse and Urugu, Oio region

(iii) Reforestation with functional trees for adaptation to and mitigation of climate change impacts in the target communities. This activity includes campaigns to replant 2,500 trees in the 34 target communities. At least 500 trees will be planted per year. A work of planning and identification of tree species to be planted will be done together with Project Partners. The objective is to contribute to climate change adaptation efforts through specific tree planting.

Functional tree planting includes the planting of trees in and around agriculture fields with a variety of species for nitrogen fixation, land fertilization, fodder for animals, shade, firewood, fruit, construction material, and improvement of health, most of these uses can be developed as alternative income generating sources. The tree planting targets the upper land of the intervention area, thus around the gardening model fields and the communities, complementing the mangrove replanting activity targeting the lower intervention zones. Most of these upper areas are left treeless result from burning practices for agriculture, firewood and other. SWI regarding,

the tree planting activity will address the unprotected land erosion provoked by extreme weather/ short duration storm events - rain and strong wind events, it will help retain rainwater reinforcing the natural groundwater recharge capacity, will prevent the rapid evaporation of the rainwater in the soils and keep the gardening soils moist for longer periods reducing the needs for additional irrigation. The rapid growth tree planting of species suitable for firewood and construction, will reduce the pressure on the nearby mangrove forests, helping in the process of establishing community based mangrove protection plans.

Local species will be prioritized whenever possible; if local species are not possible, project partners will explore the introduction of adapted sub-regional species, always assuring their compatibility with the project and country's biodiversity preservation goals.

Picture 11. Traditional women fishery in/near mangrove areas

Sub-Activities	
i.	Establishment of mangrove nurseries in communities;
ii.	Trainings in nursery management for committees;
iii.	Identification of reforestation/restoration zones (IBAP);
iv.	Restoration activities;

Activity 2.2.2. Organize sensitization sessions, and promote production and dissemination on firewood saving cookstoves:

The rural and semi-urban populations from Guinea-Bissau depend strongly on forest resources for their survival. The needs of domestic energy for lighting, heating and cooking are mostly satisfied in many cases by the firewood collected in the different forest ecosystems. About 63,4% of the population of the country uses firewood and 35% use vegetable coal (ILAP2, 2011). The use of this energy source for fish smoking, salt transformation and the trade of firewood for the supply of cities is at the root of the increasing pressure on the forests. The unitary consumption of woody fuel in 1999 is estimated at 666 kg/habitant/year, of which 555 kg/habitant/year is used for firewood and 116 kg of the equivalent firewood/habitant/year is converted into 21 kg of coal by each element of the Guinean population a year (DA SILVA et DIOMBÉRA, 2006).

The responsibility for gathering the firewood falls mainly upon women and girls. This stressful, exhausting and slow activity contributes to emphasize the inequality of opportunities in both sustenance and education. There are cases where more than 20 kgs. of this material are transported by head for a long distance.

The impossibility of assuring the constant availability of wood-of-coal in the forests and the delay that it implicates in terms of punctual supply of the market and the economic profit, leads to the production of coal no longer being made only by dead wood, but also by green wood. Data estimates that more than 15% of green wood is used for vegetable coal production.[48]

Data from the National Communication document states that, at national level, the time collecting firewood for firewood-saving cook stoves is reduced to 2-3 hours twice per week, instead of the 2-3 hours used twice per day for a traditional cook stove. The quantity goes from 50 pieces to 15 pieces per day, and the firewood used per

[48] Strategy and National Action Plan for the Biodiversity (2015-2020)

meal goes from 9-11 pieces per meal to 3 pieces per meal. The time used to cook 2 kg of rice (the basis of the Bissau-Guinean feeding) is reduced from 3 hour to 1 hour. Meaning: we reduce firewood consumption and consequent forest destruction, including mangrove forests, which, amongst other, reduces the site resilience to CC induced extreme weather phenomena; time dedicated to cooking consequently releasing useful time for women and girl; and, by reducing time and quantity, we reduce the exposure of the household to the smoke, enhancing their health and livelihood quality.

The EE project team [49] will create synergies with other ongoing initiatives and support introduction and dissemination by acquiring improved stoves produced by the surrounding communities, and with support from other CSO/CBOs active in the target areas. The activity will thus contribute to economic and social efforts of the project stakeholders. This activity will include awareness raising and trainings regarding the environmental, as well as the health and economic advantages of using firewood saving stoves in the project's 34 target communities. It is foreseen that this activity will be primarily led by the target communities' women, as they are generally those responsible for cooking in the household.

There are several CSO and CBO initiatives promoting the production and sale of firewood saving stoves at community level, using local material (clay and iron) – but there will be no private sector involved. (The private sector will not be involved because the production of firewood or charcoal saving cooking stoves is a recent activity promoted by civil society in remote rural areas, at the country level, and targeting the most vulnerable populations. It has commercialization potential, if produced and commercialized at affordable prices for the rural communities. There is, however, currently no great profit potential for stove production. In addition, there is considerable sensitization and awareness work required to promote the stove's usage. It is thus a community based income generating activity, mostly targeting women, and currently, there are no major firewood or charcoal saving cooking stove producers at country level. The small CBO's which will produce and provide the cooking stoves are mostly informal community based small businesses). The EE, ADPP-GB implemented such initiatives twice in the paste and identified that there are two main problems about this activity in the country: 1. The cost of producing good quality firewood saving stoves, although affordable regarding international standards, is too high for local community standards which hinders their salability – commercial value. Wither population won't consider the economical effort of acquisition a priority for the sparse household economy, unless they are informed. 2. Most important is the awareness and sensitization actions regarding its use and its advantages – meaning, the behaviour change. It is why, this time, it was decided not to produce the firewood saving stoves with the target communities, but to support them to acquire such stoves already being produced at local/community level in other initiatives taking place in the same area. This project focus will be on awareness and sensitization and further support on spreading the use of such stoves at community level, thus contributing too to other community's efforts of production instead of competing with them – reinforcing the firewood saving stoves value chain in the target region.

The stoves chosen by the EE team are both firewood saving stoves and charcoal saving stoves being produced by local communities under the CBO "Pobreza Zero" with INITA's technical support and approval regarding the produced models (see model's photos in the prefeasibility study). They are considered of good quality and durability by INITA (National institute for Applied Technology Research, consulted by the EE for this activity outline). The activity targets directly women and girl in the 34 project communities, since they are the lead elements in firewood collection and household daily tasks. Nevertheless, the activity will positively impact all the household, the environment and prevent further degradation of natural barriers against CC impacts.

The EE project team will establish a supplying agreement with the cooking stove producer CBO's, mostly formed by women, from the most vulnerable and isolated rural communities, who were part of previous civil society projects (namely the project led by the CBO "Pobreza Zero") and have learned, under those projects/financing, the cooking stove production techniques as an income generating activity to help them economically support their household to improve its access to basic social services and better nutrition. The project will buy (subsidize) the cooking stoves – following project-established agreement conditions – according to the producer's capacity to deliver the purchased product. The sensitization and awareness campaigns will start to take place in the 34 target communities before the first round of cooking stoves are distributed. The project team will show/calculate and demonstrate to the target family the economic, environmental and health benefits of using the project stoves. The sensitization campaigns will continue, periodically, during the project implementation period.

[49] See Figure – chapter 5.2.

The EE project team will lead the selection of the direct beneficiaries, using the usual participatory approach. The criterion for acquisition will be established following baseline assessment and clearly communicated/explained to target communities. The basic criteria will be: the most vulnerable households – these are households with less income in the target community that otherwise would not be able to acquire the stoves, with larger number of dependents, with more children and elder, with chronically ill and/or PWD dependents, and female/widows/single mothers - led households. A complementary criterion will be the voluntary expression of interest from the household to acquire and commitment to use the stove and provide related data. The profile of the households is well known to the community in general. The target communities will be selected in a participatory way, including community and religious leaders, groups of "elder" and other existing associative groups.

The direct beneficiaries will receive additional training on the use and maintenance of the stoves. The EE project team will establish a minimum affordable fee to be paid as contribution to the stoves acquisition and the paying modality. The fee amount will be established in a participatory way, including the target communities and CCC management committees, and will be established according to the financial availability of each target community. This fee will be added to the corresponding CCC management fund to be used in further supporting the firewood/charcoal saving cooking stove initiative beyond the project implementation period.

3500 cooking stoves will be distributed to the target households in the 34 target communities. Given that most target households are large families, the project foresees that the majority of the target households will acquire 3 improved cooking stoves, directly benefiting at least 850 households. Nevertheless, it is expected that the sensitization, awareness, trainings and target household's example will contribute to further promote the individual effort to acquire firewood saving stoves in the target communities.

The targeted number was calculated according to previous EE in-field experience with the introduction of this kind of "innovative" solutions in the communities. Approximately 100 cooking stoves for each of the 34 target communities will permit the project to better follow up on its use and acceptance by the target households and community in general; this number will be sufficient to create community attention regarding the impact of the stoves in the targeted families. It also provides sufficient social and environmental data for the project team to analyze and process lessons learned, and gives time to the newly created community structures, such as the CCC, to learn and create resilience in such initiatives' follow-up procedures after the project end.

Based on INITA inputs, with 3500 cooking stoves of the chosen model, it is expected to save approximately 3600 hectares of forests over 5 years.

Picture 12. Firewood saving cooking stove – model approved and recommended by INITA.

Picture 13. Charcoal saving cooking stove – model approved and recommended by INITA

Picture 14. Clay part of the stove production process. The metal part is produced by artisan blacksmiths who reuse existing metal sheets/plates.

Component 3 “Building resilience of farming communities towards climate change”.

Outcome 3 Enhanced climate-resilient livelihoods, and food and water security of the most vulerable people in coastal communities in Oio and Cacheu Region

Output 3.1. Increased and diversified livelihoods of smallholder farmers.

Key Aspect	Description
Overview	Increased rainfall variability and increased frequency and intensity leads to declines in agricultural productivity. Farming communities do not have knowledge or technical capacities to adopt CRA practices
Baseline situation	Agricultural production levels in the country are very low compared to neighbouring countries. This is due to underdeveloped value chains, and underdeveloped agricultural sector in general, and high dependency on cashew as the main cash crop. There is limited diversification of production, and practices used are old-fashioned and not adapted to new conditions. Capacities of extension services at sub-national level are near to non-existent. The enormous financial underdevelopment of the country leaves local agricultural services paralyzed, as no means are available for improving the situation.
Barriers Addressed	A. General lack of capacities in agriculture; B. Insufficiently skilled personnel in CRA and climate-resilient value chains; C. Limited extension on, and uptake of CRA practices; D. Lack of organization among farmers;
Adaptation Benefits	1. Enhanced climate-resilience of smallholder agricultural systems; 2. Enhanced technical skills of youth in climate-resilient practices along the agricultural value chains; 3. Increased social capital, as a key building block of community-based resilience;

The EE Project Team (PMU, TST, Field Teams) leads the activities to be partly implemented by ADPP-GB's TVET school - EVB. Project Executing Partners involved: Ministry of Agriculture's technical General Directorates and Regional Offices, INPA.[50]

Activity 3.1.1. Establishment, organization and regular trainings in CRA practices on Model Plots of 170 Farmers' Clubs - 8,500 farmers (70% women):

This activity will be implemented by the EE's project team. The EP will contribute to specific parts of the activity as described.[51]

This activity will involve the establishment and organization of Farmers' Clubs (FCs). Organization of producers into working/productive groups/clubs (Farmer Clubs) of approximately 50 members, led by management committees elected by the members and in conjunction with local communities. Based on 20 years of experience working with Farmers' Clubs, the project will collaborate with local and traditional authorities in the identification and mobilization of farmers. Communities will be sensitized about the programme offered, and those interested and willing and able to invest time and energy will have the opportunity to join a FC. The benefits – access to training, technical support, and inputs – will be explained. Producers are organized into productive groups depending on proximity to productive parcels/fields and common production interests. . The EE project team will provide the training of Development Officers (DO) and ongoing training of the farmers on Climate Resilient agriculture techniques and follow up on individual and group initiatives of the producers. The Farmers' Clubs system comprises approximately 50 members per Club, subdivided into 5 core group of 10 members with 1 leader and 5 front line farmers. This division and distribution happens naturally in a participatory way with the beneficiaries; it is done on a voluntary basis or based on the suggestion of the group. Women's leadership capacity will be highlighted in the Clubs. The Farmers' Clubs activities will be connected to the work of the CCCs, which will promote climate focussed initiatives and host the frontline activities of the OGs; this will be done through the work of the Community Observers [CO] in the Proximity Monitoring Station (Activity 3.1.1.).. The CO members will come from the Farmers' Clubs and the communities surrounding the CCCs.

Mentoring of productive groups (Farmers' Clubs) by the DOs and EE project team supervisors[52] will include the promotion of/training in soft and hard skills. Mentoring by the EE's project team will gradually introduce changes from agricultural to social practices. Meetings and trainings necessary to strengthen technical and operational capacities will be facilitated, a joint (by the farmers and the EE's project team) action plan will be made, and means and methods will be chosen and made available. Activity planning according to agriculture calendars will also be

[50] See table Chapter 5.2.
[51] See table Chapter 5.2.
[52] See figure – Chapter 5.2

included, as will regular training, given by the EE's project team, of farmers in Model Fields. Social activities related to agricultural and climate change will be held and post-harvesting and income generating activities will strengthen the "Club" concept and social cohesion. Committee meetings for evaluation and planning of weekly activities will be held with EE's project team supervisors, and quarterly coordination meetings will be held to monitor activities and to allow the project team's participatory evaluation. Special attention will be paid to promote women's active voice and participation in all activities.

This activity will be executed by the EE's project team[53] through training of target producers in climate-resilient production techniques in the project's model plots. The model plots will serve as classrooms through the demonstration sites (both for water and soil management works) for land preparation, potholing for water retention, rain retention simple techniques, sustainable watering, application of inputs, methods of preparing nurseries, transplanting, conservation agriculture and agronomic practices inter alia.

Particular focus will be placed by the EE's project team on diversification of production, tree (functional trees) planting management, horticulture crops, mangrove rice row and sustainable co-existence and mutual benefits between natural forests and mangroves and agriculture and pastoralism practices. The training will reinforce the farmers' general and basic knowledge and will focus on improving productive techniques and diversifying crops, considering climate change impacts, the time of planting and harvesting and the characteristics of the soil.

Production techniques will be adapted and resilient to climate change. Environmental friendly practices will be shared with each targeted farmer (8.500 farmers) private household, and the project execution team will provide regular follow-up to support individuals in the use of new practices. Products and processes that allow a greater variety of processed by-products will be valued – including conservation methods and valorisation of native wild products as well as traditional medicine – and these will contribute to food security and greater economic income (nutrition, raw and processed marketing).

CRA practices recommended for Guinea-Bissau[54], and to be promoted by this project are:

1. Use of organic manure to provide organic nutrients and increase the content of organic matter in the soil
2. Water supply through drip irrigation – solar-powered drip irrigation systems to improve water availability
3. Crop rotation to mitigate low soil fertility resulting from intensive land use without adequate nutrient replenishment.
4. Zai technique: used for the production of corn, sorghum, fonio, among other cereals. Zai involves digging pits (at 20-40 cm diameter and 10- 15 cm depth) to accumulate water before subsequent planting with or without the application of organic resources such as compost, plant residues and animal manure.
5. Forage/fodder production – forage plants such as the brachiaria to improve the diets of livestock

The EE's project team will work closely together with the EP INPA and the new seed bank (II) in selecting the most appropriate seeds for the target area, assuring they are best suited in a changing climate.

Picture 15. "Bemba", traditional seed/rice conservation system (left); traditional mangrove-rice culture, "arado" tool (right)

[53] See figure – Chapter 5.2.
[54] FAO, 2019, Climate-Smart Agriculture in Guinea-Bissau

(i) Model Plots: The identification and assignment of model plots to be used as demonstration sites, will be made by the EE's project team in consultation with authorities, the communities and the target producers. A criteria for field choice will be developed with emphasis on: the area of the plots; land ownership; accessibility and proximity to target communities and local markets; access to water; soil quality and fertility; climate impact/resilience, inter alia. Development plans will be drawn up by the EE's project team and the producers, and will consider the necessary investments and local applicability of techniques which will include handing over and legalising land use by the project beneficiaries according to national land use law and with community and owner's agreement.

The process over land ownership develops in a similar way to the one described for the establishment of the CCC's (A.3.1.1) and the CCP (A.3.3.2.), is to say, according to land availability and suitable criteria' described, the most important is the owner's availability to dispose of the land for common use by the group/community. Agreements and copies will be signed between the land owners and the community in general, represented by the community leaders, alongside testimonials (a representative number of young adults chosen by the community to be witnesses) and representatives of the local State Committee. The terms for the land concession, in the case of model fields, will be defined by each community, it can be for a limited but extended lifespan, since it represents an investment for the community benefit, or infinite, i.e. the land will be allocated for an indefinite period of time. This is a legal procedure reproducing the exact procedure done in previous projects for the establishment of "Community Model Plots" and other assets of common interest. It was done in the EU Renewable Energy project for the construction of the Community Centers and the Community Processing Centers. In Guinea Bissau there is an "informal/complementary" Lei da Terra (law of the land) applicable to the rural areas, that respects traditional procedures and community leadership, still in force; the testimony of the local State Committee (Local Authority's representative) validates the arrangement. This procedure has been applied by ADPP-GB successfully since 2008.

170 model fields (at least 2 per target community - 1 for horticulture and 1 for rice production) will be established, prepared by the project for the use as "school plots" to teach and apply CRA techniques adapted to CC, with the FC, in the target communities. Each model field will be subdivided into 8 model plots of $40m^2$ each. All the production resulting from the demonstration work developed in the model plots will be owned by the farmers and be used by them according to the plan developed/defined, in a participatory way, prior to production process. The 170 model fields are estimated to be distributed in 85 horticulture model gardens and 85 rice model plots, covering the needs of the 34 target communities' needs.

To emphasize that the 8.500 farmers that are organized in FC represent, each, their household in a approximate total of 82.450 people. The household representative (doesn't have to be and usually is not head of family) is bound to participate in the trainings and FC activities, but, experience in field evidences that he/she never comes alone, always accompanied by family members. In the same way, the work developed is not individual but include household elements. It is of the target household interest to attend and participate in the model field activities for the household to be able to benefit from the model field production.

Pictures:

Picture 16. Pictures of previous and existing model plots

(ii) Seed Bank: The project includes the creation of a seed bank for adapted seeds that are resilient to climate change impacts. The seed bank will be part of the EE's EVB-TVET teaching programme, and the project's Farmers' Clubs. Adapted seeds, inputs, materials and equipment will be provided for students from the EVB-TVET courses connected to agriculture and for farmers' trainings in agriculture. Adapted seeds will also be supplied to the project's targeted 34 rural communities and 8.500 farmers. This exercise will be done in collaboration with the EP - National Institute for Agricultural Research – INPA in the project's 1st year. The EP – INPA will provide knowhow and adequate adapted seeds and will follow-up on this action with the EVB-TVET school. The EVB-TVET school's seed bank will be operational by the project's completion and will be used by future EVB-TVET students. An agreement will be signed between the EVB-TVET school and INPA for future mutual support in the seed bank initiative. This will operationalize the follow-up and technically support to the EVB-TVET's seed bank, while the school students will support the EP - National Institute for Agricultural Research's activities in rural communities during their internship. Based on the EVB seed bank, the Farmers' Clubs seed banks will be smaller in size, comprising of simple seed storage systems and the FC committees organizing ownership and management of the seed banks.

Sub-Activities	
i.	Mobilization of farmers and organization in Farmers' Clubs;
ii.	Set up of 170 Model Fields;
iii.	Set up of Seed Bank;
iv.	Mentoring of Farmers' Clubs throughout the project;
v.	Provide continuous training and on-farm extension support in CRA practices to Farmers' Clubs;

Activity 3.1.2. Promote Sustainable Rice Intensification (SRI) and Climate-Resilient Rice Production (CRRP):

By using the SRI-CRRP approach, rice production will be more climate-resilient, better withstand droughts and floods, yields will increase, the need for irrigation water and chemical inputs will be reduced, and rice grain quality will be improved. The specific objective of this activity is to assist the small rice farmers to implement and scale-up SRI and CRRP. Training workshops will be organised in the project areas on SRI/CRRP best practices and associated SLWM and IPM practices. Also under this activity, field visits will be organised for farmers to plots that have adopted the SRI-CRRP approach.

Although the benefits of SRI are not well documented in Guinea-Bissau, the system is successfully implemented in West-Africa, in neighbouring countries with similar agro-ecological conditions. As such, the project will benefit from the OSS-implemented project "Scaling-up climate-resilient rice production in West Africa (2021 – 2025 / OSS-Adaptation Fund)" which benefits the neighbouring countries of Guinea-Bissau, and which in turn builds on the SRI West Africa Program (https://sriwestafrica.org/), in which the benefits are well documented.

The SRI-CRRP will be promoted on farmers' fields. Farmers' Clubs will elect the farmers and farms to serve as models. EE extension workers will assist the farmers to apply SRI-CRRP practices on the fields and will facilitate that member of the Farmers' Clubs are trained in these practices as a part of their 5-year training program. The key elements of CRRP-SRI to be promoted are:

a) Encourage early and healthy plant establishment.

Careful and early plant establishment maximizes the plant's potential for shoot and root development, largely by minimizing early stress from both excessive competition among plants in the nursery and from transplanting. The earlier plants can be established in a rich soil, with plenty of space, the sooner they can develop roots and start tillering, and the healthier and more resilient towards stress they become. Most commonly, this translates in transplanting much younger seedlings, and if further pushed back can also include direct seeding.

b) Minimize competition among plants.

Minimizing competition for resources—such as nutrients, water, sunlight and soil volume—helps plants grow quickly and healthy and become more productive with better panicle and grain development. This principle is highly interactive and dependent on Principles a and c, early and healthy plant establishment and building fertile soils, respectively. Under SRI management, competition is minimized by reducing the density of the plant population, by both i) increased spacing between plants, and ii) planting only 1 plant/hill instead of 3-5 plants/hill.

c) Build up fertile soils rich with organic matter and beneficial soil biota

This principle strives to create a healthy soil that supports and provides a number of functions and benefits, among others: i) a good and deep substrate for roots, and for microbial life to develop and support plant growth, ii) improve nutrient and water holding capacity of the soil, iii) improve fertilizer use efficiency, iv) create favorable aerobic soil conditions, and iv) protect and buffer against conditions created by climate change, be it variable rainfall patterns, increased temperature, pest and disease pressure. Improving soils with organic matter is the only viable solution in the long run to create and maintain productive and healthy soils. Integration of conservation agriculture principles and practices is highly beneficial to reach the objectives of this principle.

d) Manage water carefully to avoid both flooding and water stress

The core point of this principle is that while rice plants can survive in flooded conditions, they don't thrive in them, as roots lack oxygen to develop comfortably. Under non-flooded and aerobic soil conditions, roots grow more proliferous and deeper. Aerobic soil microbes support healthy plant development, and the plants tiller more and better. All this translates into better panicle development and a longer grain filling period. Aerobic soils are greatly enhanced by organic matter additions. Mineralization of nutrients found in organic matter are improved in aerobic soil conditions, making nutrients better accessible to both soil microbes and plant roots. This principle translates into different practices depending on the rice system, be it irrigated, rainfed lowland or rainfed upland rice systems. It interacts with activities under Component 2 on water management.

Activity 3.1.3 Introduction and Dissemination of Short Cycle Animal Pass on Gift system in Target Communities:

The purpose of this Activity is to support target beneficiaries to have alternative livelihoods and to reduce their dependence on agriculture greatly impacted by CC variables and natural resources, such as mangrove and forest exploitation; protection and sustainable management help to protect against CC impacts.

This activity will be executed by the EE's project team through the introduction and dissemination of short-cycle animals in the 34 target communities. The EP will follow up on the activity and provide technical support when

necessary.[55] The short-cycle animals will be introduced through a "pass-on gift system" (chicken and goats) for 680 people (women and young), 20 per community to enhance animal husbandry and livestock propagation. The EE's project team in the field will organise the mobilization and organisation of the initial animal raising and breeding households in the target communities in a participatory way, defining the criteria with the communities. The selection criteria will be established according to availability and interest and the evaluated capacity/availability to take care of the animals; priority will be given to families with women as head of the household. The criteria for selecting the second and forthcoming rounds of family candidates to receive the offspring animals will be set in the same participatory way, from the beginning of the activity, made known publically by the target community including an estimated calendar, and listing the selection criteria. The manner in which the system works is that the first 20 households will keep the first offspring, and then, pass to another family one offspring of its animals; the next family keeps the first offspring, return 1 offspring of its animals back to the original family, and pass one offspring on to the next family.

Being short cycle animals, and with the support of the project implementation team, based on the previous experience, it is expected that by the end of the project all 8.500 households will be resiliently breading goats and chicken and making use of the animal's sub-product for household consumption and surplus sale.

The targeted number was calculated according to previous EE infield experience and the EE partner's experience in Malawi and Zambia with the introduction of a "pass-on animal" system in the communities. Approximately 20 households for each of the 34 target communities will permit the project team to better follow up on animal care by the target households and the community in general; it is a number that is sufficient to call the community's attention to the impact of the animal breading in the targeted families, and it also provides sufficient social, income and environmental data for the project team to analyse and to process lessons learned. Additionally, it gives time to the newly created community structures, such as the CCC, to learn and create resilience in such initiatives' follow-up procedures after the project end.

The activity includes awareness training in animal husbandry in a "pass on gift system" system by the EE's project team. Community youth will be trained in the EVB TVET schools in the "short cycle animal husbandry" course (Activity 3.2.1 - 3-month intensive course for 2 people from each target community, 50% women, in the 1st year of project execution). This training will include gender sensitive awareness raising, training on animal sub product processing and conservation, and access to markets, among others. These wider awareness training will target all the community.

This activity, besides providing protein to the household through access to meat and animal sub products such as eggs, milk, cheese etc., represents an alternative income generating source for the household, alleviating the pressure of CC impact on their lives.

Output 3.2. Increased income options in climate-resilient economic activity along agricultural value chains.

Key Aspect	Description
Overview	Increased rainfall variability and increased frequency and intensity leads to declines in agricultural productivity.
Baseline situation	Agricultural value chains are undeveloped in the country. Only in the cashew production sector, small investmens are being made in processing, conservation and marketing. Where initiatives do exist, they are small and of artisanal nature. There is limited support for entrepreneurs willing to develop businesses along the value chains, including technical as well as financial support. The banking system is highly undeveloped, and there are very limited options for accesing grants of credits. Assocations and cooperatives prove to be mostly unsuccessful due to a lack of business management capacities, and a lack of technical support.
Barriers Addressed	A. Underdevelopment of agricultural value chains; B. Farmers and youth don't have access to financial support for establishing new income generating activities;
Adaptation Benefits	1. Adaptation of agricultural value chains to current and projected climate risks and impacts;

[55] See table Chapter 5.2.

The EE's Project Team (PMU, TST, Field Teams) leads the activities to be partially implemented by EE's (ADPP-GB's) TVET school - EVB. [56]

Activity 3.2.1. Support the establishment and mentoring of 40 micro-enterprises and women-led income generating activities (IGAs) along the value chain(s):

The Activity consists of providing the project target groups with a financing opportunity throughout a call for proposals – for small amounts – and a grants award to selected applicant small scale rural enterprises in response to the lack of available and accessible financial support by the banking system and the private sector at the country level.

This activity will be done through creation of 20 new micro-enterprises and businesses (income generating activities) for the project beneficiaries with at least 50% women led – TVET courses graduate, rainwater retention systems and /or 5.000 lt cistern constructors, adapted seed and plant nursey entrepreneurs, etc. Additionally, 20 existing micro-enterprises or service and product entrepreneurs will be trained and provided with the necessary initial equipment/investments to start up their business activities. The activity will be defined based on a mapping of structured organizations working in agribusiness in the target regions and a mapping and analysis of the available market and market priorities in the target regions and at country level to be assessed as part of the baseline study to take place at project inception phase. Furthermore, it will build on the project CC adaptation outcomes regarding all the activities with income generating potential. It will consist of training and funding in materials of the selected new and existing micro-enterprises and small agribusiness projects, prioritizing enterprises led by women.

The micro-businesses will be required to be oriented by the EE's project team, and to consider/respond to environment factors as well as adaptation and resilience to climate change and environmental protection (green businesses and nature-based enterprises). Although the limit for a green business or a nature-based enterprise goes as far as the entrepreneurs' creativity and vision for a valid business, some examples can be connected to eco-tourism as part of the sustainable mangrove community management plan, environment and biodiversity protection through sea waste recovery and recycling for mangrove protection, forests eco-exploitation, traditional eco-fishery, improved cooking stoves, mangrove honey farming and by-products as part of the sustainable community based mangrove forest's management, and salt production on abandoned rice bolanhas, amongst others. Other options include specific actions along the value chains, such as small businesses that provide services for processing, conservation, marketing or equipment repairs connected to the adaptation and conservation activities promoted in the project scope.

The opportunity will be made known by the EE's project team in the target area, open to target communities and extra-project communities as far as they operate/or will operate in the target regions and pre-defined proximity, for follow-up reasons, and their business profile fits in the project's priorities. The candidates will present their projects for a pre-selection of ideas and/or existing initiatives. The preselected projects will be visited by the EE's project team for further analysis and confirmation of idea/business consistency and alignment with the present project's goals, defining a shortlist in consultancy with the EVB's IDEA Center. (The EVB is the EE's [ADPP's] TVET school in Oio Region. It has an entrepreneurship incubator set up with UNIDO's support – The IDEA Center. The EVB incubator will support the project team in the awarded businesses' selection, preparation and follow-up.)

The shortlisted projects will be supported by the EE's project team and the EVB's IDEA Center to present an application following defined criteria. This support is necessary to overcome the difficulties raised by the low literacy level of the rural population in general and is also a practice applied in previous projects implemented by the EE; these previous projects also targeted rural areas and faced similar difficult conditions on a daily basis.

The shortlisted projects will be analysed by a jury composed of one representative from each project's Executing Partner at that local level, namely 1 element from the Agriculture Regional Directorate, 1 from Environmental Regional Directorate, 1 from the Regional government, 1 from OSS and 1 from the EVB school (ADPP-GB's TVET school) business incubator. Other jury elements can be defined at project stage. This jury will choose the 40 projects to be supported.

As a pre-condition to be supported by this activity, the support provided to the selected small businesses includes training, inception and/or equipment financing, support on planning and business follow-up by the EE project team and the EVB school/business incubator – IDEA Center. For the new micro-enterprises supported, the

[56] See table Chapter 5.2.

candidates must additionally have successfully attended the training in agribusiness management adapted to climate change.

The project foresees maximum investments around 12,500 USD, from the GCF grant, per entrepreneurship initiative (this amount may be adjusted after the baseline study) in a small grant format. An Operations Manual will be established by the EE project team and the EVB IDEA Center, with the support from the AE and the Donor following the necessary and required terms for such a small grant amount. There will be monitoring and follow-up, by the EE project team and the EVB's IDEA Center, with the selected activities during the duration of the project to support the entrepreneurs to implement their activities and make their business resilient.

Awareness campaigns will also be held in the 34 target communities and in the EVB school to target the importance of creating rural income generating activities that are adapted and resilient to climate change and environment friendly. These campaigns will be held through "bootcamp" type sessions led by the EE's project team.

The criteria for business selection will be defined by the EE's project team will include:

1. the overall objectives, the specific objective(s) and the outputs (i.e. the results) to be achieved with the financial support;
2. the different types of activities eligible for financial support, on the basis of a fixed list;
3. the types of persons or categories of persons which may receive financial support;
4. the criteria for selecting these entities and giving the financial support;
5. the criteria for determining the exact amount of financial support for each third entity; and
6. the maximum amount which may be given.

This activity will also include specific trainings in agribusiness management adapted to climate change for all EVB TVET school interested graduates. The student's selection will be organised by the school following criteria to be defined with the EE's project team; criteria will include factors such as the number of available places, interest and availability, technical, organizational and entrepreneur profile and capacity of the student assessed during its original course, and inception project idea, amongst others. The course on agribusiness management targets the possible new micro-enterprises candidates under this activity. The trainings will address components of climate change impacts adapted resource optimization, such as utilization of raw agricultural products, conservation and transformation techniques, marketing of products and services, quality systems and differentiation in the product market, management and use of inputs and assets, input renting and/or selling, among others. It will include basic and useful information to help graduates discover and understand basic business management, existing basic tools, the factors that are most important when organizing a business, how to organize a basic dossier, etc. The trainings will take place in the EVB TVET training center from the 2nd year onwards. It will consist of 6 months' training and business follow-up after graduation. 20 students every 6 months will take part with a total aggregate of 160 students with at least 50% being women students. Students will then be encouraged to join create small groups with whom to start a business and present a business model to access the grant(s), from which the 20 best evaluated projects, as determined by the activity jury, will be awarded and further followed up by the EVB's IDEA Center.

The extra-school candidates shortlisted for this activity who are interested, available and qualified to attend the course on agribusiness management adapted to climate change (qualification attested after examination and interview by the school, following the normal EVB school procedure for student's enrolment) will be included in the course. This is a necessary procedure to guaranty a minimum level of literacy to successfully conclude the course. The remaining preselected extra-school candidates (20 existing micro-enterprises to be awarded with a sub-grant support under the activity) will receive adapted support/training and follow-up by the EVB-s IDEA Center, according to their literacy level.

Activity 3.2.2. Establish and upgrade commercial associations for agricultural value chain development:

This activity will be conducted by the EE's project team[57] through:

(i) creation of agricultural community units (Community Processing and Marketing Centers - CCP), equipped with basic systems for the conservation, transformation, packaging and transportation of agricultural products from the target beneficiary communities and the surrounding communities. The CCPs will be equipped, by the project, with basic technologies, equipment and tools necessary for conservation, transformation, packaging and

[57] See table Chapter 5.2.

commercialization activities and a solar energy set. The products resulting from agricultural campaigns, in the project scope, may follow different routes considering: a) the need for diversification of food products and nutritional enrichment in the family diet, b) the intrinsic characteristics of the products, c)the quantity and diversity of products obtained, d)the supply and demand in local markets, the possibility of generating income from the sale of surplus production, the interest of the consumers and the local private sector.

The products to be processed in the CCPs, are rice - pealing and flour production, maize for flour, peanuts for peanut butter, cassava for flour, mango for drying and others to be defined according to the farmer's activity and the CCP's availability. These processes will be set-up and followed up by the EE's project team and each CCP management team during the project implementation period as part of capacity building for the CCP management teams. The CCP management team is to be selected and trained by the EE's project team.

The project envisages the construction of two new CCPs in Cacheu region and one new CCP in Oio Region in remote areas to be defined in the project's baseline study. This activity will also entail the reinforcement of one existing CCP in Oio Region, Bissorã sector. Each CCP will have the necessary equipment and basic materials required (mill, rice peeler, peanut mill, palm oil press and solar energy system). The project envisages the selection and training of the CCP management teams by the EE's project team. The joint setup of the management model, and a marketing plan for processed products and access to markets will be designed by the EE's project team with the CCP's management teams. For the selection of the management team's members, the EE's project team will establish a ToR with basic necessary skills, targeting people from the project's 34 communities – whenever possible, this will include individuals who graduated from EE's EVB TVET school and/or graduates from other TVET schools in the country. Preference will be given to people living in the 2 target regions and as close as possible to the project's intervention area. . Whenever possible, a gender balanced CCP management team will be selected for each CCP. The management team will be trained in basic management and followed up and supported throughout the project execution by the EE's project team. This will build and strengthen each CCP's resilience and promote the CCPs' long-term sustainability and will form part of the project exit strategy, which will be executed/promoted from the CCPs' commencement by the EE's project team.

Following the EU-Renewable Energy project experience with the setup of 7 small CCPs, the management of the CCP will be based on service provision. For the project beneficiary's production, for each Kg of farmers processed product, a small percentage (to be adjusted according to CCP management plan) will stay in the CCP as fee payment, this surplus will be sold by the CCP, generating income for CCP's operationalization and equipment maintenance. The CCP management unit will be trained and responsible for this income management. The CCP's will be open to process the products from small farmers external to the project too, this services will be payed according to local market prices. The CCP management plan will include a waste management plan. The waste from the basic processing offered by the CCP will be used mainly for natural compost, for animal fodder and as biofuel, to be used in the scope of the project activities and/or sold to external stakeholder as an extra revenue for the CCP.

Location: The criteria for the location and land choice, similar to the one for the CCCs (activity 3.1.1.), is the land Availability and suitable size, owner's availability to dispose of the land for community use, accessibility for the community to participate in the construction works and to use it - proximity/centrality and its strategic and "weather safe" proximity to the fields and watercourses to be monitored by the OG and CO. Agreements and copies will be signed between the land owners and the community in general, represented by the community leaders, alongside testimonials (a representative number of young adults chosen by the community to be witnesses) and representatives of the local State Committee. The terms for the land concession are infinite, i.e. the land will be allocated for an indefinite period of time. This is a legal procedure reproducing the exact procedure done in previous projects for the establishment of "Community Model Plots" and other assets of common interest. It was done in the EU Renewable Energy project for the construction of the Community Centers and the Community Processing Centers. In Guinea Bissau there is an "informal/complementary" Lei da Terra (law of the land) applicable to the rural areas, respecting traditional procedures and community leadership, still in force; the local State Committee (Local Authority's representative) validates the arrangement.

Oio's Region existing CCP is located in the Watine community, near the national road. It has basic equipment that needs some upgrades and additional mills. It is equipped with solar panels system and two generators that are adapted to work on biofuel. The exact location of the new CCPs will be defined following established criteria such as located in a central community with easy access from other project communities and located near the national road, amongst others. The criteria will be defined in the project inception phase, after the baseline assessment and the definitive selection of the target communities.

Construction: As for the CCCs (Activity 3.1.1.), the buildings consist in simple constructing structures, build by the target communities themselves with the support and orientations from the EE's project team. The project will guaranty the purchase of imported material and transport and subsidise the work. Each community will organize small work groups, identify were to pick good quality sand and gravel as well as cibe palm wood, they will produce the clay blocks themselves without any cost for the project. It worked well in the previous experience and contributed to the ownership of the Centers by the community. The material to be used is mainly Local materials such as: "cibe" palm's wood (Borasus aethiopum), clay block, zinc, nails and cement for concreting and plastering the walls. It will have 3 compartments, 1 central compartment for the processing of products, one small side compartment for product storage and 1 small side compartment which will work as small community store selling the processed products and some basic products as oil, soap, salt, sugar etc.

Picture 17. Traditional mango fruit drying

and (ii) Creation, organisation and start-up of a new Farmer's Commercial Association, covering the direct beneficiaries of the present project in the region of Cacheu (mobilisation, organisation, planning, training of the management team, legalization etc.)

The reorganisation and reinforcement of the existing farmer's Association, ACACB, in Oio will also be undertaken in this activity. ACACB was created as part of an exit strategy of a previous ADPP-GB project and its members who are all the project beneficiaries (2,800 – 90% women) will be supported by the project.

Following the ACACB example and the EU ownership rules regarding project assets, all the assets generated by the present project, in each region, will be handed over to the regional Commercial Association's ownership, namely the Association's members, as part of the Exit Strategy. The Association's responsibilities include the overview of the CCPs and the CCCs (Activity 3.1.1.) management and active support. The Commercial Associations will provide support to its members on value adding to their products, they will, in coordination with the CCCs (Activity 3.1.1.) promote refreshing trainings on Adaptation to CC and CRA techniques, will support the members in accessing markets, provide buyers for their products etc. The Commercial Association will prioritise working with the micro-enterprises activity.

As a result from the lessons learned in the previous EE's EU Energy project, and aiming for a more institutionally resilient structure after project completion, the Farmer's Commercial Associations will be set up as soon as possible in the project implementation timeframe (ACACB was set up in the last year of the previous project) and will be gradually held accountable for its activity, under the supervision of the EE's project team, throughout the project's implementation period. This will permit a better follow-up and support to the institutional capacity building of the Associations by the EE's project team. The Association members will be elected and/or selected in the project scope and with the participation of the target community representatives. The project, through its EE's project team, will provide the management knowledge and tools, orientation, and institutional capacity building, as well as support for its legalization. The target beneficiaries from each region will be informed and invited to become members of the Farmer's Association as a support means to follow up their project connected activities after the project is finalised. The Farmer's Association is expected to have an active part in the project activities, together with the project team, the CCC (Activity 3.1.1.) team and the CCP team, and it will build resilience throughout the project implementation period. The entrepreneurship activity's beneficiaries as well as the TVET graduates in the project scope will be encouraged to actively participate in the Farmer's Associations and share their entrepreneurship initiatives and capacities in order to strengthen the Association's team and overcome the literacy limitation problem at country level – especially in rural areas.

The CCP ownership will be transferred to the farmers throughout the community based Commercial Associations. As for ACACB's case, the EE and EP will continue to follow up, informally, the performance of the Farmer's Commercial Associations after the project's completion and will continue to look for opportunities to strengthen their capacity.

Picture 18. Example of a processing center, inside and outside; Watine Processing center

Picture 19. Products being processed and packaged (peanut butter, peanuts, corn flour, rice)

Activities 0.0.0. Includes the Project Management, Project Setup, M&E, Visibility, Internal and External monitoring assessments and other logistical activities:

All 3 Components contribute directly to GCF's RMF Impact: "Vulnerable populations benefit from increased climate-resilient sustainable development." Component 1 develops technical and institutional capacity of government and civil society by strengthening stakeholders capacity and knowledge management to monitor and address climate risks, improving observation and management systems for monitoring climate risks, strengthening stakeholders technical capacities for addressing water and agriculture related climate risks and enhancing and better systematizing knowledge management capacities. Component 2 generates knowledge and adapts water management towards climate risks in target coastal zones by improving adaptation planning for water management at local level, promoting climate-resilient community-based water management and, consequently, improving the management capacity of coastal ecosystems. The Component 3 Builds resilience of farming communities towards climate change using components 1 and 2 outputs. It will strengthen the adaptive capacities of target communities and enhance the climate-resilience of smallholder agricultural systems by improving communities access to climate change information, climate change trainings and activities, engaging and professionalise the youth from the target areas on climate change adaptation concept and techniques, increase and diversify the climate-resilient production of smallholder farmers and diversify and improve income generation options along climate – resilient value chains in the country. The project will create tools to disseminate the experiences and document future pilot and relevant experiences, making them reachable by all interested stakeholders in the country and at sub-regional level. Webinars and workshops will take place, documents will be publicly discussed and officially recognized, new training modules will be made available for Government institutions and other interested stakeholders, both at national and sub-regional level. Through the project outcomes and outputs, GCF will be able to disseminate project experiences, tools and lessons learned

(both positive outcomes as challenges faced) to feed future projects, boosting their efficiency and effectiveness through international forums and UNFCCC initiatives.

A needs assessment and a pre-feasibility study conducted in the targeted regions identified the main constraints and barriers to climate change adaptation and climate-resilient development. The political and institutional instability that results in economic fragility is the biggest barrier to a resilient and coordinated path to a paradigm shift at country level. The table below summarizes the main barriers identified, which are documented and recognized by the national authorities. It details possible project responses to each and relies on CSO stakeholders and multi-lateral support.

Output 0.1.1: Best practices and lessons learned are documented and widely shared
(A0.1.1.1) Development of document on lessons learned in rice cultivation techniques: During the 5th year, the project will elaborate a synthesis of all the new knowledge acquired and good practices and lessons learned in the fields, including the techniques promoted under the project. This synthesis exercise will allow the project to produce an interesting document of lessons learned that will be of great importance for promoting land restoration in Guinea-Bissau and other neighboring countries.

(A0.1.1.2) Production and promotion of film showing main results of the project: Throughout the duration of the project, a team of TV journalists will monitor the implementation of field activities, such as participatory territorial diagnosis, consultation and negotiation of restoration options, implementation of restoration measures, support for alternative livelihoods, environmental education and ecological monitoring of restored habitats. It will be important to ensure that images are collected throughout all major activities so that the project has diverse and relevant video material for film editing. During the 5th year, a 30-minute documentary will be produced and widely presented locally, nationally and internationally to promote the approach and lessons l GPS coordinate of pre-selected project community

earned during the project's implementation.

1.11 Selection Of Beneficiaries

The populations of the identified communities are the main beneficiaries of the project and have much to gain from better management of their resources. Their active participation in the project is essential to ensure that they acquire the appropriate capacity and level of responsibility not only to protect their habitat but also to improve livelihoods and income.
In the light of the current ecological, social and cultural events, it is urgent to rethink the way resources are used, based on the reorganization of the territory, in order to improve the efficiency of exploitation of natural spaces and their resources, and ensure that the main source of security for communities, particularly the most disadvantaged, is not exhausted.
In view of these challenges, the project will carry out a participatory territorial diagnosis. All the fringes of the communities in the area of operation will be encouraged to actively involve themselves in the search for planning proposals that are the most appropriate to the realities of each community space (mangrove, forest and tabanca), so that in the future each individual and community can adopt more integrated and prospective attitudes of their space.
Regarding the needs of the target groups and beneficiaries, the following stand out:

- Farmers: The central difficulties for this target group are related to the necessary support to increase the production and productivity of bolanhas and other cultivation areas in the areas to be intervened. This includes support for the improvement and rehabilitation of the perimeter of rice cultivation that passes through the cultivation space, a consequence of natural physical changes or resulting from agricultural interventions recorded in the courses of the rivers that condition the hydrological dynamics in the cultivation perimeters and which have been accentuated over the years.
- Women: Most of the daily tasks are under the responsibility of women, and in addition to these, they play a fundamental role in rice cultivation. They are responsible for ensuring a large part of cultivation operations. In the target communities, women support the provision of materials to reinforce the structure of the dykes (oyster shells), water and food for workers.
- Youth: The difficulties in securing the presence of young people in the communities is transversal to all the target communities and is closely related to the lack or scarcity of basic services (schools and alternative vocational training) and job opportunities in their tabancas. This reality makes this group look for better

conditions in urban centres. Young people are the main work force in the chosen tabancas and constitute an indispensable social group for the cohesion and sustainable development of communities in their spaces.

Target group	Specific needs and constraints (based on field research results)	Expected impact on the target group	Modalities for inclusion of the target group
Farmers	Support for materials and equipment to improve the drainage system; construction of water retention basins and seeds that are more adapted to the climate changes; technical assistance for capacity building with regard to water management in rice perimeters and seed production	Improve production and productivity of bolanhas	Participation in participatory diagnosis; responsible for the rehabilitation of bolanha and seed multipliers and guardians; promoters of bolanha rice production; leading actor in the mangrove restoration and rehabilitation of bolanha agreement and in forest restocking
Women	Promotion of alternative income activities and financing of economic initiatives through the provision of materials to help develop initiatives associated with exploitation and enhancement of natural resources (horticulture, oyster farming, and saliculture); improvement of domestic energy efficiency through the use of alternative and/or renewable energy; capacity building and technical assistance for the sustainable exploitation of resources; promotion of literacy	Lighten workload and improve access to new income-generating activities; empowerment	Participation in participatory diagnosis; boosting of the local economy; protection of mangrove resources; producers of mangrove nurseries; support in mangrove replanting; awareness raising; multifunctional community managers of platforms powered by solar energy; promotion of the development of income-generating activities (horticulture, trade in local products such as oysters and salt)
Youth	Lack of job opportunities in their tabancas and lack of access to vocational, technical and professional training, low schooling	Improve entrepreneurship and access to specialized technical training; decrease exodus to urban centres	Opportunities for technical/vocational education; training and work in original spaces; provision of services; construction of improved stoves and solar dryers; environmental awareness and education; rehabilitation actions for waist dykes and water management in production perimeters; multiplication of local rice seeds; preservation of traditional knowledge of rice cultivation in this ecosystem; communication and awareness actions; environmental education; capitalization and dissemination of the lessons learned to defend the conservation of these ecosystems; mangrove restoration process in areas destined by the community for natural regeneration and/or replanting through replanting initiatives; economic valorisation of rice through the creation of opportunities to provide services with the addition of value to the sector as managers and operators of multifunctional platforms
Community Based Organizations, Associations and Cooperatives	Poor ability to manage rice field to increase productivity; low capacity to contain rising sea levels and coastal erosion; reduction of labour force due to rural exodus; failure to respect basic texts (statutes and internal regulations), which generate noticeable inadequacies in the operation and management of POs; internal democracy is not exercised within a good number of POs and the members of the governing bodies are automatically appointed and renewed	Improve capacity of those responsible for POs to better manage resources through appropriate training; improve communication system in the different categories of POs; define and implement mechanisms to mobilize	Participatory approach, which requires a permanent and interactive dialogue; formation and stimulation of the group; relatively easier access to land, credit, equipment; prioritizing community participation in planning, implementing and evaluating activities, including risk analyses and vulnerability assessments

Target group	Specific needs and constraints (based on field research results)	Expected impact on the target group	Modalities for inclusion of the target group
	without a mandate limit; overlapping of responsibilities generating intergroup conflicts, linked to the malfunctioning of the organs; low flow of information; low participation in decision-making at the PO level; inability to mobilize resources and to choose and develop profitable activities; low level of education of PO members; low PO negotiation capacity; failure to master cultivation techniques; lack of adequate consultation structure; low level of inter-cooperation between POs	adequate and sustainable resources to guarantee the financing of PO activities; strengthen the internal functioning of the OPs and the skills in human resources; support the economic activity of POs in order to make the reinforcement of their structure and functioning more effective; strengthen the capacity of POs to provide services to their members	
Local, regional and central authorities	Weak institutional capacity to define priorities, to coordinate and to follow public investment programs and insufficient qualified human resources; lack of rigor in administrative management: deficiency in the administration of public goods; weak control, monitoring and evaluation mechanisms; lack of a human resources policy (insufficient specialized staff); lack of financial incentives and working conditions; imbalance in the organization of the sector and weak capacity for intervention in the rural environment, essentially linked to consultation at the central level of trained or experienced staff; lack of capacity for coordination and harmonization of interventions; lack of resources for all orders and working methods	Capacity building must involve identifying the real needs of the different technical services and the main actors involved in the rural world, in human and material resources; formulation of a capacity building program should include training strands in various fields as well as the formulation of agricultural and rural development policies and strategies, production techniques, equipment in the rural environment, trade negotiations, management and leadership	Sensitization of local communities about risks, impacts and appropriate responses; mobilizing domestic and community resources and strengthening domestic and community capacities to prepare for an effective response in order to mitigate the impact of climate change; integration of traditional norms and values to document management of livelihoods and natural resources in implementation; promote knowledge, wisdom and traditional and local practices to improve and enrich the planning, implementation and assessment of the effects of climate change; actively involve CSOs, as well as local scientific, vocational, technical and higher education institutions in collaborative education and disaster risk research, as well as in capacity building, especially in communities at risk; strengthen partnerships between actors of the research system and agricultural councils, essentially linked to aspects of training and demonstration by peasants (school camps), relaunching training of professionalization in agriculture; support for the development of the seed sub-sector

Table 33. Description of needs, constraints, expected impact on project beneficiaries and modalities for inclusion of target groups.

At the project intervention sites, the target groups will be involved in the Participative Diagnosis, to identify the main elements for an environmentally sustainable management of spaces and resources. This diagnosis will be carried out in a participatory and inclusive way, so that the project's objectives and the interests of all social groups in the communities at each intervention site are assured.

The target groups will benefit from the increased capacities and awareness gained through the project and will continue to benefit from the structures, tools and connections established by the action. This will be strengthened by the duration of the project (5 years of effective implementation in phases, including a continuous exit strategy) and the continued presence, local knowledge and long-term experience of all partners involved.

Direct beneficiaries will be able to continue to improve their agricultural production through ecologically sustainable and low-emission climate-resilient agricultural techniques, thereby improving the income of their families. Young people will receive various technical trainings provided by the project.

It is estimated that the continuous and long-term benefits at the socio-economic level will reinforce the acquired awareness, contributing to the long-term behaviour change targeted by the project. Increasing the technical capacity of public and private beneficiaries will provide broader, longer-term access to technical support and monitoring. Awareness-raising activities will create a more informed and critical population, more demanding and better prepared to contribute to the paradigm shift.

To achieve its objectives, the project will focus on rural women's associations (existing and new) to strengthen the capacity of its members to engage in the diversification of sustainable livelihoods to increase food, nutritional and economic security.

The program will support communities that demonstrate a strong willingness to work to improve the living conditions of their communities. This project will make it possible to best complement the capabilities of women, young people and the general population in order to consolidate their resilience.

In general, the project aims to reach the communities, and especially associations and the most vulnerable women and young people, in the Cacheu and Oio regions. This means those who obtain most of their livelihood from production and who face very low purchasing power and have livelihoods highly exposed to climate hazards.

In the identification of beneficiaries, high level of poverty with extreme vulnerability to food and nutritional insecurity was also considered.

PROJECT-LEVEL LOG FRAME

1.11.1 Indicator Framework

	Description	#	Indicators	Baseline	Targets (mid-term)	Targets (final)	Sources and means of verification	Assumptions
High-level Indicators (GCF RMF Core Indicators)	Impact: Vulnerable populations benefit from increased climate- resilient sustainable development	I-1	Impact Indicator 1. N. of total beneficiaries relative to total population (disaggregated by gender).	0	4,5% of the total population of Guinea-Bissau (70% women)	4,5% of the total population of Guinea-Bissau (70% women)	Baseline Data base Progress and final reports Mid-term and final audits Final evaluation Monitoring & Evaluation Inquiries Surveys National Statistics (National Institute of Statistics, Ministry of Agriculture and Rural Development, Ministry of Environment and Biodiversity)	
		I-2	Impact Indicator 2. N. of total direct beneficiaries (disaggregated by gender)	0	82.450 people (70% women)	82.450 people (70% women)		
		I-3	Objective Indicator 3. N. of total indirect beneficiaries (disaggregated by gender).	0	120.000 people (70% women)	120.000 people (70% women)		
	Result Area 1: Increased resilience and enhanced livelihoods of the most vulnerable people, communities, and regions	R.A-1.1	Result Area Indicator 1. N. of people benefiting from the adoption of diversified, climate resilient livelihood options (disaggregated by gender).	Baseline	N.D.	+ 202.450 people (70% women)		
	Result Area 2: Increased resilience of health and well-being, and food and water security	R.A-1.2	Result Area Indicator 2. N. of food-secure households (disaggregated by male and female-headed households).	Baseline	+ 8.500 (70% female-represented)	+ 8.500 (70% female-represented)		
		R.A-1.3	Result Area Indicator 3. N. of people with year round access to reliable and safe water supply despite climate shocks and stresses (disaggregated by gender)	Baseline	N.D.	+ 82.450 (70% women)		
Outcome Indicators <- GCF RMF Indicators								

	Description	#	Indicators	Baseline	Targets (mid-term)	Targets (final)	Sources and means of verification	Assumptions
Component 1. Development of technical and institutional capacity of government and civil society.	Outcome 1 Strengthened capacity and knowledge management to monitor and address water and agriculture-related climate risks in Oio and Cacheu Regions	OC-1.1	Outcome 1 Indicator 1. N. of effective coordination mechanisms in the target Regions that are able to serve the population with data on water and agriculture and respective adaptation options	0	2 Observatory Groups operational and working with the National authorities	2 Observatory Groups operational and working with the National authorities, providing information to the population	Reports of the Observatory Groups; OG Meeting minutes; Documentation of data collected and disseminated;	1. The COVID-19 pandemic, or other epidemic crisis, is not progressing and personal protection measures are adopted. 2. Guinea-Bissau's political framework is stable. 3. There are no major disruptions in local and national economic markets 4. The different cultural and traditional contexts of different ethnic groups allow the implementation of the action. 5. The paradigm shift of the target communities and of the key actors for the adoption of new practices and new technologies/products is promoted.
		OC-1.2	Outcome 1 Indicator 2. Knowledge on water- and agriculture related climate risks and adaptation options is captured, disseminated and systematized	0	5 knowledge products are developed	10 knowledge products are developed	Knowledge Dissemination Strategy Document; Reports from workshops; Knowledge Products; E-platform website and user Data;	
				0	5 workshops for knowledge dissemination conduucted	10 workshops for knowledge dissemination conduucted		
				0	0	1 e-platform is operational		
Component 2 - Adaptation of water management towards climate risks in coastal zones	Outcome 2 Sustainable management of coastal ecosystems leading to climate-resilient communities in Oio and Cacheu	OC-2.1	Outcome 2 Indicator 1. N. of public-sector services of action supported tools, instruments, strategies and activities to respond to climate change and variability.	0	34 adaptation and contingeny plans	34 adaptation and contingeny plans	Adaptation and Contingeny plans documents;	
				0	34 agirculture and water management plans	34 agirculture and water management plans	Agriculture and Water Management Plans documents;	
				0	0	1 updated coastal management plan	Coastal Management Plan Document;	
		OC-2.2	Outcome 2 Indicator 2. N. of people reached by risk reduction measures established/strengthened (disaggregated by gender).	0	82.450 (70% women)	82.450 (70% women)	Final Evaluation; Mid-term and final report;	
Component 3 - Building resilience of farming communities	Outcome 3 Enhanced climate-resilient livelihoods, and food and water security of the most	OC-3.1	Component 3 Indicator 1. N. of people made aware of Climate Change threats and related appropriate responses (disaggregated by gender).	0	40,000 (60% women)	120,000 (60% women)	Progress reports and final reports; KAP Studies;	

	Description	#	Indicators	Baseline	Targets (mid-term)	Targets (final)	Sources and means of verification	Assumptions
towards climate change	vulerable people in coastal communities in Oio and Cacheu Region	OC-3.2	Component 3 Indicator 2. Use of vulnerable households, communities and public sector serices of GCF-supported activities to respond to climate change and variability	0	10 communities access community climate centres	20 communities access community climate centres	Annual Reports; Mid-term and final evaluation; Reports from Ministry of Environment and Biodiversity;	
		OC-3.3	Outcome 3 Indicator 3. N. of vulnerable households using action supported tools, instruments, strategies and activities to respond to climate change and variability (disaggregated by male-headed and female-headed).	0	8,500 farmers (70% female-represented) adopt CRA practices promoted on 170 Model Plots	8,500 farmers (70% female-represented) adopt CRA practices promoted on 170 Model Plots	Production data from Farmers' Clubs; Descriptive memories of the Farmers' Clubs; Farmers' Clubs bookkeeping and training reports;	
				0	8,500 farmers (70% female-represented) with improved access to water for production	8,500 farmers (70% female-represented) with improved access to water for production	Production data from Farmers' Clubs; Descriptive memories of the Farmers' Clubs; Farmers' Clubs bookkeeping and training reports;	
				0	160 people (70% women) gained access to support for establishing micro-enterprises and IGAs	160 people (70% women) gained access to support for establishing micro-enterprises and IGAs	Business Model doccuments; micro-enterprises registration datat; Descriptive memories of the green enterprises or business;	
		OC-3.4	Outcome 3 Indicator 4. N. of businesses using action supported tools, instruments, strategies and activities to respond to climate change and variability.	0	30 businesses and 2 farmer's Cooperatives/ Associations	40 businesses and 2 farmer's Cooperatives/ Associations	Business Model doccuments; Enterprises' and Associations' regulatory documents, statutes and bookkeeping;	
Output Indicators - Project-specfic								

	Description	#	Indicators	Baseline	Targets (mid-term)	Targets (final)	Sources and means of verification	Assumptions
Outcome 1 Strengthened capacity and knowledge management to monitor and address water and agriculture-related climate risks in Oio and Cacheu Regions	Output 1.1. Improved local observation and management systems for monitoring water and agriculture-related climate risks in Oio and Cacheu Region	Op-1.1	Minimum N. of official meetings of the Observatory Group per year of project implementation.	0	4	4	Meeting Minutes and Reports of OGs; Annual Reports;	1. The contingency plans for the COVID-19 pandemic are fulfilled and are adapted to the local reality, enabling action. 2. Political and economic stability are maintained. 3. Policies and strategies for the agriculture and environment sectors are maintained by the Government of Guinea-Bissau. 4. Central and local authorities maintain institutional support for implementing the action. 5. The macroeconomic and sectoral framework is maintained conducive to the resolution of conditioning factors related to climate resilient agriculture. 6. The partners remain committed to the implementation of the action. 7. The logistical conditions are gathered
		Op-1.2	N. of annual action plans of the Observatory Group designed and validated.	0	5 per region	5 per region	Annual Action Plans - documents;	
		Op-1.3	N. water and soil quality monitoring systems are functional at the end of the project. (CCCs)	0	40 (20 water, 20 soil)	40 (20 water, 20 soil)	OG Meeting minutes and Reports; Mid-term and final evaluation;	
		Op-1.4	No. of community members, CSOs, CBOs and individuals trained on WSQM	0	110	110	Reports from Training sessions; Attendance Sheets; Operation and Maintenance Manual;	
	Output 1.2. Strengthened technical capacities of decision-makers and field staff in Oio and Cacheu Region for addressing water and agriculture related climate risks	Op-1.5	N. of workshops/trainings sessions addressed on agri-environmental practices, technologies, water and soil quality monitoring.	0	5	10	Reports from Training sessions and Workshops; Attendance Sheets; Pre- and post-training surveys;	
		Op-1.6	N. of mapping at local level of initiatives on Early Warning Systems and Climate Information provision. (CCCs)	0	2	2	Mapping documents;	
		Op-1.7	N. of workshops and training courses addressed for decision-makers at national and regional level on agri-environmental practices, technologies, water and soil quality monitoring system.	0	4	10	Reports from Training sessions and Workshops; Attendance Sheets; Pre- and post-training surveys;	
		Op-1.8	N. of workshops implemented for local decision-makers on agri-environmental practices,	0	4	10	Reports from Training sessions and Workshops;	

	Description	#	Indicators	Baseline	Targets (mid-term)	Targets (final)	Sources and means of verification	Assumptions
			technologies, water and soil quality monitoring system.				Attendance Sheets; Pre- and post-training surveys;	for the operationalization of the activities proposed by the action. 8. Suppliers, service providers and companies maintain the stability of market values. 9. Target communities maintain their commitment to action. 10. The structures, entities and communities follow the agreed procedures and rules.
	Output 1.3. Improved availability and accessibility to knowledge on water and agriculture-related climate risks and adaptation options	Op-1.9	N. of knowledge management and dissemination strategies developed.	0	1	1	Knowledge Management Strategy - Document;	
		Op-1.10	N. of informative documents with lessons learned and recommendations integrated in national monitoring systems.	0	1	2	Lessons Learned and Recommendaitons Publications; Annual Report Meteorology Institute;	
		Op-1.11	N. of project collaborative e-platform developed and integrated with executing entity's website.	0	0	1	E-Platform Website and website review;	
Outcome 2 Sustainable management of coastal ecosystems leading to climate-resilient communities in Oio and Cacheu	Output 2.1. Community-based water management is improved and adapted towards climate risks, including salt-water intrusion and extreme weather events	Op-2.1	N. of plans for water management interventions on lower flood prone areas developed.	0	22	34	Adaptation and Contingeny plans documents;	
		Op-2.2	N. of plans for mini-dams for irrigation of rice and vegetable crops developed.	0	22	34	Agriculture and Water Management Plans documents;	
		Op-2.3	No of updated Coastal Management plans	0	0	2	Coastal Management Plan Document;	
		Op-2.4	N. of actions for water management interventions on lower flood prone areas implemented.	0	22	34	Progress Reports reporting on water management in the target areas; Pictures pre- and post-Action;	
		Op-2.5	N. of actions for micro-scale irrigation systems interventions implemented.	0	22	34	Progress Reports reporting on water management in the	

	Description	#	Indicators	Baseline	Targets (mid-term)	Targets (final)	Sources and means of verification	Assumptions
							target areas; Pictures pre- and post-Action;	
		Op-2.6	N. of actions for mini-dams for irrigation of rice and vegetable crops implemented.	0	22	34	Progress Reports reporting on water management in the target areas; Pictures pre- and post-Action;	
		Op-2.7	N. of actions for rain and storm water retention systems implemented.	0	34 community + 20 household systems	34 community + 20 household systems	Progress Reports reporting on water management in the target areas; Pictures pre- and post-Action;	
	Output 2.2. Mangrove ecosystems are better managed as an ecosystem-based adaptation measure towards salt-water intrusion	Op-2.8	No of community nurseries for mangroves and coastal trees established and operational	0	2	4	Progress Reports reporting on Mangrove Ecosystems IBAP Reports;	
		Op-2.9	No of communities engaged in reforestation of mangroves	0	22	34	Progress Reports reporting on Mangrove Ecosystems IBAP Reports;	
		Op-2.10	No of communities where firewood saving stoves are introduced	0	22	34	Progress Reports reporting on Mangrove Ecosystems IBAP Reports;	
Outcome 3 Enhanced climate-resilient livelihoods, and food and water security of the most vulerable people in coastal	Output 3.1. Vulnerable populations have gained access to community-based structures for climate change adaptation	Op-3.1	N. of CCCs established and functioning.	0	20	20	Regulatory and Legal documents on the constitution of CCCs;	
		Op-3.2	N. of CCCs management committees trained.	0	20	20	Progress Reports; Mid-term and final evaluation; Pictures pre- and post-Action;	
		Op-3.3	N. of CCCs integrated in the operation of Ministry of Environment & Biodiversity.	0	0	20	Annual Reports; Mid-term and final evaluation; Reports	

	Description	#	Indicators	Baseline	Targets (mid-term)	Targets (final)	Sources and means of verification	Assumptions
communities in Oio and Cacheu Region							from Ministry of Environment and Biodiversity;	
		Op-3.4	N. of communities sensitized on agri-environmental practices, technologies, water and soil quality monitoring system.	Baseline	34	34	Progress reports and final reports; KAP Studies;	
	Output 3.2. Increased and diversified climate-resilient food production of smallholder farmers	Op-3.5	N. of youth trained on climate-resilient agriculture with practice done in the project Farmer Clubs.	0	55 (50% women)	110 (50% women)	Technical-pedagogical dossiers of trainings; EVB Reports; Training Manuals;	
		Op-3.6	N. of trained youth integrated in the Farmers' Clubs.	0	34	68 (50% women)	Technical-pedagogical dossiers of trainings; EVB Reports;	
		Op-3.7	N. of youth trained on post-harvest practices and use of technologies.	0	30	115 (50% women)	Technical-pedagogical dossiers of trainings; EVB Reports; Training Manuals;	
		Op-3.8	N. of farmers organized in Farmers' Clubs.	0	8.500 (70% women)	8.500 (70% women)	Descriptive memories of the Farmers' Clubs; Farmers' Clubs bookkeeping and training reports;	
		Op-3.9	N. of farming families mentored throughout the project.	0	8.500 (70% represented by women)	8.500 (70% represented by women)	Descriptive memories of the Farmers' Clubs; Farmers' Clubs bookkeeping and training reports;	
		Op-3.10	N. of training courses addressed for government extension workers and CSO field staff on CRA and adaptation towards	0	4	10	Reports from Training sessions; Attendance Sheets;	

	Description	#	Indicators	Baseline	Targets (mid-term)	Targets (final)	Sources and means of verification	Assumptions
			water and soil salinization/managment.				Pre- and post-training surveys;	
		Op-3.11	N. of model plots established.	0	170	170	Descriptive memories of the Farmers' Clubs; Farmers' Clubs bookkeeping and training reports; Pictures pre- and post-Action;	
		Op-3.12	N. of farmers trained on climate-resilient farming practices.	0	8,500 (70% women)	8,500 (70% women)	Reports from Training sessions; Attendance Sheets; Pre- and post-training surveys;	
	Output 3.3. Increased income options in climate-resilient economic activities along agricultural value chains	Op-3.13	N. of people trained in business management.	0	40 (50% women)	160 (50% women)	Annual Reports Vocational Training School; Graduation Data; Business Models;	
		Op-3.14	N. of micro-enterprises along the value chain(s) and women-led IGAs supported	0	30 (50% led by women)	40 (50% led by women)	Business Model doccuments; micro-enterprises registration datat; Descriptive memories of the green enterprises or business;	
		Op-3.15	N. of community processing and marketing centers operational	0	2	4	Business Model doccuments; micro-enterprises registration datat; Descriptive memories of the green enterprises or business;	

TIMELINE

ACTIVITIES		2022				2023				2024				2025				2026			
		Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Outcome 1 Strengthened capacity and knowledge management to monitor and address water and agriculture-related climate risks in Oio and Cacheu Regions																					
Output 1.1. Improved local observation and management systems for monitoring water and agriculture-related climate risks in Oio and Cacheu Region																					
A1.1.1	Conceptualization and operationalization of The Observatory Group (OG) for climate-resilient agricutlure (CRA) practices and technologies and water and soil quality monitoring (WSQM)																				
A1.1.2	Training of OG members, including community members and individuals on O&M of observatory equipment																				
Output 1.2. Strengthened technical capacities of decision-makers and field staff in Oio and Cacheu Region for addressing water and agriculture related climate risks																					
A1.2.1	Development of Training Manuals and Modules for CRA practices and adaptation towards water and soil salinization																				
A1.2.2	Workshops for national-level and local government decision-makers on WSQM systems and CRA practices																				
Output 1.3. Improved availability and accessibility to knowledge on water and agriculture-related climate risks and adaptation options																					
A1.3.1	Conduct Baseline Study and KAP Survey																				
A1.3.2	Disseminate knowledge and information in local, national and regional workshops and forums																				
A1.3.3	Development of a collaborative e-platform as a knowledge base for climate-resilience and adaptation practices and integration of OG activities with national monitoring systems																				
Outcome 2 Sustainable management of coastal ecosystems leading to climate-resilient communities in Oio and Cacheu																					
Output 2.1. Community-based water management is improved and adapted towards climate risks, including salt-water intrusion and extreme weather events																					
A2.1.1	Elaborate concrete plans for adaptation in rice fields, on-site agricultural and water management adaptation, and coastal mangement in the target areas																				
A2.1.2	Construct and rehabilitate water management infrastructures in areas prone to climate risks, including water retention systems and water points																				
A2.1.3	Establish water management systems to address water shortages for production and consumption during prolonged dry spells																				
A2.1.4	Promote micro-scale irrigation systems to maintain agricultural production																				
Output 2.2. Mangrove ecosystems are better managed , as an ecosystem-based adaptation measure towards salt-water intrusion																					
A2.2.1	Functional reforestation of mangroves for erosion control and adaptation towards sea level rise and salt water intrusion																				
A2.2.2	Introduction and dissemination of firewood saving stoves in 34 target communities																				
Outcome 3 Enhanced climate-resilient livelihoods, and food and water security of the most vulerable people in coastal communities in Oio and Cacheu Region																					
Output 3.1. Vulnerable populations have gained access to community-based structures for climate change adaptatio																					
A3.1.1	Establishment of 20 Climate Community Centers (CCC)																				

A3.1.2	Conduct sensitization campaigns and address concrete barriers at community-level for climate change literacy, adaptation options, and other resilience-building topics																						
A3.1.3	Mainstream environmental education in the young adult education system in the target areas																						
Output 3.2.1. Increased and diversified climate-resilient food production of smallholder farmers.																							
A3.2.1	Capacity building of extension workers and CSO field staff on CRA practices and adaptation towards water and soil salinization																						
A3.2.2	Train youth through vocational training coursesa in CRA practices, including specializations in livestock management and post-harvest practices																						
A3.2.3	Establishment, organization and regular trainings in CRA practices on Model Plots of 170 Farmers' Clubs - 8,500 farmers (70% women)																						
A3.2.4	Promote Sustainable Rice Intensification (SRI) and Climate-Reslient Rice Production (CRRP)																						
A3.2.5	Introduction and Dissemination of Short Cycle Animal Pass-on gift system in Target Communities:																						
Output 3.3. Increased income options in climate-resilient economic activitie along agricultural value chains																							
A3.3.1	Support the establishment and mentoring of 40 micro-enterprises and women-led income generating activities (IGAs) along the value chain(s)																						
A3.3.2	Promotion of alternative livelihood options along the value chains (community processing and commercialization centres, strengthening of commercial associations)																						
Project Monitoring*			Inception Report			APR				APR		Interim Evaluation			APR					APR			
Setup and Management Activities																							
A0.0.0	Project Management Unit																						
A0.0.1	Project implementation teams																						
A0.0.2	Project set-up activities, management and planning, M&E, exit strategy																						
A0.0.3	Baseline and identification of target areas and comunities																						
A0.0.4	Environmental and Social Action Plan set up and follow up																						

DETAIL OF IMPLEMENTATION

1.12 Overview

The project will be carried out in collaboration with the Ministry of Agriculture and Rural Development and the Ministry of Environment and Biodiversity through ADPP-GB, who will be the national executing people of the project.

ADPP-GB will be technically and administratively responsible to apply the proceeds of the project in order to achieve the results defined in this project document. ADDP-GB is responsible for the timely delivery of project results and Outputs and, in this context, for the coordination of all other responsible parties, including other ministries, local authorities and non-governmental organizations.

A national Coordinator will be responsible for implementing key decisions about project management and will play a key role in ensuring technical quality, financial transparency and overall impact on the development of the project. The coordinator will be recruited as soon as this project is approved.

A Project Management Unit (PMU) will be created, and will be composed of specialist technicians recruited (on the basis of a public tender). The main responsibility of the PMU is to ensure that the project produces the results stated in the project document to the required quality standard and within the specific time and cost limits. The Project Management Unit will be supported by a central team of technical and support staff located within the ADPP-GB to carry out the project activities, including day-to-day project operations and all management and operational reports and financial resources.

ADDP-GB will support the implementation of the project, facilitating the monitoring of project budgets and expenses, program personnel contracts and consultancy services, and the subcontracting and purchase of equipment at the request of the PMU. At the technical level, ADDP-GB will monitor progress in the implementation and realization of the project's results/ Outputs according to the approved project document.

A program officer will be appointed by ADDP-GB to provide financial and technical monitoring and implementation support services. For the delivery of specific results, as indicated in the logical framework, ADDP will delegate responsibilities to external partners (to be called responsible parties), namely the national and regional technical directorates of hydraulics, agriculture, livestock, forest, as well as NGOs through direct contracts.

ADDP-GB will be responsible for supplying these Outputs and will implement appropriate measures to supervise this work. These institutions will be hired through the appropriate modalities (as directed by the Green Climate Fund).

The General Directorates of the technical Ministries will be responsible for the development and elements of national policies related to climate change, coordination and technical supervision of regional and local units.

The General Directorates for Agriculture, Livestock, Forestry will be the technical partners for the implementation of activities aimed at strengthening local livelihood systems, such as agriculture, livestock and forestry in the context of climate change. ADDP (national implementation partner) will sign a memorandum of understanding with experienced NGOs operating in the beneficiary regions to be implementing partners for certain activities.

ADDP-GB will hire suitable suppliers of goods and services (vendors) for the successful implementation of activities that aim to strengthen the capacity of local institutions to adapt better to climate change.

The main underlying risks of the project were analysed in the framework of the predictability study. The experience already gained in the beneficiary regions has enabled the following table to be drawn up:

Table 34. Project-related risks and mitigation measures

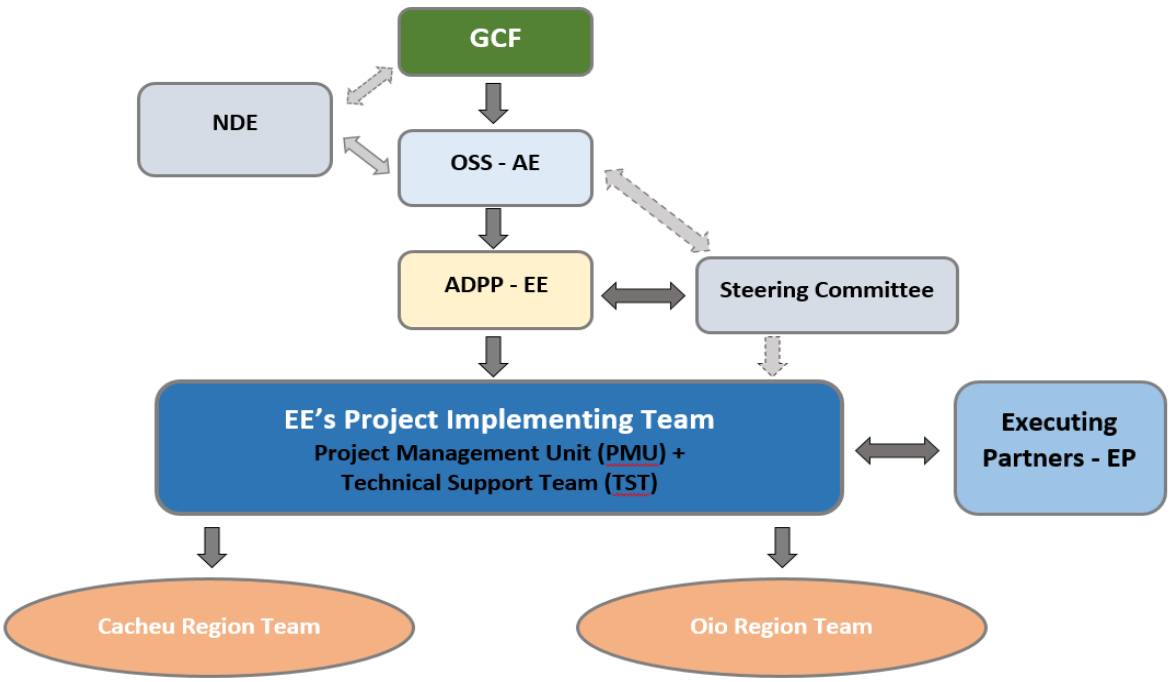
Risks	Level	Mitigation measures	Responsibility
Institutional political instability	High	Use of mediation by international communities and civil society organizations to enable the project to be implemented in the target regions	ADPP-GB, OSS, International community, Civil Society Organizations

Delay in launching the project, achieving results and reducing support as announced in the proposal	Medium	Develop detailed initial work plan to guide the launch phase	ADPP-GB and OSS
Poor collaboration between partners	Medium	Launch workshop to clarify roles and responsibilities; collaborate between the parties and the project team activities	ADPP-GB
Insufficient understanding of the objectives by the project team	Low	Support national experts, MoUs; adapted trainings	ADPP-GB
Weak mobilization of the target group due to insufficient understanding of issues related to climate change	Low	Strong collaboration with target communities; participatory approach; awareness/information about the project and activities to be developed; raising awareness of the effects of climate change	ADPP-GB
Lack of sufficiently qualified partners	Low	Capacity building; permanent selection and evaluation of partners; collaboration with communities at decentralized level	ADPP-GB

The main financial and operational risks have to do with political and institutional instability in the country. Political and institutional instability has existed for at least 20 years in the country. Government changes usually happen in high-level institutions, weakening, delaying decision-making and policy-making. It delays multilateral and bilateral cooperation and deprives financial support institutions and/or means to take effective and practical measures that meet the needs of the population.

1.13 Implementation team and preagreed arrangments

1.13.1 Project Coordination – Implementation Team – country level



1.13.2 Implementation Team – Regional level

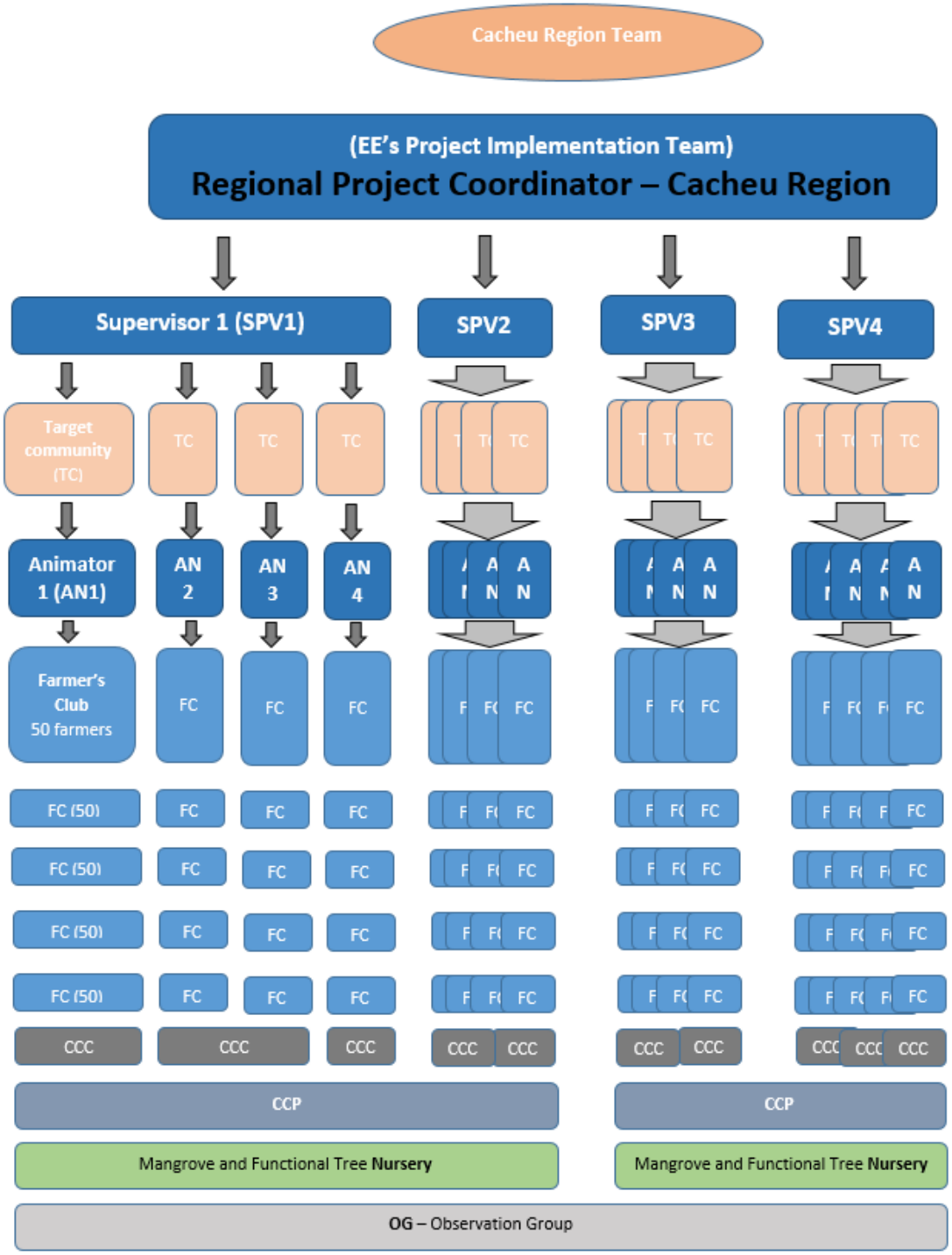


Table 35. Execution pre-arrangements[58]

Components, Outputs, Activities	Executing Entity (EE)	Executing Partners (EP)	Arrangements
Component 1. "Development of technical and institutional capacity of government and civil society"			
Outcome 1 Strengthened capacity and knowledge management to monitor and address water and agriculture-related climate risks in Oio and Cacheu Regions .			
Output 1.1. Improved local observation and management systems for monitoring water and agriculture-related climate risks in Oio and Cacheu Region:			
Activity 1.1.1. Conceptualization and operationalization of The Observatory Group* (OG) for climate-resilient agriculture (CRA) practices and technologies and water and soil quality monitoring (WSQM) and integration of the OG activities with national monitoring systems.:	ADPP	Ministry of Environment and Biodiversity - MoEB; IBAP; Meteorology Institute - MI; Ministry of Agriculture - MoA; General Directorate of Water Resources – GDWR; National Civil Protection Services – NCPS; Maritime and Port Institute of Guinea-Bissau – MPI;	EE's Project Team will lead this activity. The EP will provide technical staff to inform, discuss and define the OG's conceptualization, scope of work, needs, methodology and operation – technical input to the Manuals. This team will proceed with the ToR definition. The ToR Validation will be done by senior/official representatives from the listed EP and key external CSO representatives to be consulted.
Activity 1.1.2. Training of OG members, including community members and individuals on MO&M of observatory equipment:	ADPP	NA	NA
Output 1.2. Strengthened technical capacities of decision-makers and field staff in Oio and Cacheu Region for addressing water and agriculture related climate risks:			
Activity 1.2.1. Development of Training Manuals and Modules for CRA practices and adaptation towards water and soil salinization:	ADPP	IBAP; MoEB and Regional Offices (MoEB-RO), MoA's technical General Directorates (MoA-GD) and Regional Offices (MoA-RO); MI; INPA – National Institute for Agriculture Research; NCPS; INITA - National institute for Applied Technology Research;	EE's project team will lead this activity. The EP will provide technical staff to inform, discuss and provide expertise/input and necessary technical documentation. The EP will validate the project's manuals and modules and help disseminate them to all interested stakeholders at national level and to neighbourhood countries' (Senegal and Guinea-Conakry) equivalent authorities for experience exchange.
Activity 1.2.2. Capacity building of national-level decision-makers and local government authorities on WSQM, Adaptation and CRA practices	ADPP	MoA; MoEB; MI;	The EE's project team will organise the activities logistic and guarantee its completion. The EP will provide the technicians that will lead the workshop/webinar, each on its respective expertise area, with the coordination/support from the EE team. The EP MoE, MoA and MI, with the support from the EE team, will

[58] Teaming pre-agreements with the consortium partners, are included in Annex to this study. The final agreements, defining the scope of work of each partner, will be signed after project is approved.

Components, Outputs, Activities	Executing Entity (EE)	Executing Partners (EP)	Arrangements
			invite, through official channels, their homonymous authorities from the neighbourhood countries to attend the workshops and further invite key stakeholders.
Output 1.3. Improved availability and accessibility to knowledge on water and agriculture-related climate risks and adaptation options			
Activity 1.3.1. Conduct Baseline Study and KAP Survey:	ADPP	NA	NA
Activity 1.3.2. Disseminate knowledge and information in local, national and regional workshops and forums :	ADPP	IBAP; MoEB and MoEB-RO, MoA-GD, MoA-RO; MI; INPA, NCPS.	EE's project team will lead this activity, frame, outline the strategy and collect the necessary information. The EP will revise and contribute with relevant technical inputs to the strategy. The PE will contribute for the dissemination of activity outputs.
Activity 1.3.3. Development of a collaborative e-platform as a knowledge base for climate-resilience and adaptation practices:	ADPP	IBAP; MI; NCPS; MoEB; MoA-GD;	The EE team will lead this activity, organise the collected data and purchase the necessary technology, licence etc. throughout the project. The e-platform will be connected to IBAP's official website to increase its outreach. MI and NCPS to keep specific data updated.
Component 2: "Adaptation of water management towards climate risks in coastal zones"			
Outcome 2 Sustainable management of coastal ecosystems leading to climate-resilient communities in Oio and Cacheu			
Output 2.1. Community-based water management is improved and adapted towards climate risks, including salt-water intrusion and extreme weather events .			
Activity 2.1.1. Elaborate concrete plans for adaptation towards salinization of rice fields, on-site agricultural and water management adaptation, and coastal management in the target areas:	ADPP	MoEB and MoEB-RO, MoA-GD, MoA-RO; MI, NCPS, General Directorate of Water Resources – GDWR; MPI; General Directorate for Traditional Fishery – GDTF; Gabinete de planificaçãso Costeira	The EE team will lead this activity at organizational/coordination level. The EP will collaborate with their technical staff for technical input to the adaptation plans and contingency plans on a regional level, each on its specialization area. Their collaboration will guarantee that plans are aligned with national policies and priorities and will be used/integrated in national database.
Activity 2.1.2. Construct and rehabilitate water management infrastructures to prevent salt water intrusion in mangrove-rice paddies	ADPP	MoEB-RO, MoA-GD, MoA-RO	The EE team will lead this activity. The work will be done by the target communities. EP extension workers will be invited to follow-up the interventions.

Components, Outputs, Activities	Executing Entity (EE)	Executing Partners (EP)	Arrangements
Activity 2.1.3. Establish water management systems to address water shortages for production and consumption during prolonged dry spells:	ADPP	MoEB-RO, MoA-GD, MoA-RO, GDWR;	The EE team will lead this activity. The work will be done by the target communities. EP technicians will overview the interventions.
Activity 2.1.4. Promote micro-scale irrigation systems to maintain agricultural production:	ADPP	MoA-RO, MoEB-RO;	The EE team will lead this activity. The work will be done by the target communities. EP extension workers will be invited to follow-up the interventions.
Output 2.2. Mangrove ecosystems are better managed , as an ecosystem-based adaptation measure towards salt-water intrusion			
Activity 2.2.1. Functional reforestation of mangroves for erosion control and adaptation towards sea level rise and salt water intrusion:	ADPP	IBAP; MoEB-RO;	The EE team will lead this activity. The EP will supervise and advise.
Activity 2.2.2. Introduction and dissemination of firewood saving stoves in 34 target communities:	ADPP	INITA; MoEB-RO;	The EE team will lead this activity. The EP will supervise and advise.
Component 3 “Building resilience of farming communities towards climate change”.			
Outcome 3 Enhanced climate-resilient livelihoods, and food and water security of the most vulerable people in coastal communities in Oio and Cacheu Region			
Output 3.1. Vulnerable populations have gained access to community-based structures for climate change adaptation.			
Activity 3.1.1. Establishment of 20 Climate Community Centers (CCC):	ADPP	NA	NA
Activity 3.1.2. Conduct sensitization campaigns and address concrete barriers at community-level for climate change literacy, adaptation options, and other resilience-building topics	ADPP	MoEB; MoE - Ministry of Education (INDE – National Institute for Education Development and General Directorate for literacy); ADPP’s Teacher Training school – TTC-Bachil in Cacheu Region; ADPP’s TVET school EVB – Escola Vocational de Bissorã in Oio Region.	The EE team will lead this activity. The EP will collaborate in specific parts of the activity according to each one’s speciality. The EE’s schools in both region will actively participate in the activity implementation, according to their profile and proximity outreach.
Activity 3.1.3. Mainstream environmental education in the young adult education system in the target areas:	ADPP	IBAP; MoEB; MoE; ADPP’s TTC-Bachil; ADPP’s EVB;	The EE team will lead this activity. EP will support with the content’s and integration in the national education system. The model of teaching and the produced material will be piloted

Components, Outputs, Activities	Executing Entity (EE)	Executing Partners (EP)	Arrangements
			in the EE's schools during the project lifespan to provide field input for approach and material revision.
Output 3.2. Increased and diversified food production of smallholder farmers.			
Activity 3.2.1. Capacity building of extension workers and CSO field staff on CRA practices and adaptation towards water and soil salinization:	ADPP	MoEB; MoA;	The EE team will lead this activity. The EP will participate in the extension workers mobilization and selection and training content approval;
Activity 3.2.2. Train youth through vocational training courses in CRA practices, including specializations in livestock management and post-harvest practices:	ADPP	ADPP's EVB;	The EE team will lead this activity. The EE's school will include this project's target group in its teaching system;
Activity 3.2.3. Establishment, organization and regular trainings in CRA practices on Model Plots of 170 Farmers' Clubs - 8,500 farmers (70% women)	ADPP	MoA-RO; INPA - National Institute for Agriculture Research; ADPP's EVB;	The EE team will lead this activity. EP extension workers will be invited to follow-up the interventions. The EP will collaborate in the seedbank to be created in the ADPP's EVB school. EE's school will host and actively undertake the seedbank management as part of its teaching programme.
Activity 3.2.4. Promote Sustainable Rice Intensification (SRI) and Climate-Resilient Rice Production (CRRP):	ADPP	MoA-GD; MoA-RO;	The EE team will lead this activity. EP technicians will overview the interventions. EP extension workers will be invited to follow-up the interventions.
Activity 3.2.5. Introduction and Dissemination of Short Cycle Animal Pass-on Gift system in Target Communities:	ADPP	MoA-GD; MoA-RO;	The EE team will lead this activity. EP technicians will overview the interventions. EP extension workers will be invited to follow-up the interventions.
Output 3.3. Increased income options in climate-resilient economic activity along agricultural value chains			
Activity 3.3.1. Support the establishment and mentoring of 40 micro-enterprises and women-led income generating activities (IGAs) along the value chain(s):	ADPP	ADPP's EVB;	The EE team will lead this activity. EE's school will include this project's target group in its entrepreneurship follow-up programme;
Activity 3.3.2. Promotion of climate-resilient livelihood options along the value chains (community processing and	ADPP	NA	NA

Components, Outputs, Activities	Executing Entity (EE)	Executing Partners (EP)	Arrangements
commercialization centres, strengthening of commercial associations):			

Table 36. Key Roles and Responsibilities

Entity	Key Roles and Responsibilities
OSS (AE)	• Oversee overall financial and monitoring aspects of the project; • Reporting of project consolidated results to the GCF; • Approval of project annual work plan and budget at the regional level; • Approval of annual financial and technical reports; • Provide administrative and management support to the EE; • Provide specific specialized technical support to project's Technical Support Team; • Contribute to communication outreach of project outcomes;
Project Steering Committee (PSC) OSS, ADPP, NDA, Executing Partners, key stakeholders from Civil Society and Private Sector;	• Meet twice a year and provide strategic direction for the project at the national level (meetings will be organized back-to-back with other technical meetings); • Provide political support and advocacy; provide policy guidance; • Ensure local government engagement and participation; • Facilitate cooperation between all project partners and facilitate collaboration between the Project and other relevant programmes, projects and initiatives; • Approval of project annual work plan and budget at the regional level; • Approval of annual financial and technical reports; • Advise on issues and problems arising during project implementation;
NDA – Ministry of Environment and Biodiversity	• Supervise and follow-up the project achievements through the project regular reports and field visits; • Participate in the PSC; • Provide political support and advocacy; provide policy guidance; • Ensure local government engagement and participation;
ADPP (EE)	• Responsible for the execution at national level through the Project Management Unit (PMU) and project Executing Partners; • Set up the Project Implementation Team; • Supervise and follow up the project Team activity; • Provide all the necessary means for the project to be successfully implemented; • Retain full responsibility for any delegated authority to the executing partners over financial management and procurement.
The Project Implementation Team: Project Management Unit (PMU); Project Technical Support Team (TST);	• Coordinate project management and execution at the national level; • Coordinate implementation with Executing Partners; • Ensuring the project activities are implemented according to plan; • Ensure compliance with national technical standards and integration with government programmes; • Consolidate results from the project and link with PSC; • Monitoring and evaluation at national level; • Stakeholder engagement at national level;

Entity	Key Roles and Responsibilities
Regional Field Teams – 1 per target region;	• Manage execution of project activities at community-level; • Ensuring the project activities are implemented according to plan and have a positive impact on the beneficiaries; • Consolidate the results from the project sites and link with the PMU; • Monitoring and evaluation of the project data at regional level and link with PMU; • Stakeholder engagement at regional and local community level; • Conflict management at community level;
ADPP's TVET school EVB in Oio Region and Teacher Training school TTC-Bachil in Cacheu Region;	• Participate in specific activities providing support and services according to their scope of work and local outreach to community schools and private sector at regional level;
Main Executing Partners/ Technical Body of the Government of Guinea-Bissau: Ministry of Environment and Biodiversity; Ministry of Agriculture through its General Directorates of specific technical areas; IBAP; INPA; IM; NCPS; MPI; GDWR; GDTF; INITA; MoE;	• Create a conducive environment for the program execution especially by mobilizing technical experts at the national level where needed; • Participate in PSC; • Provide political support and advocacy; provide policy guidance; • Ensure local government engagement and participation; • Ensure ownership and sustainability; • Dissemination of project results in national and international forums; • Provide expertise in specific project areas; • Directly participate in the implementation of specific trainings and activities according to expertise; • Support implementation of activities on the ground; • Support dissemination of project results;

1.14 Institutional and sectoral context

Several institutions in Guinea-Bissau are involved in the management of natural resources at national, regional and local levels.

At the national level, several Ministries deal with the restoration of mangroves, forests and landscapes and adaptation to, and mitigation of the effects of climate change, social aspects of adaptation.

1. Ministry of Agriculture and Rural Development (MADR) is responsible for formulating, proposing, coordinating and executing government policies for the agricultural sector, including the forest, fauna and livestock sectors. The Ministry also defines and supervises food and nutrition security policies. The Ministry includes several directorates relevant to the project, in particular:

- The Directorate-General for Agriculture (DGA), whose main mission is to promote plant production by training producers and operators in the agricultural sector, and by determining the technical and economic conditions for the development of agribusiness and food industries.
- The Directorate-General for Forests and Fauna (DGFF), whose mission is to ensure the sustainable management of forest resources, fauna and apiculture, as well as raise awareness of the conservation of these resources and the protection of the country's ecological heritage. DGFF is responsible for the management of mangroves, forests and landscapes, located outside protected areas.
- The Directorate-General for Engineering and Rural Development (DGEDR), whose mission is to define, coordinate and supervise policies for hydro-agricultural planning, agricultural mechanization, application of chemical and organic fertilizers, as well as to ensure the implementation of policies to promote and maximize agricultural infrastructure as a way to increase production and productivity.
- The National Institute of Agricultural Research (INPA) is an autonomous administrative and financial entity that is indirectly part of the State Administration. INPA is responsible for the development of research on increasing production capacities, conservation and improvement of agro-silvo-pastoris resources and quality of livestock, access and quality control of seeds improved and better adapted to climate changes.

2. The Ministry of Environment and Biodiversity (MAB) is responsible for defining, implementing and coordinating environmental policies in a perspective of sustainable development. The ministry includes the following directorates that are relevant to the project's intervention:

- Directorate-General for the Environment (DGA), which is responsible for the elaboration of policies, strategies and programs for the environmental sector in general and for the conservation of biological diversity.
- General Directorate for Sustainable Development (DGDS), which is responsible for implementing public policies for sustainable development through the rational use of natural resources.
- Institute for Biodiversity and Protected Areas (IBAP), whose main mission is the management of protected areas and strategic biodiversity resources.
- Coastal Planning Office (GPC), whose mission is to promote sustainable development and integrated management of coastal zone resources, with a focus on ecosystems and mangrove species and wetlands.
- Competent Environmental Assessment Authority (AAAC), which is in charge of the administrative coordination of the environmental impact assessment processes and the monitoring of the implementation of environmental policies.

3. Ministry of Women, Family and Social Solidarity is responsible for the protection of women and children, family, social inclusion and Social Solidarity in Guinea-Bissau.
4. The National Institute of Meteorology is the national authority in the fields of meteorology and climatology and aims to pursue national policies in the fields of meteorology and climatology. The following directorate is relevant for the project:

- National Civil Protection Service

At the regional level, the institutions involved in the restoration of mangroves, forests and landscapes are:

- The Regional Precincts of Agriculture and Rural Development (DRADR), which are deconcentrated structures of MADR that support the development and implementation of agricultural policies in collaboration with partners in the respective regions.
- IBAP regional representations in National Parks.

The table in annex 2 details the alignment of activity with executing entities.

1.15 Detail of co-financing

The initial investments required to design and implement smart climate change strategies can be a barrier to successful adaptation and mitigation. However, the variety and rapid evolution of financial instruments and donors that support activities related to climate change can help to overcome this obstacle.

Funding for climate change actions can come from national and local budgets, private sector investments, international development assistance, bilateral donors and regional development banks.

In the first phase of the project, adaptation and mitigation activities are supported by the Green Climate Fund.

At a later stage, it is possible to prepare and submit to the donors of bilateral and multilateral funds a project proposal concerning climate change, in relation to the elements initially foreseen by the project.

In this chapter we present some existing international funds (some assets in Guinea-Bissau) that allow the development of activities related to the mitigation and adaptation to climate change. The institutions that will support in the implementation of this project in collaboration with ADPP-GB and with others partners can compete on the basis of a resource mobilization and plaidoyer program.

Multilateral climate funds play an important role in supporting countries in adopting climate-resilient development paths with low emissions. They play a role in capacity building, research, piloting and demonstrating new approaches and technologies, and removing barriers to other flows of climate finance.

Multilateral climate funds also have critical political significance, reflecting recognition of developed countries for historic greenhouse gas emissions and in line with the commitments made by developed countries under the UNFCCC to support developing countries in mitigation and adaptation to climate change.

Adaptation for Smallholder Agriculture Programme (ASAP)

The fund is administered by the International Fund for Agricultural Development (IFAD) and the objectives of this program are to channel climate and environmental finance to small farmers, expanding adaptation to climate change in rural development programs, and integrating climate adaptation into IFAD's work.

Supported activities include: Improve land management and agricultural practices and technologies resilient to climate; increase availability of water and efficient use of water for the production and processing of family farming; increase human capacity to manage short and long term climate risks and reduce losses in climate-related disasters; make rural infrastructure resilient to the climate; and improve the documentation and dissemination of knowledge of Climate Smart Family Farming.

Adaptation Fund (AF)

The Adaptation Fund is a financial instrument under the UNFCCC and its Kyoto Protocol and was established to finance concrete adaptation projects and programs in developing countries Parties to the Kyoto Protocol in an effort to reduce the adverse effects of climate change that communities, countries and sectors face. The Fund is financed with a portion of the proceeds from project activities Clean Development Mechanism (CDM), as well as through voluntary pledges from donor governments. The share of CDM resources is equivalent to 2% of Certified Emission Reductions (CERs) issued for a CDM project activity.

Supported activities include: Water resource management, land management, agriculture, health, infrastructure development, fragile ecosystems; improve the monitoring of diseases and vectors affected by climate change, and their forecasting and early warning systems and, in this context, improve disease control and prevention; support capacity building, including institutional capacity, for preventive measures, planning, preparedness and disaster management related to climate change; strengthen existing ones and, where necessary, establish national and regional centres and information networks for a rapid response to extreme weather events, using information technology as much as possible.

Least Developed Countries Fund (LDCF)

The Least Developed Countries Fund was established to meet the adaptation needs of least developed countries (LDCs). Specifically, the LDCF financed the preparation and implementation of National Adaptation Programmes of Action (NAPAs) to identify priority adaptation actions for a country based on existing information.
The Least Developed Countries Fund is administered by the Global Environment Facility (GEF) with the World Bank as Curator.

The LDCF aims to meet the needs of the 48 LDCs that are particularly vulnerable to the adverse impacts of climate change.

As a priority, the LDCF supports the preparation and implementation of National Adaptation Programmes of Action (NAPAs), which are country-oriented strategies that identify the immediate needs of LDCs to adapt to climate change. The LDCF can finance the implementation of NAPA, including the design, development and implementation of projects on the ground.

Pilot Program for Climate Resilience (PPCR)

The Pilot Program for Climate Resilience is a targeted program of the Strategic Climate Fund (SCF), which is one of two funds within the framework of the Climate Investment Funds (CIF).

PPCR aims to test and demonstrate ways in which climate risk and resilience can be integrated into central development planning and implementation, providing incentives for expanded action and initiating transformational change.

The World Bank serves as the PPCR's Fiduciary and Administrative Unit. The World Bank Group, the African Development Bank, the Asian Development Bank, the European Development Bank and the Inter-American Development Bank are the implementing agencies for PPCR investments.

The PPCR was designed to provide programmatic funding for climate-resilient national development plans with four main objectives:

1. Pilot and demonstrate approaches for integrating climate risk and resilience in development planning and policy;
2. Strengthen capacities at the national level to integrate climate resilience with development planning;
3. Expand and take advantage of climate-resilient investment, based on other ongoing initiatives; and
4. Enable learning in practice and sharing lessons at national, regional and global levels.

In addition, PPCR regional pilots will aim to strengthen cooperation and capacity at the regional level to integrate climate resilience with appropriate regional development planning and processes.

PPCR supports technical assistance to enable developing countries to take advantage of existing national work to integrate climate resilience into national and sectoral development plans as well as finance investments from the public and private sectors identified in national or sectoral development plans or strategies and address climate resilience.

Global Climate Change Alliance (GCCA)

The Global Climate Change Alliance is an initiative of the European Union. Its overall objective is to build a new climate change alliance between the European Union and the poorest developing countries that are most affected and least able to deal with climate change. The GCCA does not intend to create a new governance structure or fund, but is working through the channels established by the European Commission for political dialogue and cooperation at national and international level.

The GCCA was launched in 2007 by the European Commission to strengthen dialogue and cooperation on climate change between the European Union (EU) and the developing countries most vulnerable to climate change, in particular the Least Developed Countries (LDCs) and Small Island Developing States (SIDS), which are hardest hit by the adverse effects of climate change. The GCCA acts as a platform for dialogue and exchange of experiences between the EU and developing countries on climate policy and on practical approaches to integrate climate change into policy development and budgets.

The GCCA also provides technical and financial support to partner countries to integrate climate change into their development policies and budgets, and to implement projects that address climate change on the ground, promoting climate-resilient and low-emission development. Technical and financial cooperation, in turn, inform political dialogue and exchange of experiences at the regional and global levels.

The GCCA's five priority areas include:

1. Integrating climate change into poverty reduction and development strategies;
2. Adaptation, based on the National Adaptation Programmes of Action (NAPAs) and other national plans;
3. Disaster risk reduction (DRR);
4. Reducing emissions from deforestation and forest degradation (REDD);
5. Increase participation in the Global Carbon Market and Clean Development Mechanism (CDM)

This fund is managed by the European Commission – Directorate-General for Development and Cooperation – EuropeAid.

The Special ClimDev-Africa Fund (CDSF)

The Special ClimDey-Africa Fund is a joint initiative of the African Development Bank, the African Union Commission and the United Nations Economic Commission for Africa, which will support three main areas of intervention:

1. Production and wide dissemination of reliable and quality information on the climate in Africa;
2. Capacity building of institutions responsible for policies for integrating climate change information into development programs;
3. The implementation of pilot adaptation practices that demonstrate the value of integrating climate information into development.

1.16 Monitoring & Evaluation

The project's M&E will be conducted according to the procedures established by the Observatoire du Sahara et du Sahel (OSS) and the Green Climate Fund (bearing in mind that the GCF does not have standard procedures). ADPP-GB plans to use EU procedures as a departure for OSS and GCF validation and will be led by the Project Management Unit.

The project's M&E will be carried out according to the activities and budget presented. The project document, tracking tools from the OSS and the GCF, structure of results and associated indicators and targets, will form the basis on which the project's M&E system will be developed.

The main project executing organizations will be directly involved in monitoring and evaluating activities, products and results, and all groups of beneficiaries and stakeholders will be consulted, using a gender-sensitive approach.

The monitoring process itself will serve as a learning and training platform for the project's implementing agency. Adaptive management principles will be applied in conducting regular reviews of the effectiveness of the project's implementation mechanisms. Two important independent external evaluations will be commissioned, one in the middle of the project and the other at the end of the project.

The establishment of the project's M&E processes will involve the following steps:

Launch phase

A project launch workshop will be held during the first two months of the project's start. It will be conducted with ADPP-GB, the entire project team, key institutions involved in implementation at national and regional level, relevant government representatives, NGOs and community organizations, co-financing partners. It is important that all major stakeholders participate in the Launch Workshop to allow the establishment of a common vision and ownership of the project's implementation strategy. The Launching Workshop is crucial to build ownership of the project's results and to plan the activities of the first year.

The Launching Workshop will provide an opportunity for all parties to understand and clarify their roles, functions and responsibilities within the project's decision-making and implementation structures, including lines of communication and reporting, and conflict resolution mechanisms, containing the dispute resolution mechanism. complaint. The project's decision-making and implementation structures and the Terms of Reference for the project team and the Project Steering Committee will be discussed in order to clarify the responsibilities of each one during the project's implementation phase.

One of the main tasks of the Launch Workshop will be the preparation of the first Annual Work Plan for the project based on the logical structure of the project and the Project Document. This annual work plan and budget must clearly highlight the areas of collaboration between this project, confirmed sources of funding and potential sources. This implies that all identified co-financiers must participate in the initiation workshop, as well as being expected to participate in the project management committee. In this initial workshop, specific targets and progress indicators for the first year of implementation, together with their means of verification, will be developed and will form part of the Annual Work Plan. These must be specific, measurable, achievable, relevant and time-bound (SMART) and should help the project team and partners to assess whether project implementation is proceeding at the intended pace and in the right direction to meet the goals and indicators of the logical structure. Goals and indicators for subsequent years will be defined annually as part of the internal assessment and planning processes carried out by the project team in consultation with all key project stakeholders.

The results structure will also be reviewed at the Launch Workshop. Progress and performance indicators will be adjusted in consultation with key stakeholders. All indicators must follow SMART criteria. The initial workshop report will clearly describe all changes made and why they were proposed. A Results and Activities Assessment and Monitoring Plan will also be developed at the launching Workshop.

The launching workshop will also provide an opportunity for ADPP-GB to inform the project team and national counterparts and partners about budget reviews related to the project, planning and mandatory budget overhaul. It will provide the basis on which the project team will develop an operational plan.

Monitoring and event responsibilities

A detailed schedule of project review meetings will be developed by the Coordination Unit, in consultation with the project's implementing partners and stakeholder representatives. This will be incorporated into the Project Inception Report. Such a schedule will include: (i) interim deadlines for tripartite reviews and project steering committee meetings, and (ii) M&E activities related to the project.

Daily monitoring of implementation progress will be the responsibility of the National Coordinator based on the project's Annual Work Plan (AWP) and its indicators, and the project document and results structure. The national coordinator will inform ADPP-GB of any delays or difficulties encountered during implementation, so that appropriate support or corrective measures can be taken in a timely and corrective manner. He/she will also inform ADPP-GB of any significant change in circumstances that may have an impact on the logic or approach of the project.

Quarterly Monitoring

The quarterly monitoring of the project implementation will be the responsibility of the PMU, accompanied by Quarterly Progress Reports (QPR). The preparation of the QPR will be the result of a unified planning process between the main partners of the project. As results-based management tools, QPRs will report on monitoring the implementation of actions and the achievement of goals and results.

Annual monitoring

The Annual Project Implementation Reports (PIR) will be prepared to monitor the progress made since the beginning of the project and, in particular, since the previous reporting period. The PIR combines the reporting requirements of the Green Climate Fund. The PIR includes, but is not limited to, reports on the following:

- Progress made in relation to the project's objectives and results – each with indicators, baseline data and end-of-project goals (cumulative);
- Project Outputs delivered as a result of the project (annual);
- Lessons learned/good practices;
- AWP and other expense reports; and
- Risk management and adaptations.

The annual review of the project budget and expenses will also be carried out by the Project Coordinator, with the support of ADPP-GB. This will assess the project's expenditure levels and funding contributions throughout the year to ensure they are on track.

The Tripartite Review (TPR) is the highest-level policy meeting of the parties directly involved in the implementation of a project. It will be carried out with the Project Steering Committee. The project will be subject to Tripartite Review at least once a year. The first meeting will be held in the first twelve months after the start of project implementation.

The PIR will be used as one of the basic documents for discussions at the TPR meeting, and the project coordinator will present the latest PIR to the TPR, highlighting policy issues and recommendations. Separate reviews of each component of the project can also be conducted, if necessary. The TPR has the authority to suspend the disbursement of funds if the project's performance is not achieved.

Periodic monitoring through site visits

ADPP-GB will conduct visits to the project sites based on the schedule agreed in the Initial Report and the project's Annual Work Plan to assess the progress of the project. Other members of the steering committee can also join these visits. A Field Visit Report (BTOR) will be prepared by ADPP and will be distributed at least one month after the visit to members of the project's Coordination Unit, the Steering Committee and the Observatoire du Sahara et du Sahel.

Mid-term evaluation

The project will undergo an independent mid-term assessment halfway through the project's implementation. The mid-term evaluation will determine the progress made towards achieving the results and will identify the course correction, if necessary. It will focus on the effectiveness, efficiency and timeliness of project implementation; highlight issues that require decisions and actions; and will present the initial lessons learned

about project design, implementation and management. The conclusions of this review will be incorporated as recommendations for improved implementation during the final half of the project term.

End of Project

A final independent evaluation will take place three months before the final Steering Committee meeting and will be carried out in accordance with the guidelines of the Observatoire du Sahara et du Sahel and the Green Climate Fund. The final evaluation will focus on the fulfilment of the project's results as initially planned (and as corrected after the intermediate evaluation, if such correction occurred). The final evaluation will examine the impact and sustainability of the results, including the contribution to capacity development and the achievement of global environmental benefits/objectives.

The Terminal Assessment should also provide recommendations for follow-up activities and require a management response.

The final tripartite review (FTPR) will take place in the last month of the project's operation. The project coordinator will be responsible for preparing the Final Report (FR). The FR will be forwarded to ADPP and later to the Observatoire du Sahara et du Sahel. It must be prepared as a draft at least two months before the FTPR meeting, in order to allow a complete revision of the document and will serve as a basis for discussions in the FTPR. The FTPR meeting decides whether any action is still needed to achieve the project objective, particularly in relation to the sustainability of the project's results. It acts as a vehicle through which lessons learned can be captured to feed other projects under implementation or formulation.

Project monitoring reports

The Project Coordinator, jointly with ADPP, will be responsible for preparing and sending the following reports that are part of the monitoring process:

a) Inception Report

A Project Start Report will be prepared immediately after the Launch Workshop, to be submitted within 3 months of the project start date. It will include a detailed Annual/First Year Work Plan divided into quarterly deadlines, detailing activities and progress indicators, including the baseline, which will guide implementation during the first year of the project. Together with the main activities, this Work Plan will include the dates of the specific field visits of the ADPP-GB, as well as the schedules for meetings of the project's decision-making structures. The Report will also include a detailed project budget for the first full year of implementation, prepared based on the Annual Work Plan. This will include monitoring and evaluation activities to allow effective measurement of project performance over the 12-month period.

The Inception Report will include a more detailed narrative about the institutional roles, responsibilities, coordination actions and feedback mechanisms of partners related to the project, as agreed at the Launch Workshop. It will outline the progress so far in establishing the project and in the initial activities. It will also include an update of any changed external conditions that may affect the project's implementation (positive or negative) or that change the project's baseline. It will highlight any new project partnership/co-financing opportunities and propose an approach to ensure that the project works to maximize partnership opportunities.

It will also confirm the status of risks and assumptions. As an attachment to the Initial Report, the project coordinator will prepare a draft of the List of Reports, detailing the technical reports that are expected to be prepared during the implementation of the Project and the provisional due dates. When finalized, the Initial Report will be distributed to ADPP-GB, which will review it and provide comments within two weeks. ADPP-GB in turn must submit the report to the Observatoire du Sahara et du Sahel for approval. After approval, the report will then be distributed to all major project executing organizations and stakeholders, who will have a period of one month to respond with comments or questions.

b) Annual Project Implementation Review (APIR)

This is an important management and monitoring tool for project managers. Once the project has been under implementation for a year, an APIR report must be prepared by ADPP-GB together with the PMU. The APIR must be agreed between PMU, the executing agency (ADPP), Observatoire du Sahara et du Sahel and the PSC. It should be discussed at the PSC meeting.

APIRs are collected, reviewed and analysed by ADPP-GB, which will provide comments and ensure that they have been completed correctly. They are then sent for analysis to the Observatoire du Sahara et du Sahel, before being sent to the GCF for approval.

c) Quarterly Progress Reports

Short reports describing the main updates on the project's progress and the main problems/constraints encountered will be provided quarterly by the project coordinator, in consultation with the relevant stakeholders. Then it will be sent to ADPP-GB. The quarterly reports form the basis for discussions with the Observatoire du Sahara et du Sahel and the Green Climate Fund.

d) Final Project Report

During the last three months of the project, before the Terminal Assessment, the project team will prepare the Final Project Report. This comprehensive report will include:

- Summary of all areas of activity and associated Outputs implemented by the project, the results achieved, or not achieved, in relation to those intended in the Project Document (report against declarations of Outputs and results, goals and indicators);
- Any changes made to the project's implementation after the mid-term review, why these changes were made and whether the proposed results were achieved;
- Implementing organizations, key project stakeholders and project beneficiaries – how they were involved and what impact the project had for them;
- How the project worked in synergy with the associated baseline activities;
- Lessons learned;
- Structures and systems for project implementation approach;
- The probability of sustainable impact of the project's impacts and analysis of any potential risks to sustainability;
- An assessment of project expenditures by Output and by outcome throughout project implementation, based on APIRs.
- Any changes in the levels and types of expenditure compared to those proposed in the Project Document and the associated annual work plans will be fully explained;
- An assessment of the level of funding committed to the project, throughout the project's implementation, indicating the levels of funding and agency/organization; and
- Any other measures that may be necessary to ensure the sustainability and replicability of the Project's results before the end of the project, and by national partners, after the end of the Project.

e) Project Publications

Project publications, whether written or visual, can form an important mechanism through which the project disseminates results and achieves impact.

'Publications' can be scientific, technical or informational documents, journalistic articles, multimedia publications, training films or documentaries and radio programs. Publications can be summaries or compilations. The PMU will determine the most appropriate mechanisms for publication and dissemination, based on the Project Document, intended impact and stakeholder consultations.

The main considerations will be the beneficiaries/target audience, their literacy levels, their information needs and the likely impact of publications in meeting those needs. All publications will be accessible on the ADPP, Observatoire du Sahara et du Sahel and Green Climate Fund websites.

FEASIBILITY

1.17 Alignment with national policies

Guinea-Bissau has a strategic and legal framework to boost its development and manage its natural resources. The project whose predictability we are evaluating is in line with all these strategic policies and legal framework linked to the protection of the environment as a whole.

National Environmental Management Plan (NEMP): institutionalized as the main document of the national environmental policy through decree nº 03/2004. This document seeks to optimize existing resources in order to guarantee economic growth and improve the quality of life of the present generation and to ensure the maintenance of natural resources for the future generation, contributing to the country's sustainable socio-economic development. Furthermore, it supports the search for solutions that aim to guarantee: -food security, poverty eradication, pollution and harmfulness control and environmental sanitation, conservation of natural resources, control of the advance of desertification (sahelization), and minimization of anthropic impacts that influence climate change.

National Action Plan for Adaptation to Climate Change (NAPA): developed in 2006, to assist Least Developed Countries in identifying priority activities to respond to their immediate needs and most urgent concerns, with regard to adaptation to negative effects of climate change. Associated with this policy document are those of the 1st, 2nd and 3rd National Communication on Climate Change. The objectives and final result of the project are in line with this important national document.

The project contributes to the Actions identified in PANA, notably in the Agriculture sector (diversification of production, low-cost irrigation, micro dams and small dams for water retention). This adhesion will be ensured through the participation of the Ministry of Environment and Biodiversity, holder of these strategies, and OSS, delivery partner of GCF Readiness in Guinea-Bissau.

NDC /INDC: Known as Nationally Determined Contributions (NDCs), the plans publicly establish what each country plans to do under the Paris Agreement to contribute to the international effort to ensure a sustainable future for all by maintaining the rise in global temperature since the pre-industrial times well below two degrees Celsius, with a preference to limit it to 1.5 degrees. NDCs present countries' climate policies and measures to reduce emissions and adapt to climate change in many sectors, such as decarbonizing the energy supply with transfers to renewable energies, improving energy efficiency, better soil management, urbanism and transportation.

The project will contribute to achieving the priorities established in the NDC, notably the Adaptation Priorities to increase food security for populations in rural areas, in order to increase their adaptability, supported by the activities of Component 2 of the project. The project deals specifically with the salinisation of soils and water, identified as a key challenge in the NDC.

National Biodiversity Conservation Strategy and Action Plan (NBCSAP): Policy document on the biodiversity sub-sector establishes in detail the national guidelines, themes and areas of national intervention related to the conservation and sustainable use of biological diversity in the context of the implementation of the Convention on Biological Diversity. It also establishes as national objectives the protection of ecosystems, afforestation and forest restocking, optimization of water resources, exploration of new energy sources, fight against soil erosion and coastal erosion, strengthening the participation of civil society, based on education and training in the field of the environment.

The project in its component 2 addresses the ability of farmers to face the new challenges related to climate change and its present impacts. This involves carrying out activities that lead to the protection of the environment, the fight against soil erosion, especially those adapted to agriculture, as well as the exploration and use of new energy sources.

National Action Plan to Combat Desertification (PAN/LCD): Guinea-Bissau is one of the signatory countries to the United Nations Convention to Combat Desertification. This document, emanating from the 1992 Rio Conference, invites contracting parties to draw up the National Action Plan to Combat Desertification (PAN/LCD). Guinea-Bissau finalized and validated its action plan in 2006, as political and institutional instabilities, as well as the lack of financial resources, caused delays. In 2015, Guinea-Bissau's PAN/LCD was aligned with the UNCCD Ten Year Strategy (2008-2018) whose global vision is "to build a global partnership to stop and prevent desertification and land degradation and mitigate the effects of drought in the affected areas".

Coastal Planning Master Plan: The Coastal Zone Master Plan, developed within the framework of the Coastal Planning Program (IUCN/MDRA-DGFC, 1993), aims to define guidelines that lead to a sustainable development of the entire coastal zone, ensuring a correct and durable exploitation of natural resources and the environment, preserving coastal ecosystems and their biological diversity.

Forestry Master Plan (May 2010): Establishes an analysis of the situation on the basis of which the policies, strategies and objectives to be achieved for the sustainable use of forest resources are defined, but also defines the means necessary for their application. It proposes specific measures to strengthen the institutional capacity of the sector, as well as the creation, within the scope of the national organization of the territory, of conservation units representative of the different biogeographic zones of Guinea-Bissau.

Agricultural Development Policy Letter: Elaborated in 1997, it establishes the strategy and priorities in the fields of agro-silvopastoral production and agricultural research. Its main objectives for the sector are: to guarantee food security, increase and diversify agricultural exports, ensure the rational management of resources and improve the quality of life of the population. This document consistently presents the different sub-sectoral policies (agriculture, livestock and forests) and interactions with other sectors, namely fisheries, public works, natural resources, environment, education, gender promotion and trade. Analysing this document, it appears that agriculture is the sector that maintains a closer relationship with desertification, taking into account forest pressures from itinerant agriculture and deforestation for planting of cashew trees. The new forestry policy translated into the CPDA, updated in 2002, essentially aims at making the population and rural communities responsible, particularly in the management of resources and spaces.

National Agricultural Investment Plan (PNIA): has a long-term approach and is divided into three phases: 2010-2015, 2016-2021 and 2021-2025. PNIA includes the following seven subprograms: (i) promotion of plant Outpution, (ii) promotion of animal Outpution, (iii) promotion of fishery Outpution, (iv) sustainable management of natural resources (water, land and forests), (v) agricultural research and advice, (vi) institutional strengthening and sectoral coordination, and (vii) adaptation of the agricultural sector to climate change. In the fourth subprogram of sustainable management of natural resources, PNIA includes the following three components: (i) integrated management of water resources, (ii) management sustainable land management, and (iii) sustainable forest management.

Second document of the National Poverty Reduction Strategy (DENARP II): The strategy document to fight poverty (DENARP) stems from the decisions arising from the long-term prospective study, with a horizon set in 2025. The document underlines that the development of Guinea-Bissau will depend on the eradication of poverty and for that it will be necessary to take into account, not only the macroeconomic aspects, but also the social, human, environmental and institutional aspects. This involves considering issues related to governance, the fight against corruption, respect for human rights, gender equality, strengthening institutional capacities, improving the provision of social services, increasing agricultural production and fisheries, preserving the environment, etc. DENARP II includes the following four pillars: (missing) (i) strengthen the rule of law and democratic institutions, (ii) ensure a stable and attractive microeconomic environment, (iii) promote sustainable economic development, and (iv) improve human capital development levels.

The Land Law (n ° 05/98): gives the following definition of land: (i) State property and the common heritage of all people, (ii) a fundamental physical support for the community, which is of any national value whatever the form of its use and exploitation, (iii) the rights established over the land and natural resources matter in equal protection, whether they come from the law or from customary rights, (iv) the improvements can be public or private property.

Preparation roadmap for REDD+ in Guinea-Bissau: The Government of Guinea-Bissau has recognized that REDD+ (Reducing Emissions from Deforestation and Forest Degradation, and Conservation, Sustainable Forest Management and Increasing Carbon Stocks in Forests) is a mechanism with an innovative concept, aligned with a strategy of sustainable development and mitigation of the negative/adverse effects of climate change, which promotes the conservation and sustainable management of natural resources. It was proposed to evaluate the possibility of starting a process of preparing the national REDD+ mechanism. Guinea-Bissau currently has the status of observer country for the UN-REDD and FCPF (Forest Carbon Partnership Facility) programs, and benefits from two technical support initiatives FAO and BM. In this context, at the beginning of 2015, a REDD+ Working Group (RWG) was formed, based on a multisectoral logic made up of elements from the various national institutions. The main objective of the RWG is to coordinate the development of the REDD preparation roadmap. This document describes the current situation in the forestry and land use sectors and identifies the existing

capacities and needs in the country according to a set of minimum requirements necessary to prepare Guinea-Bissau for the future implementation of the REDD+ mechanism (Cancun Agreements, COP16, UNFCCC).

The proposed project is in line with all the policies and strategies mentioned above, and the present analysis has not found any major "flaws" worth mentioning in the present study.

The project's philosophy is essentially based on the conservation of natural resources in the face of the causes of climate change, in a perspective of improving the living conditions of the beneficiary populations.

1.18 Alignment and synergies with other Initiatives

At the national level, several ongoing initiatives are relevant to the intervention of the project under analysis. Coordination with these projects will be crucial to ensure that the present project capitalizes on the results achieved by other similar initiatives to ensure a global synergy of action.

Summary:

"Strengthening climate information and early warning systems for climate resilient development and adaptation to climate change in Guinea Bissau" (UNDP, 2019-2023, updated starting date 2021, GEF-7, ID:10105) – which establishes functioning Early Warning Systems in the country. Common implementation Partners.

"Strengthening the resilience of vulnerable coastal areas and communities to climate change in Guinea Bissau" (GEF-6 project; ID: 6988) – UNDP/Min Environment: Sustainable land management in production systems (agriculture, rangelands, and forest landscapes) as well as use and feed the plans and policies to be created in the referred project scope. The bridge is made throughout common partners.

"Strengthen the Adaptation Capacity and Resilience of Coastal Communities in Guinea-Bissau Vulnerable to Climate Risks", (GEF/UNDP-00077229 Project, Government as main partner, 2020-2025) - jointly stimulate the stakeholders to discuss resilience and risks management, such as: floods, erosions, temperature variations and landslides, that undermine living conditions and sustainability in the target areas. Common project partners;

"Scaling up Climate-smart Agriculture in East Guinea Bissau" (Adaptation Fund project - GNB/RIE/Agri/2015/1; 2018-2023) – build on the formulation of detailed intervention plan to pilot climate-smart agriculture actions and policies, procedures and guidelines related to CC, gender and natural resources; technical trainings material on adaptive systems and organizational capacity building; formulation/update of contingency plans for climate-risk management; forest fires prevention plan; experience on development of lowlands to maintain agricultural production in drought periods; manuals and other materials on best practices and measures for climate-smart agriculture; Common implementing partners.

European Union initiative "DeSira - Mangrove, mangrove rice and mangrove people - sustainably improving rice production, ecosystems and livelihood" (2020-2024) – Align with the Mangrove management experience and meteorological and hydrological stations.

"Deduram" - Sustainable Development of Mangrove Agriculture, (AFD/UE, 2019-2023), KAFO (amongst others): Shared region – Oio; Sharing the experiences and lessons learned about mangrove rice; the georeferenced database and dissemination of good practices, eventually in the present project e-platform; ADPP and KAFO have a good relationship and communication channels;

"Ianda Guinea Arrus", (EU - 2019-2025), IMVF, LVIA (amongst others): Oio region as common ground, sustainable and productive mangrove rice production systems; explore traditional mangrove beekeeping techniques as alternative income generating activity and nutrition source (good quality honey, pollen, propolis, wax and apitoxin); ADPP is implementing 2 of the UE-Ianda projects, namely the Water and Energy and the Horticulture Ianda, good access to the project outcomes;

"Project for Protection and Restoration of Mangroves and Productive Landscape to strengthen food security and mitigate climate change" (IBAP / IUCN - GEF; 2018/23) - Common implementing partners; partially coincides geographically - North Cacheu Region; The lessons learned shared at sustainable livelihood experiences and in local techniques/technologies for mangrove protection; build on tools produced;

The "Cacheu River Mangroves National Park (PNTC)" – IBAP/IUCN – since 1997 – mainly by proximity of the target area and foreseeing a future expansion of the Park area – the project will reproduce and align with the PNTC initiatives, land and resources management experience, sensitization material, ecological restoration/recovery methodology. The bridge will be the common implementing partner.

PDCV-RIZ (2018-2021) and PACVEAR (2021-2024); AFDB – Rice Value Chain in Guinea-Bissau - ADPP-GB is one of both project implementing partners, capitalising the lesson learned.

The Scaling-up climate-resilient rice production in West Africa (2021 – 2025 / OSS-Adaptation Fund) for the benefit of Benin, Burkina Faso, Côte d'Ivoire, The Gambia, Ghana, Guinea, Liberia, Mali, Niger, Nigeria, Senegal, Sierra Leone and Togo, will be contribute to climate resilience and increase rice system productivity of smallholder rice farmers across West Africa using a climate-resilient rice production approach. This project is being implemented by OSS and thus its results and approaches will benefit to Guinea Bissau Even though it is not a direct project partner. Same accredited Entity.

Project for Protection and Restoration of Mangroves and Productive Landscape to strengthen Food Security and mitigate Climate Change (IBAP/UCN-GEF; year started: 2018, final year: 2023)

The project is financed by the GEF, under the technical assistance of IUCN, implemented by IBAP.

The objective of this project is to support the restoration and rehabilitation of the functionality and services of degraded mangrove ecosystems to improve food security and mitigate climate change. The general strategy is built around a policy of influence and knowledge sharing which will lead to the replication and expansion of approaches and results. It is structured in four components.

The first component supports the development and adoption of knowledge-based policies that promote the restoration of mangroves and forests. The second component of the project, promoting a participatory approach to planning and managing land use at the landscape level, will focus on the restoration and rehabilitation of degraded land in mangrove areas. The third component contributes to improving the institutional and financial context for mangrove and forest restoration in Guinea-Bissau. It will strengthen the capacities of national stakeholders to raise funds, expand and replicate restoration initiatives in the wider landscape in other regions of the country, based on lessons learned and successful approaches implemented in the field by the project. Lessons learned from the third component will be incorporated into the fourth component, which will focus on project management and evaluation, as well as knowledge management.

The project operates in the regions of Cacheu (north of the Cacheu River), Quinara and Tombali and the results of the project are as follows: Result 1.1: The three target mangrove ecosystems benefit from a restoration strategy; Result 2.1: Traditional knowledge and local natural resource management systems are recognized and integrated in the restoration of mangroves and the rehabilitation of rice fields; Result 2.2: The livelihood resources of local communities are improved in a sustainable way; Result 3.1: Guinea-Bissau's institutional and coordination capacities are strengthened in order to increase and finance restoration; and Result 4.1: The project is implemented according to management principles based on results, the lessons learned are disseminated within the Restoration Initiative and applied to future operations.

There must be ample discussion with this project to create synergy and complementarity between the activities and approaches since several similar themes are addressed by the two projects.

Project for the Resilience of Protected Areas and Climate Change (Min. Environment/IBAP/GCCA; year started: 2016, final year: 2021)

This Global Climate Change Alliance (GCCA) project is carried out by the Ministry of Environment and Sustainable Development and by IBAP for a period of 5 years (with a total budget of 3.9 million euros).

The overall objective of the project is to reduce the population's vulnerability and improve its resilience to climate change, supporting the country in its efforts for low-carbon and climate-resilient development. The specific objective of the project is to strengthen national capacities to face climate change, strengthening governance systems and reducing deforestation and forest degradation, especially in the National Protected Areas System (NPAS). The project includes two main components.

The first component focuses on training and aims to coordinate investments and projects linked to climate change, as well as to strengthen capacities to support resilient development to climate change. Some of the project activities in this component consist of supporting the establishment of a climate change secretariat and strengthening the capacities of IBAP and BioGuiné in monitoring as well as measurement, reporting and verification (MRV) systems. The second component focuses on mitigating climate change and aims to reduce deforestation in and around protected areas. Activities under this component include the following: creation of a database for the Cacheu River Mangroves National Park (PNTC), Cantanhez National Park (PNC) and Lagoas de

Cufada National Park (PNLC) through inventories and forest maps; support the participatory management of the three conservation units (PNTC, PNC and PNLC); test and implement the carbon storage measurement process; and promote REDD+ and establish an MRV system for NBSAP.

There are potential synergies between this project and the proposed project, especially in activities related to capacity building.

Project to Strengthen the Adaptation Capacity and Resilience of Coastal Communities in Guinea-Bissau Vulnerable to Climate Risks (Ministry of Environment and Biodiversity (DG Environment/GEF/UNDP; year started: 2020, final year: 2025)

The project has a duration of 5 years, and was financed in the total amount of USD 12.5 million, through funds from GEF and UNDP, to be implemented by the Ministry of Environment and Biodiversity in partnership with several public, private and NGO institutions dedicated to environmental issues.

The project aims to support the country to establish an institutional and legal framework that allows integrated planning and management of the coastal zone, the protection of the coast in areas affected by erosion, combating the degradation of mangrove ecosystems and areas of agricultural production affected by climatic severity. The project also includes strengthening the livelihoods of coastal communities vulnerable to climate risks, especially women and young people, through financial subsidies for investment in income-generating activities.

The project that is being analysed and this project can jointly stimulate the stakeholders as beneficiary communities to discuss resilience issues and risks that are part of their daily life, such as: floods, erosions, temperature variations and landslides, situations that can be occasionally small but that gradually undermine living conditions and sustainability mainly in the areas of intervention. It is essential to tackle imminent climatic risks in coastal areas as extreme events can reach disastrous levels. Therefore, the synergy between both projects must be created from the beginning of its implementation.

Deduram (Sustainable Development of Mangal Agriculture) (KAFO/ Univ.Fr - UE/AFD; year started: 2019, final year: 2023)

This project, financed by the EU and AFD (Agence Française de Développement), is carried out by the French non-profit university and the Guinean NGO KAFO in the Oio region.

The general objective of the project is to contribute to improving the living conditions of local communities in mangrove areas through the sustainable development of rice cultivation and salt production, as well as through better management of this fragile ecosystem. The specific objective of the project is to develop methods of producing rice and salt that respect the environment and guarantee the adoption by producers in mangrove areas.

In particular, the project will promote water management practices, as well as the rehabilitation of mangrove rice fields and salt production based on solar energy. The project will also establish a georeferenced database and develop and disseminate best practices.

It will be imperative to create synergies with this project, especially in actions linked to the sustainable development of rice cultivation, the use of salt in abandoned balls and others.

Ianda Guinea Arrus (IMVF/LVIA/RESSAN-EU-Anode; year started: 2019; final year: 2025)

The project is financed by the European Union and implemented by a consortium of NGOs: Marques de Valle Institute, Flor, LVIA and RESSAN.

The project is aimed at supporting more sustainable and productive mangrove rice production systems. It consists of sensitizing producers/animators, in particular women, as well as promoting and supporting agricultural alternatives to rice around the perimeter of salt water bolanhas in the project intervention areas (Encheia/Oio, Cafal and Cafine/Tombali and Antula/SAB) to obtain foods of high nutritional value, increase in family income through feasibility studies and the options selected with local communities, including: fruit growing (banana, citrus and coconut); apiculture (production of honey and later the other products such as royal jelly, pollen, propolis, wax and apitoxin).

The initiative under analysis could study ways of synergies through joint actions to improve traditional mangrove beekeeping techniques, by training producers/vulgarisers (beekeepers) in the field of improved beekeeping

techniques, as an important source for obtaining good quality honey. This can serve as an important nutritional source for children, family recipes and wax production, which is also very popular in the foreign market, as well as other products.

1.19 Innovation

The potential for a paradigm shift in the project under analysis lies in the holistic approach of transforming the agricultural sector into regions of traditional practices oriented towards extractivism and facing long-term investments in adaptive and climate-resilient practices. This transition results from capacities built across the sector, from training institutions to government extension workers and NGOs, to farmers and their communities. Based on theories of social learning applied through the methodological approach of the project, systems are put in place to ensure the continuous transfer and maintenance of knowledge between farmers, farmer-based organizations and public services.

From the perspective of the actions to be carried out within the framework of the project, they constitute an innovative approach to the project since it will allow to extend the experience, and to draw lessons, in the near future, through the website that will be set up by the project, or by the dissemination information for all regions of the country, with the support of responsible authorities and multilateral entities, environmental education, green entrepreneurship, the elaboration of a detailed intervention plan for low-emission and climate-resilient agriculture actions and the assembly and operationalization of observation and registration monitoring systems with advanced stations led by communities as active agents for monitoring the effects of climate change in two relevant regions of the country.

In order to have good results and apply them in other regions, the project will focus on developing synergies with ongoing and future initiatives in early warning systems and provision of climate information. This development must be accompanied by and working out action maps, considering geographic aspects, target audiences, activities, sectors of intervention, among other aspects, contributing to a concerted and integrated program of Early Warning Systems and provision of Climate Information that should cover the entire phases in the next phases. parents.

1.20 Effectiveness and scalability

In this chapter, it should be remembered that the objective of the project is to strengthen the resilience of the populations and ecosystems of the target areas. In general, the project aims to tackle the challenges identified, developing the technical and institutional capacity of the government and civil society to address the increased climate risk in planning to adapt to climate change (Component 1), increasing the resilience of existing agricultural production systems and diversifying production and income (Component 2) and promoting the dissemination of knowledge from lessons learned on climate-resilient agriculture and adaptation planning for other coastal regions of the country (Component 3). The project will also focus on project management and evaluation, as well as in knowledge management through the Cross Implementation Method of an inclusive and productive M&E.

The components of the project, as well as the results, will serve as pilot actions and may be scaled up and extended to other regions of the country, as long as there is additional funding for this purpose. The lessons learned and the good practices and tools resulting from this project will serve as leverage for accessing additional financing, which could cover the other regions of the country. The establishment of synergies with other actions even outside the project's intervention area, the exchange of experiences and good practices are essential aspects for expansion.

The aspect of technical capacity development and integrated knowledge about low-emission and climate-resilient agricultural practices among family farmers, development professionals and government experts, mentioned in Result 1.2, is one of the issues that interest and concern all regions from the country. The prevention and management of the impacts of climate change do not only concern the Cacheu and Oio region. The project will, in a first phase, improve the capacities of the two regions, intending to prevent and manage the impacts of climate change on agricultural production and food security. This implies the establishment of conditions conducive to adaptation in the agri-food sectors at local, regional and national levels, namely by integrating climate change into national policies and strategies.

The activities provided for in Output 1.2.2, related to the elaboration of a detailed intervention plan for low-emission and climate-resilient agriculture actions, consists of operationalizing and monitoring rice fields in order

to improve water management and of the introduction of environmentally sensitive and adapted agricultural techniques on selected parcels. These plans and the methodologies that will be piloted and tested within the scope of this project will be done so with the aim of being applied in other regions of the country. In case of complementary financing, this action could be expanded to other regions of the country, especially those that are in the coastal zone.

The problem of water and land management is crucial and impedes the development of sustainable agriculture across the country, rendering simplified land management plans advantageous, by defining specific strategies for mangrove restoration (natural regeneration and/or reforestation of Rizófora and/or Avicenia) as well as restoration action plans (opening and/or retreating) of dykes to be implemented and developed by the project, adapted according to the type of region.

Regarding the training of government extension workers and NGO field staff in adapting to the salinisation of water and soil, the project will support the professional qualification of public structures in the sectors involved and strengthen the capacities of producer organizations or those related to production to make them capable of managing the perimeters, developing their technical capabilities. This training will take into account young people from communities who can be an asset as extension workers and trainers in other regions of the country.

ADPP-GB has years of experience in the creation of farmers' clubs. For this project, producers will be organized into productive groups according to the proximity of the production plots and common interests, led by management committees. The Farmers' Clubs will have model fields/fields for technical demonstration of resilient, low-emission cultivation and irrigation techniques, adapted to the impacts of climate change. The FCs will work as a school-field, helping farmers to replicate the techniques learned in their individual plots. Well-organized farmers' clubs can serve as a hub of learning, support and monitoring for farmers in the various sectors of the country's regions, adapting to the different types of agriculture in each region. Furthermore, such clubs allow farmers to be the managers and custodians of mechanized equipment, offering a wider scope of support to farmers and to the rural development of more remote areas of the country.

Strengthening the capacities of young people and women in the target communities in climate change and low-emission and climate-resilient agriculture is undoubtedly of paramount importance in improving the resilience of populations across the country. The project will also endorse the creation of community centres to promote meetings, seminars, workshops, training, and technical assistance available to productive communities (in line with the local water and soil quality monitoring system). In these meetings, some farmers from neighbouring areas to the project may be invited. In the next phases, these trainings may be carried out in other regions with additional funding.

The training will serve to reinforce/recycle general and basic knowledge and will have as a main focus the improvement of productive techniques and diversification of crops, considering the time of planting and harvesting and the characteristics of the soil. Production techniques adapted and resilient to climate change and with less environmental impact will also be considered. Outputs that allow a greater variety of processed by-products will be evaluated.

In addition to these activities, the project may have the possibility of being, gradually, replicated in other regions of the country, reinforcing the following aspects:

- Promotion of alternative livelihood options through post-harvest activities, including the establishment of small processing centres, and the sale of products and connection to the market;
- Establishment of micro-scale irrigation systems to maintain production during periods of drought and when groundwater is salinized;
- Construction of mini-dams for irrigation of rice and vegetables;
- Establishment of water retention systems;
- Development of sustainable horticulture in the project's intervention villages, where technically feasible (This activity is practiced mainly by women and is an important source of income for families).

The project will also provide training in green agribusiness as well as promote the organized entrepreneurship of the beneficiaries. It will strengthen the post-production/processing/conservation/storage and conditioning of the cultivated products. Promoting collective cooperation will facilitate production, post-production and access to markets, thus feed the entire value chain of the cultivated product, be it rice, fruit or vegetables. The creation and formation of a wide range of new microenterprises and businesses (income-generating activities) for women will also be promoted. Micro-enterprises or entrepreneurs of services and products will be trained and will receive the initial equipment/investments necessary to start their business activities. There will be monitoring and

mentoring of its activities throughout the duration of the project in order to support entrepreneurs in basing their activities/capabilities. Based on synergies and experiences from other organizations, this type of entrepreneurship may be applied in other regions.

Some of the initiatives planned at this stage and which may also be relevant for scaling and dissemination in the remaining regions are: Installation of multifunctional platforms powered by solar energy and equipped with a mill, a peeler and a battery charger; training in IGA management for those responsible for multifunctional units; creation of units' sustainability mechanisms (management committee, maintenance fund); training of young people in building improved stoves; and supply and construction of solar dryers, among others.

1.21 Impact and sustainability

The project will have direct socio-ecological impacts through the intensification of agriculture resilient to the climate and of low-emission, as well as through interventions applied to production in vulnerable lands and around protected areas that are at risk from climate change. Supporting smallholder farmers in adaptation is essential, given the role they play in current and future food security in Guinea-Bissau, and strengthening community-based and agricultural activities and organizations is of fundamental importance for the transition to a greener economy in the country. This will be strengthened by training young people and promoting entrepreneurship in specific technical skills relevant to adaptation. The project will also prioritize the recovery of arable land abandoned due to the effects of climate change, thus preventing the continuation of deforestation for the same purpose.

Capacity building for development professionals and government experts in different layers of the agricultural sector forms the foundation for long-term adaptation benefits in the regions, as well as for the country. Directly, the impact of adaptation is to increase the resilience and adaptive capacity of 82,450 people (4.5% of the total population of Guinea-Bissau), including 8,500 farmers (70% women) and their families. It is estimated that the project will additionally benefit 120,000 people indirectly, resulting in a total of 202,450 people (10.9% of the total population).

Although the aim of the projection is adaptation to climate change, there are, by definition, mitigation benefits in increasing the scale of low-emission and climate-resilient agriculture.

Below, the various impacts that the project will have in different areas of sustainability are described.

Impacts and sustainability of agricultural practices

The methods and techniques recommended for adaptation to climate change are adapted to the terrain and are generally accessible to populations. The fight against erosion and the use of good agricultural practices will be disseminated to all producers, regardless of their political, cultural or socioeconomic affiliation, or their ability to read and write.

On the one hand, learning will occur throughout the project's execution time. On the other hand, the dissemination of certain approaches related to climate change on a large scale could compromise the quality of facilitation and the content of the training of the “new” groups, if it is not in line with proper quality monitoring and control system.

Economic impacts and sustainability

The promotion of commercial horticulture, through training and agricultural equipment provided by the project, will help many women to increase their income from commercial horticulture.

The focus on good agricultural practices and the calculation of profitability will help producers to work more effectively and better manage their resources. Training in production techniques, conservation and processing of products will allow an increase in production and better marketing

An exit strategy will be developed and implemented in parallel with the development of the project activities to ensure the sustainability of the initiatives created by the project after its completion.

Environmental impacts and sustainability

The methods and techniques to be promoted by the project will be environmentally sustainable. The project will promote the intensification of production and - if applicable - the reduction of sown areas. The project will facilitate the recovery of degraded lands and encourage the population to fight against soil erosion. The cultural

practices to be identified, documented and disseminated used will be compatible with the health of the producers, and their families, their animals and the ecosystem. They will prevent soil and water pollution from synthetic pesticides. The approach favours the use of biological treatments, which are not harmful.

To reinforce economic sustainability, environmental education with coastal communities should also be taken into account for the preservation and recovery of mangroves as a protective barrier for cultivated fields, protection against coastal erosion, carbon sequestration and a cradle for the preservation of biodiversity and increased availability of crustaceans, bivalves, fish and others for conscious and sustainable exploitation by target populations. The integration of factors and strategies to mitigate risks from the initial phases of the project is essential for its success.

Institutional impacts and sustainability

Adaptation to climate change will be well integrated into agricultural sector programme policies. The project will also contribute to the identification and intersectoral definition of guidelines and methods of adaptation, as well as to strengthening the capacities of extension workers and other technicians from Ministries and project implementation partners. The observation and monitoring system that will be operationalized, the methodology and tools created and piloted will be appropriated by the public partner institutions.

The great challenge here concerns the implementation of these activities by the Government, decentralized structures and communities, if financial availability is not ensured after the project.

Sustainability impact on gender

Adaptation interventions based on income-generating activities, taking into account climate change, play an essential role in building capacity and empowering women. The participation of women in these types of activities (cultivating a vegetable garden, for example) increases their opportunities of access and land ownership. While women work on certain plots and generate income, they acquire the means to discuss property issues with landowners (usually men) and local officials, who in some cases allowed them access to the property. Multifunctional solar platforms and other technologies such as improved stoves, access to quality water, sanitation and other initiatives created within the framework of the project will also help to alleviate women's workload and provide access to new income-generating activities.

Ownership of the project by national actors

The project will be implemented in collaboration with the Ministry of Agriculture and Rural Development, the Ministry of the Environment and Biodiversity and IBAP and will facilitate the involvement of several sectorial departments. A framework for consultation on integrating adaptation to climate change will be created. The activities to be implemented will be placed mainly at the community level with technical support from national institutions.

The appropriation of the activities ensured by the project will, at the same time, encourage the participation of many actors in its implementation, making the issue of adaptation to climate change a national concern. In this dynamic, a national dialogue on climate change will be initiated from the planning stage of the project. This inclusive dialogue will be carried out at various levels (state, non-state, beneficiaries of the intervention), between these same actors and at the level of administrative regions with the establishment of a consultation forum. Local communities and the private sector will be partnered. The diversity of actors and consultants in the planning process and in the level of consultation that will facilitate the implementation of national priorities.

TECHNICAL EVALUATION

1.22 Monitoring of Water and Soil Quality

Guinea-Bissau is essentially an agricultural country, with abundant potential in the Agrarian sector and favourable conditions for the development of this sector, despite the barriers of climatic nature that have been felt in the last decades.

Water

Water is not only a consumer good, but also a factor in the intensification of agricultural and livestock production and which can increase the resilience and adaptation capacity of populations to climate change.

Groundwater and surface water reserves (free aquifers) are estimated to be several hundred m³ / year (from 10 to 250 m³ / year), but with low rates exploitation and salinity problems. Indeed, much of the river network is actually an estuary with tides and a significant salt water intrusion extending 175 km up river within the territory. This causes significant salt water intrusion into the aquifer, which can cause problems during the dry season, if the extraction exceeds the water filling the aquifer. There is a huge water potential in the regions of Cacheu Oio. However, cases of pollution of aquifers by salt water, are most common in these regions. Deep aquifers, though little known in the south, have more limited exploitable renewable resources in the order of 10 to 30 Mm³ / year. The current exploitation of aquifers is estimated at 15 Mm³ / year and only 14% of deep aquifers are exploited in the region (DGRH, 2012). Groundwater is mainly used for agriculture and supply of drinking water for rural and urban populations. In agriculture sector groundwater is mainly used for livestock consumption, irrigation and horticulture and rice production.

Groundwater is the main source of drinking water for the population in the country, which is captured at depths of 30 m to 80 m. Recharge of the shallow to medium groundwater aquifers is directly dependent on precipitation during the wet season. The combination of reduced rainfall, increased temperatures and increased frequency of drought episodes could impact freshwater resources quantitatively and qualitatively

These groundwater and surface water reserves are a regulatory factor and important source for agriculture. The renewal of these resources depends largely on the intensity and regularity of rainfall, whose parameters have been worsening gradually over the years. River and ground water recharge is estimated to be 45 million m³ annual average distributed variably from north to south.

The effect of decreasing rainfall volumes includes complex and multiple impacts. It has effects on the recharge of the water table, on the flow of rivers and on the physical and chemical conditions of the estuaries, in most coastal marine areas, and on fisheries production in the continental interior in rivers, lakes and vendos, etc. It has caused silting and/or even fossilization of river channels. A process of increasing continentalization of river basins, from the Geba to the North Frontier, is taking place, resulting from a decrease of the respective flows and currents, including salt tidal currents.

The localized effects of over-exploitation of groundwater and replacement deficit due to the decrease in rainfall and the impermeability of soils are at the origin of saline intrusion. In the continental interior, the weak replacement affects the level of groundwater, which is increasingly located in greater depth and which translate into higher costs of capture and distribution and/or sometimes hamper the access of populations and animals, especially in the dry season. In turn, water that is unfit for consumption and has a greater potential for contamination and disease through vectors transmitted by water is used.

Lack of water, in general, causes substantial deficits in agricultural production and in particular in the production of cereals. Since the staple foods of the Bissau-Guinean population is essentially made up of rice (coastal zone and centre) and maize (black maize and horse maize) in the continental interior, such deficits also have consequences for the supply of urban centres, for the trade balance and exports. This creates a situation of food insecurity that can reach extreme levels in certain areas, even turning into chronic hunger situations.

Improving the process of capturing and distributing water not only as a consumption good but also as a factor in intensifying agricultural and livestock production could increase the resilience and adaptation capacity of the populations.

Despite the fact that the country has hydrographic resources (groundwater and surface water), the use of these resources for agriculture entails enormous costs. And since there is a lack of hydraulic infrastructure for better

water management, the country does not take advantage of the potential irrigation system that would allow two harvests a year. In the tabancas, the pumping of water from traditional wells and the irrigation/watering of vegetables (strenuous tasks practiced mainly by women) are done manually, limiting labour productivity.

Sustainable water management in agriculture is essential to increase agricultural production. There is an urgent need to improve the efficiency of its use in the target areas. It is not just about "more harvest per drop", but also about ensuring that water savings are used effectively at agricultural, catchment, national or cross-border levels, taking into account a fair allocation among competing sectors – needs of households, industries, and energy, as well as environmental requirements.

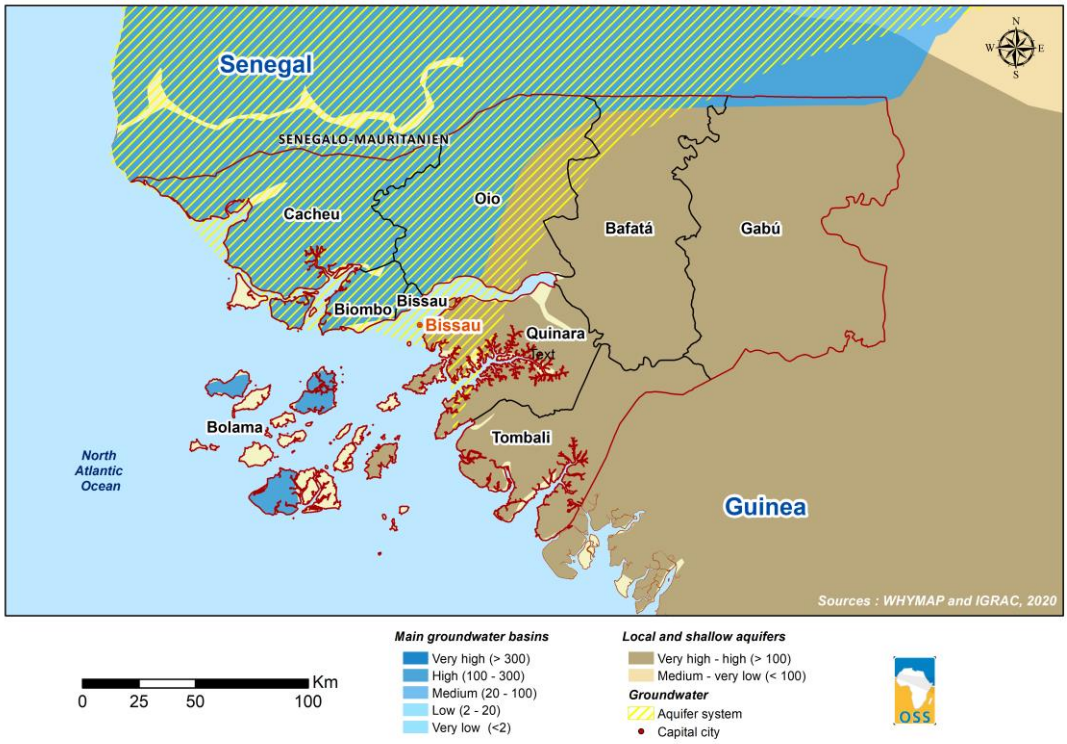


Figure 52. Aquifers Map in Guinea-Bissau

Soil

Agricultural systems that favour soil quality are those that cultivate plants intensively, preferably from different species, without soil disturbance. Soil quality is the basis for the development of agricultural sustainability (Wang & Gong, 1998; Doran & Zeiss, 2000), serving as an indicator for land management (Herrick, 2000), soil and crops (Hussain et al., 1999). Agricultural sustainability depends on maintaining soil quality within the scope of the ecosystem and on positive interaction with neighbouring ecosystems over time (Mello, 2006).

The great challenge in relation to soil quality is in the planning of complex agroecosystems that favour the diversified cultivation of plants. The complexity of ecosystems is important for the efficient performance of the functions of the soil system, determining its quality and the environmental quality. This complexity is achieved by the continuous and diversified cultivation, which allows the soil system to maintain quality over time and to develop the sustainability of the agro-ecosystem.

In recent years at national level, technological advances in horticultural fields have been verified through projects such as: PRESAR, PEASA, PASA, resilient climate change project, etc. Many locations in the south, north and east of the country have benefited from the construction of micro-dams for retention and management of low water availability, recovery of abandoned bolanhas due to salt intrusion and others due to loss of vegetation cover and organic matter that enriches the soil.

1.23 Action to deal with water and soil salinization

The coastal zones of Guinea-Bissau are areas extremely sensitive to the effects of climate change. Soil erosion affects the entire national territory but is a more pronounced issue at the level of the coast and its islands, which are also affected by flooding, mainly caused by rising sea levels. Saline intrusion is another prominent problem in these areas, increasingly influenced by growing human intervention, especially in terms of over-exploitation of groundwater. The effect of salt is also felt on the surface, due to the decrease in rainfall volumes combined with the poor use of mangrove soils.
The following mechanisms can be used to deal with, or prevent, the phenomenon of salinization:

Institutional-level policies on water resource management

Dynamic knowledge of:

- Available water resources and their use
- Water distribution and storage systems (infrastructure such as reservoirs, pipes, etc.)
- Best practices to improve the efficiency of water use, in terms of modality, time and needs
- Responsibility for security and control of water supply (illegal water theft)
- Water agreements between various economic sectors, agents and decision makers
- Desalinization

Main water resource management actions

- Irrigation and water quality control systems
- Agronomic water conservation measures
- Water storage
- Traditional knowledge and techniques of water resource management

Main soil management actions

- Construction of anti-salt dykes or girdles and their periodic maintenance to retain saltwater from rivers and seas
- Discharge system or dams to regulate the water that allows leaching
- Agronomic measures for soil conservation
- Water quality control before irrigation of plants
- Correct use and dosage of fertilizers in the soil or use of products that harm the soil less (organic fertilizers)
- Ploughing system type "réguas camaleao"
- System of organic and diversified cultivation, practices that give the soil increased resistance to attacks

1.24 Agricultural Practices

Organic farming has as one of its main focuses soil conservation and preservation, which plays a crucial role for human activity, for the survival of ecosystems and agricultural practices. Soil has as its main functions the provision of a physical and cultural environment for man and his activities, the production of biomass and raw materials, the storage, filtering and transformation of nutritive elements, substances and water, the provision of support for the development of biodiversity, the constitution of a carbon reserve, as well as the conservation of the geological and archaeological heritage. In Guinea-Bissau, however, soil degradation represents a serious problem, caused or aggravated by human activities, such as inadequate agricultural and forestry practices, urban expansion and inadequate land use. The use of chemical products offers high yields of production but ignores the ecology of the environment. In a way, it has limited or replaced the application of traditional and environmentally friendly fertilizers, specifying an intensive system, which is showing to be extremely harmful to the environment.

The application of agro-chemical products and the use of inappropriate agricultural practices and systems is resulting in a growing area of soil deemed unsuitable for food production. Such products and practices drive the soil to become impoverished, reduce its water holding power and production potential.

Currently, the use of technology in this field is in full expansion. Precision agriculture or smart agriculture, which uses meteorological data to monitor the stages of crop development and minimize losses in production, has increasingly won over farmers across the country. The knowledge of data on air temperature, leaf wetting time, precipitation and soil moisture, can significantly help in the production of crops.

For the implementation of sustainable forms of agriculture, the country must adopt the following practices:

- ✓ Soil conservation and preservation;
- ✓ Crop diversification (where the land is divided into plots, each with a different crop and fallow, rotating every year);
- ✓ Management and control of water quality through the creation of catchment area or reservoirs, drainage systems, drip irrigation system and discharges to regulate the water, allowing leaching if necessary;
- ✓ Construction of micro-dams to facilitate the cultivation of bas-fond rice in two seasons and avoid water scarcity, especially during the dry season;
- ✓ Correct application of inputs (dosage), allowing for healthy growth of the plant and avoiding the emission of nitrous oxide and other greenhouse gases in the atmosphere;
- ✓ Use of improved seeds that are of short cycle and tolerant to salt content;
- ✓ Hybridization of rice seeds, aimed at to avoiding cross-varieties and improving yield;
- ✓ Creation of agro-climatological and agro-ecological zoning to help the meteorological service make a meteorological calendar to facilitate agricultural planning for farmers;
- ✓ Creation of stables to control the grazing of animals and the deposition of their manures that are harmful to the environment;
- ✓ Planting of strong wind-protective trees, capable of causing bedding in rice plants and other crops or damage in the growth phase, and on the other hand reducing soil erosion and land degradation.

1.25 Green micro-enterprises

Guinea-Bissau is a country with great agricultural potential that is not fully exploited due to a lack of public policies and serious investment in this primary sector. The country is rich in natural resources and its agricultural sector could be the engine of its economic development.

Before independence, some support infrastructures were constructed, such as unpaved roads and tracks, ports and anchorages, small boats that sailed along the country's rivers to transport goods, including rice. Granaries were, however, not always built in production centres. The same was true of commercial centres. Some companies and/or commercial houses introduced small peelers in some areas at the time, as well as a transport system, mainly by river. It was in this colonial period that a new category appeared in the exploitation of the rice sector, modern producers (ponteiros) with financial means and materials available.

After independence, the centralized political system had negative economic and agricultural effects for the sector. Because the country's economic policy was centralized, so was its economic visibility, reflecting delays and considerable productivity losses for the sector. In the meantime, many infrastructures set up by the previous regime deteriorated. The colonial commercial houses that operated in the sector were nationalized and new commercial houses emerged as true monopolies of commerce and small industry, like their predecessors.

In order to revitalize the private agricultural sector, the State/Government must invest in the creation of an agricultural credit bank to support micro and macro projects and private initiatives in the agricultural domain. It must also create policy to promote a private sector that involves incentives and subsidies of projects by the Ministry of Agriculture. Such projects aim to assist farmers in the acquisition of agricultural materials and inputs to increase production, training and recycling in agricultural monitoring (monitoring of weather conditions that allows the farmer to know the right time to sow, to irrigate, to spray , harvesting, in addition to listing the most critical phases of the crop), monitoring pest behaviour, insects and harmful organisms for agriculture and training in the meteorology of the area, allowing periodic control of climate change. Implementation of a profitable livestock business project, such as those that have already been successful in some African countries, specifically Botswana, Uganda and Senegal, is also important.

Agricultural products, such as cashew, rice, mancarra, maize and sesame (beno), would be able to generate more effective yields if the producers were incentivised. Producers are discouraged by high rates from the Ministry of Finance, to the point of lowering their production. Taking into account their demands, these products could compete in national, regional and even international markets (cashew nuts and cotton), despite risks of political, economic nature and natural disasters that may have repercussions and lower commercial values. Investment in horticultural production systems is another important aspect that can increase incomes, especially for women and young horticulturists. Their markets, however, are limited in the interior of the country due to the lack of

access to transport to markets and processing and conservation conditions. Perhaps, with serious investment, in the future some of these products can be projected into regional markets.

In order to develop green companies, it is necessary to promote durable and decent opportunities for young people through training and post-training monitoring. The problem of youth unemployment (boys and girls) is very worrying. As in most African countries, this problem threatens socio-economic growth, peace and national security. The situation is characterized by continuous migratory movements of young people, which can lead to social upheavals that are difficult to master.

One of the strategies to overcome the problem of youth unemployment is to create attractive jobs in rural areas. Job creation can be achieved through the introduction of attractive trade speculations, capable of better exploiting the productive resources available in rural areas and generating interesting income and jobs, along the agricultural (in the broad sense) and agribusiness value chains. This would contribute to (i) the reduction of youth unemployment through support of agricultural and professional training, short films and practices to support the installation of new farmers; and (ii) improving the living conditions of young people by supporting the creation of sustainable and decent jobs.

For this, it is necessary to support the training of young people in agriculture, in the use of agricultural equipment, entrepreneurship, small business management and accounting through vocational schools and training centres, and to provide services in the communities. It is also necessary to conduct a study on business possibilities in the Cacheu and Oio regions. Then, on the basis of this study, guide young people on the type of business to undertake, as well as. create a credit system with low interest rates to enable young people to start their businesses.

Strengthening the competitiveness of the economy and improving professional integration are priorities for Guinea-Bissau. Guinea-Bissau must create jobs to facilitate the professional insertion of young people who enter the labour market each year and who weigh on the country's social and economic balance. It must strengthen the competitiveness of its economy, increase its export capacity and face growing international competition for goods and services. To meet this double requirement, Guinea-Bissau must redefine its employment, education and training policies and seeks to better link vocational training to economic demand.

To this end, representatives of the private sector must be involved at all levels, within the framework of a strategic and operational partnership between professional organizations of employers, skilled candidates, and the State, which promotes the trainings offered and guarantees its quality and quality and its opening to great number.

1.26 Mangroves / Coastal Ecosystems

The coastal zone of Guinea Bissau is characterized by a succession of rivers and estuaries as well as an archipelago composed of more than 80 islands and islets. The main rivers that cut the Guinea-Bissau coastline are the Cacheu, Mansoa, Geba, Buba, Tombali, Cumbija, and Cacine rivers. The three project intervention regions are located along the Cacheu, Geba and Cumbija rivers respectively.

Mangrove vegetation and intertidal mudflats whose sediments are mainly of estuarine origin dominate this coastline. According to MONTE and IBAP 2015, Guinea Bissau has at least 326,087 hectares of mangroves representing more than 9% of the national territory. The mangrove is the woody vegetation in the coastline which is directly under the tidal influence. This vegetation cover includes a small number of mangrove species, some of which are largely predominant, such as the three Rhizophora species and Avicennia germinans species. These vegetation types grow in mudflats with low relief, and emerging from a recent formation under the combined action of saline and brackish water. The biological richness of these coastal ecosystems makes of mangroves important natural nurseries for associated species such as fish, molluscs and crustaceans and for other animals that migrate to these coastal areas during at least one phase of their life cycle. Contributing to soil fixation and acting, through their roots, as filters to retain sediments, mangrove vegetation contributes to prevent erosion and to stabilize the shoreline.

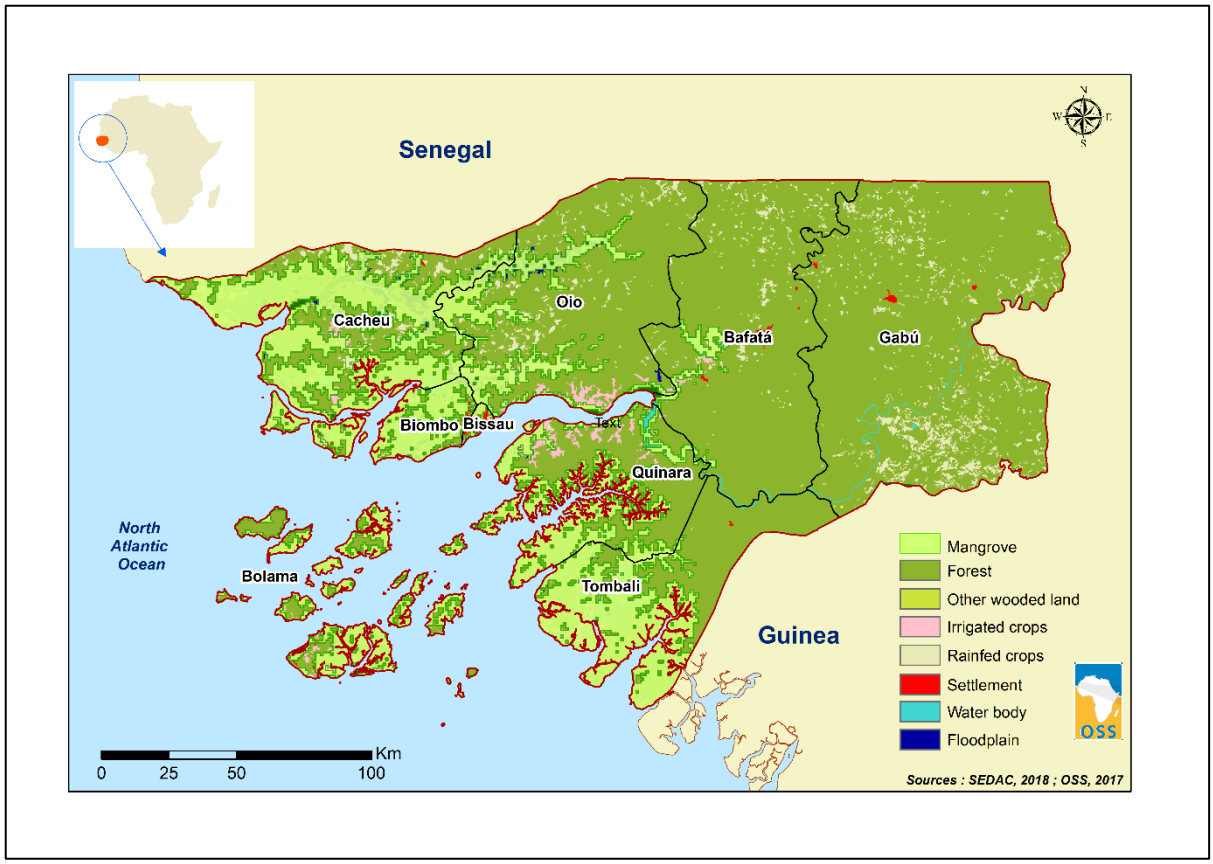


Figure 53. Mangroves map on Guinea-Bissau

The specific conditions of mangrove areas (salty and regularly sea water flooded soil), requires particular characteristics from vegetation growing there. Species colonizing the interface zones between sea and land are highly specialized to survive under these specific conditions. There are a limited number of species living in such environment. According to available data, mangrove vegetation along the Bissau Guinean coastline includes the six following species:

1. Rhizophora harrisonii,
2. Rhizophora mangle,
3. Rhizophora racemosa,
4. Avicennia germinans,
5. Laguncularia racemosa and
6. Conocarpus erectus,

The predominant species in the three regions of project intervention are the three Rhizophora species and the Avicennia species. The most important factor in intertidal vegetation distribution is the depth gradient from the mainland to the maximum possible depth for vascular plant colonization, which appears to be approximately low tide limit. The longitudinal dimension of the depth gradient is the main organizing factor in the zonation of halophyte coastal plant communities (adapted to salty environments).

In places where the depth gradient is large or medium, Rhizophora mangrove is found in the lowest zone and Avicennia mangrove in the intermediate zone. In the area flooded only sporadically during the dry season and more frequently during the rainy season, there are two types of vegetation dominated by herbaceous plants: salt water lala in the flattest areas and halophytic vegetation rampant in sloppy areas. In areas where the depth gradient is shorter, Rhizophora mangrove is widely developed, although some specimens of Avicennia germinans can also be found.

The topographic sequence of natural habitats representative of the coastal zone is generally composed from the sea to the mainland by the succession of:

- Mangroves dominated by Rhizophora spp. on the edge of the sea water;
- Mangroves dominated by Avicennia further upstream;
- Coastal savannahs that can evolve into salt flats according to drought, salinization and acidification processes;
- Groves of oil palm (Elaeis guineensis); and
- Dry and humid forests mainly based in latitude.

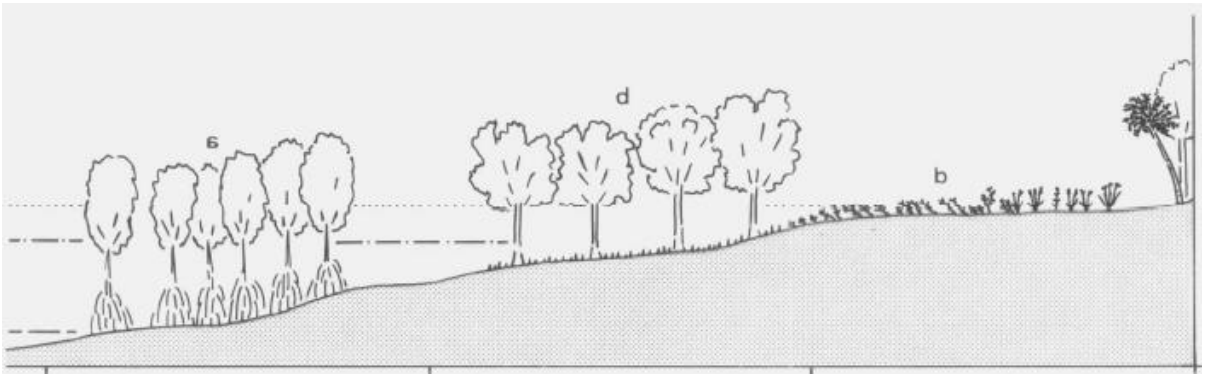


Figure 54. Schematic representation of the topographic sequence along the coastline (Rhizophora mangrove, Avicennia mangrove, Savannahs, Palm trees' plantations and Forests)

This original topographic sequence of natural habitats has gradually evolved over the centuries, according to the settlement of human populations and their agricultural production and rice cropping systems. Three rice cropping systems are practiced in Guinea-Bissau: tidal rice fields on former mangrove land, freshwater rice fields in lowlands and wetlands, and itinerant rice production in the plateaus where areas of forests are slashed and burned.

The mangrove areas have suffered from dieback, mainly due to their conversion to rice fields. This type of traditional rice cultivation on saline soil uses sea water, which enters the rice fields during the dry season, to reduce the acidity of the soil. The fish and shellfish that live in this ecosystem are the main source of protein for local communities. Mangroves are also used as firewood, logs and for the production of medical products. Currently, mangroves are threatened by the numerous dams built to decrease the salinity of these areas and increase commercial rice production.

Both rising sea levels and the destruction of mangrove forests, which act as natural barriers, have been blamed for the loss of land. mangroves have been harvested as fuel wood for smoking fish and for other household needs. As a result of coastal erosion, trees and infrastructure have been disappearing gradually. Towns and villages located close to the shoreline, where most of the economic activity takes place, are likewise threatened. The ruins of a tourist resort, built in the 1980s, stand as a poignant reminder of the forces of the rising

As cashew nuts became the main national cash crop and export commodity in the 1990s, cashew production spread throughout the country, including the coastal zone. Cashew trees' plantations are now at risk of gradually replacing areas of first cleared forest for rice cultivation. The ongoing expansion of cashew trees' plantations is contributing to the destabilization of natural habitats and the gradual disappearance of dry and humid forests. This trend contributes to increasing sedimentation in high areas of lowland and mangrove rice fields, leading to water management problems (aggravated by declining and irregular rainfall) and often leading to abandonment of important parts of rice field areas. To compensate for these losses in terms of upstream production space, a strategy widely adopted by local farmers in the coastal zone consists in expanding the tidal rice fields in mangrove areas, leading in some cases to the sharp decline of mangrove ecosystems. Gradual rise in sea level due to climate change threatens the sustainability of rice fields in mangrove areas that are regularly invaded by seawater during high tides and often causing destruction of important rice field areas.

FINANCING AND BUDGET

COMPONENTS / RESULTS / OUTPUTS / ACTIVITIES	Amount (USD)
Component 1: Development of technical and institutional capacity of government and civil society	
Output 1.1.1 Improved local observation and resilient management systems for water, soil and agriculture practices	
A1.1.1 Conceptualization and operationalization of The Observatory Group (OG) for climate-resilient agricutlure (CRA) practices and technologies and water and soil quality monitoring (WSQM)	452,000
A1.1.2 Establish Community Climate Centers (CCCs)	1,376,000
A1.1.3 Equip OGs and CCCs with technologies for WSQM	702,900
A1.1.4 Training of OG members, including community members and individuals on O&M of observatory equipment	28,200
Output 1.2. Strengthened technical capacities of decision-makers and field staff for addressing water and agriculture related climate risks	
A1.2.1 Development of Training Manuals and Modules for CRA practices and adaptation towards water and soil salinization	73,500
A1.2.2 Capacity building of national-level decision-makers, local government authorities and field staff on WSQM, Adaptation and CRA practices	84,000
A1.2.3 Train youth through vocational training courses in CRA practices, including specializations in livestock management and post-harvest practices	639,665
A1.2.4 Conduct sensitization campaigns and address concrete barriers at community-level for CC literacy, adaptation options, and other resilience-building topics	144,160
A1.2.5 Mainstream environmental education in the young adult education system	109,300
Output 1.3 Improved availability and accessibility to knowledge on water and agriculture-related climate risks and adaptation options	
A1.3.1 Conduct Baseline Study and KAP Survey	35,000
A1.3.2 Elaborate a knowledge base with a collaborative e-platform for climate resilience and adaptation practices	21,100
A1.3.3 Disseminate knowledge and information in local, national and regional workshops and forums	134,500
Component 2: Adaptation of water management towards climate risks in coastal zones	
Output 2.1. Community-based water management is improved and adapted towards climate risks, including salt-water intrusion and extreme weather events	
A2.1.1 Elaborate adaptation management plans (salinization of rice fields, on-site agriculture, water and coastal management)	100,000
A2.1.2 Construct and rehabilitate water management infrastructures to prevent salt water intrusion in	275,100
A2.1.3 Establish water management systems to address water shortages for production and consumption during prolonged dry spells	836,500
A2.1.4 Promote micro-scale irrigation systems to maintain agricultural production	258,900
Output 2.2. Mangrove ecosystems are better managed, as an ecosystem-based adaptation measure towards salt-water intrusion	
A2.2.1 Implement erosion control and adaptation towards sea level rise and saline water intrusion through functional reforestation of mangroves	538,000
A2.2.2 Organize sensitization sessions andpromote production and dissemination on firewood saving cookstoves	132,800
Component 3: Building resilience of farming communities towards climate change	

Output 3.1. Increased and diversified livelihoods of smallholder farmers	
A3.1.1 Establishment, organization and regular trainings in CRA practices on Model Plots	2,023,560
A3.1.2 Promote Sustainable Rice Intensification (SRI) and Climate-Resilient Rice Production (CRRP)	287,750
A3.1.3 Introduction and promotion of short cycle animal production	119,000
Output 3.2 Increased income options in climate-resilient economic activity along agricultural value chains	
A3.2.1 Support the establishment and mentoring of 40 micro-enterprises and women-led income generating activities (IGAs) along the value chain(s)	878,000
A3.2.2 Establish and upgrade commercial associations for agricultural value chain development	222,700
Grand Total	9,472,635

Table 5. Budget proposal (the values presented for the activities are flexible and are based on suggestions by the team of consultants. The values for the components have not been changed, they are in accordance with those presented in the concept note).

Annex 1: Proposal for internal analysis of activity in relation to partners

(This is a basis for discussion and adjustments)

No.	Activities		Partners Involved
	Component 1 / Result 1 / Output 1.1.1		
1/1	Activity 1.1.1.1 Conception / Concept of practices and technologies resistant to the climate and with low emissions, and monitoring of the quality and quantity of water and soil.	Design and development, in coordination with the main stakeholders, considering both the technical aspects (infrastructure, tools, necessary equipment, etc.) and their functionality (personnel, O&MM, sustainability, etc.). This includes management systems and global monitoring of the data collected (both at community level and at the level of CCC and GO). • Conception/definition of the concept - 5 work sessions with Min. Environment + Min Agriculture + IBAP + INPA - Bissau (ADPP logistics and leads the work) • 2 Observation Groups - 1 for each region - (reference: 3 people - water + soil + environment); competences + material and equipment needed + methodology and operation defined. TDR	Ministry of Agriculture, Ministry of the Environment, IBAP
2/1	Activity 1.1.1.2 Validation of the observation group for practices and technologies resistant to the climate and with low emissions, and composition and scope of work of the members to monitor the quality and quantity of water and soil.	Conduct a set of validation seminars with key stakeholders and experts, from government and civil society, at local and national level. • 2 seminars of 2 days and 1 day - 1 in Oio and 1 in Cacheu - include the expenses of the travel of the technicians from the Central Authorities to the regions +/– 20 participants per seminar (forecast face-to-face costs, but if we are still in a COVID situation it can be necessary to do it via internet - forecast costs for virtual seminar with internet access for smaller groups of participants 5 + 5 + 5 + 5) (Min. Agriculture gives the seminars and Min. of the Environment, ADPP supports + logistics) • Seminar nº 1 by region for TDR Approval (Min. Agriculture gives the seminar and Min. of Environment, ADPP supports + logistics) • Seminar nº 2 by region to present the 2 GOs; (ADPP logistics, Min. Agriculture and Min. of the Environment)	Ministry of Agriculture leads, Ministry of the Environment
	Component 1 / Result 1 / Output 1.1.2		

3/1	Activity 1.1.2.1 Establishment of the observation group, including the provision of equipment.	Establishment and supply of equipment for the 2 Observation Groups and monitoring stations, considering the functionality of the desired monitoring systems and the proximity of the CCCs. • Interviews and selection of management members of the GO (after TDR validation) - 10 interviews + 2 work sessions with 3 Min. of the Environment + 3 Min. of Agriculture + 2 IBAP + 2 INPA - Bissau (ADPP organizes) • Purchase of the equipment and materials necessary for the development of the tasks of the GOs (34 x kit of soil quality monitoring equipment x 5 years of project + 34 x kit of water quality monitoring equipment x 5 years of project + measuring equipment x 2 for GO)	Ministry of Agriculture, Ministry of the Environment, IBAP
4/1	Activity 1.1.2.2 Development of Operation and Maintenance Manual (O&MM) for observatory tasks.	Creation of guidelines for O&MM of observation tasks and their equipment, controlling the correct functioning of each equipment, in order to promote preventive and corrective maintenance, repairs, inspections, cleaning, among others. • Training sessions for the 2 GO (ADPP logistics, Min. of the Environment + Min. of Agriculture + IBAP + INPA) Min Agriculture • Working sessions with the members of the GO to create the O&MM (Min. of Agricultura leads, ADPP logistics) • Printing of O&MM - 100 copies to be distributed by the ministries and by each project nucleus on the ground - the project nucleus coincides with the structure of the FC and the CCC = 34 (ADPP)	Ministry of Agriculture, Ministry of the Environment, IBAP
5/1	Activity 1.1.2.3 Training of community members and individuals in O&MM.	Training of key actors/people involved in the O&MM procedures of the observatory's tasks with a community-based approach in liaison with CCCs. • Training sessions for the project team by the GO • Training sessions for Community Observers (OC) (CF members) on the ground by the EP (ADPP) with supervision by the GO	
	Component 1 / Result 2 / Output 1.2.1		
6/1	Activity 1.2.1.1 Workshops and training of interested parties on agri-environmental practices,	Conducting information and training sessions for key actors/people on processes for monitoring practices and technologies resistant to climate and low emissions and systems for controlling water and soil quality.	Ministry of Agriculture, Ministry of the Environment,

	technologies, monitoring of water and soil quality.	• 2x year - training/information/refresher sessions for OCs, project team and other key entities in the target communities (régulos, etc.) (+100 people in groups of maximum 25 people) - GO • 4 x year - awareness raising actions with communities on the topics covered - OC • 1 x year - CSOs operating in the intervention areas - GO	IBAP
7/1	Activity 1.2.1.2 Integration of observatory activities into national monitoring systems.	Alignment of the operational strategy of the observation group created in the national monitoring system, involving the national authorities of interest and with a mandate for the sectors involved (water, soil, seeds, environmentally sensitive agricultural practices and technologies). • 1 meeting per year x 5 years = 5 meetings – Min. of the Environment + Min. of Agriculture + IBAP + EP (ADPP)	Ministry of Agriculture, Ministry of the Environment, IBAP
8/1	Activity 1.2.1.3 Development of synergies with ongoing and future initiatives on Early Warning Systems and provision of Climate Information.	Promotion of a mapping of actions, considering geographical aspects, target audiences, activities, sectors of intervention, among other aspects, contributing to a concerted and integrated program on Early Warning Systems and provision of Climate Information Min. of the Environment + Min. of Agriculture + IBAP –with collaboration of the ADPP Project Team - EP (ADPP) - 2 work sessions per year, semi-annually = 10 work sessions	Ministry of Agriculture, Ministry of the Environment, IBAP
	Component 1 / Result 2 / Output 1.2.2		
9/1	Activity 1.2.2.1 Development of adaptation and contingency plans for the intrusion of saline water in rice fields and management of saline groundwater.	Design and development of the project plans necessary for the recovery of dykes, both modern and traditional, and the management of rice field water and priority planning to tackle saltwater intrusion, including saline groundwater, revitalizing the production of the fields, with technical quality criteria for the improvement and adaptation of the techniques in use or to be introduced. • Project team with support of Min. of Agriculture and Min. of the Environment, OSS input • 2 adaptation and contingency plans, 1 per intervention region - 5 joint work sessions	Ministry of Agriculture, Ministry of the Environment, OSS

10/1	Activity 1.2.2.2 Development of agricultural adaptation and water management plans on site.	Operationalization and monitoring in the rice fields of plans designed to improve water management and the introduction of adapted and improved agricultural techniques that are environmentally sensitive for the selected plots. • Implement 34 agricultural adaptation and water management plans on site - bolanhas - EP (ADPP)	
		Operationalization and monitoring in the fields of general crops and horticulture of plans designed to improve the management of water resources and the introduction of adapted and improved agricultural techniques that are environmentally sensitive for the selected plots. • Implement 34 agricultural adaptation and water management plans on site - rest of crops including horticulture - EP (ADPP)	
	Component 1 / Result 2 / Output 1.2.3		
11/1	Activity 1.2.3.1 Training of government extension workers and CSO field personnel on adaptation to water and soil salinisation.	Support the professional skills of public structures in the sectors involved and strengthen the capacities of producer organizations or those related to production to enable them to manage the perimeters with regard to adapting to the salinisation of water and soil, developing their technical capacities. • 1 training (30 people) per year for 5 years = 5 sessions • ADPP project team with support of Min. of Agriculture and Min. of the Environment, OSS input	Ministry of Agriculture, Ministry of the Environment, OSS
12/1	Activity 1.2.3.2 Training of government extension officers and CSO field staff on climate-resilient agricultural practices (conservation agriculture, agro-forestry, etc.).	Support the professional skills of public structures in the sectors involved and strengthen the capacities of producer or production-related organizations to enable them to manage the perimeters with respect to climate-resilient agricultural practices (conservation agriculture, agro-forestry, etc.), developing their technical skills. • 1 training (30 people) per year for 5 years = 5 sessions • Project team ADPP - EP (ADPP) with support of Min. of Agriculture and Min. of the Environment	Ministry of Agriculture, Ministry of the Environment,
	Component 2 / Result 1 / Output 2.1.1		
1/2	Activity 2.1.1.1 Establishment and	Organizing producers into work/production groups/clubs of approximately 50 members led by management committees elected by the members and in	

	organization of Farmers' Clubs.	conjunction with local communities. Producers are organized into productive groups according to the proximity of production plots and common interests, led by management committees. • ADPP project team - define/quantify the needs with NHQ	
2/2	Activity 2.1.1.2 Monitoring of Farmers' Clubs throughout the project.	Monitoring of productive groups by animators and supervisors with experience and soft and hard skills who will work on agricultural itineraries with producers, introducing changes from agricultural practices to social practices. The meetings and training required to strengthen technical and operational capacities are facilitated, a joint action plan is drawn up, means and methods are chosen and made available. • Project team ADPP - EP (ADPP) - define/quantify with NHQ the needs	
	Component 2 / Result 1 / Output 2.1.2		
3/2	Activity 2.1.2.1 Training of young people (50% women) in climate-resilient agriculture.	Promotion of a technical and professional course in climate-resilient agriculture, in the vocational training school (boarding school), for young people, mostly girls/women, from the target communities in improved, ecological and climate-resilient production techniques. • EVB training - define how many per year - from the first year • 10 per year since the first year, 10x5 years = 50 students (50% women) • NOTE: Coordination with the rest of the project - students will work during the practical internship and potentially after they graduate)	EVB
4/2	Activity 2.1.2.2 Integration of trained young people into Farmers' Clubs (during their training).	Integration of young people into the productive groups of the communities of origin, during and after technical and professional training, provision of technical assistance to producers and dissemination of knowledge acquired during an internship period. Young people, once integrated, will be guided by the animators (development agents) and supervisors of the productive groups and their trainers. • 50 (25 women) will be trained. The project does not require that all be integrated after the training, but all will do the internships during training • Provide payment for the services of these young people as they graduate and are being integrated into the project (from 2nd year onwards, when the first group of young people will be formed)	EVB

5/2	Activity 2.1.2.3. Training of young people (70% women) in post-harvest practices and the use of technologies.	Promotion of training for young people on post-harvest practices and the use of technologies, promoting the development of agricultural value chains, namely in techniques for conservation, transformation and marketing, reduction and use of post-harvest waste. Resources for improved and appropriate technologies to create added value for agricultural products. • EVB training - define how many per year - from the 2nd year on • Proposal: 10 per year, 10x4 years = 40 students (70% women)	EVB
	Component 2 / Result 1 / Output 2.1.3		
6/2	Activity 2.1.3.1 Establishment of Community Climate Centres (CCC).	Creation of Community Climate Centres to promote activities related to climate change among communities (meetings, seminars, workshops, training, technical assistance available to productive communities) in line with local monitoring of water and soil quality managed by the Observatory Group • EP project team (ADPP) - define/quantify the needs with NHQ • Define how many are to be recovered; how many need a new set of solar energy systems; how many need to be established from scratch, including solar power system. • Bear in mind that the "proximity observatory/monitoring stations" will operate in these CCC - the centres will have monitoring equipment that will be defined by the GO • Provide school desks or armchairs, boards, projectors, etc. (define with EU-Energy team)	
7/2	Activity 2.1.3.2 Mobilization and training in CCC management.	Creation of a management committee for each CCC and promotion of training in management and administration of community centres, in order to guarantee the organizational and operational capacity of the new structures created, so that they are coherent, functional and sustainable. Training will be promoted to ensure the sustainability of the goods and services provided, including for the Observatory's Monitoring and Early Warning System Group, in order to optimize its operation, increasing its reach and the quality of the service offered. • EP project team (ADPP) - define/quantify the needs with NHQ • Training of the teams responsible for the CCCs • Definition of teams by CCC that will work with the GO in the measurements.	

8/2	Activity 2.1.3.3 Functional literacy classes at CCCs in the context of adaptation to the effects of climate change.	Functional literacy classes in the field of adaptation to climate change (agriculture, health, nutrition, gender equality, etc.) as well as mitigation of the impacts of the same - make content with the Min. of the Environment, consultation with Min. of Education. • 20 vacancies per CCC and per year, from the 2nd year - 20x17x4 years for each region (1,360 places for literacy - some people will only need 1 year, others 2, others 3) • Educational material for 1,360 vacancies	
9/2	Activity 2.1.3.4 Integration of CCC into the functioning of the Ministry of Environment and Biodiversity.	Alignment with the Min. of Environment & IBAP for the use of CCCs as instruments for operational strategies at local, regional and national levels. • Min. of the Environment + IBAP with EP (ADPP) - 2 work sessions per year = 10 work sessions • Central Level - Bring the GO and the focal points of the Regional Directorates to Bissau	Ministry of the Environment, IBAP
	Component 2 / Result 2 / Output 2.2.1		
10/2	Activity 2.2.1.1 Establishment of model plots.	Identification and allocation of the perimeters of the 175 model plots, in consultation with the authorities, communities and producers. Perimeter selection criteria will consider land ownership, accessibility and proximity to communities and markets, access to water, soil quality and fertility, climatic impact/resilience, the presence of external agents that interfere with production, perimeter potential, among others. Development plans will be prepared, which will consider the necessary investments and the local applicability of the techniques. • EP (ADPP) - define/quantify the needs with NHQ • Define the number and size of the plots to be used as models, as well as the needs for equipment and supplies for their preparation and operation • Current estimate/base - one per 250 farmers = 17 per region = 34 in total - each model plot with 1 hectare, equalling 40m^2 per person/household	
11/2	Activity 2.2.1.2 Training and assistance to target farmers on agricultural practices adapted and resilient to new climatic conditions	Formation of producers in climate-resistant production techniques in the model plots created. The training will serve to reinforce / recycle general and basic knowledge and will focus mainly on improving production techniques and diversifying crops, considering the time of planting and harvesting and the characteristics of water and soil. Production techniques adapted and resilient to climate change and with less	Ministry of Agriculture

	(including crop diversification).	environmental impact will also be considered. Products that allow a greater variety of processed by-products will be valued. • To be defined by EP (ADPP) + input INPA and Min. of Agriculture - 3 work sessions in the first year. NOTE: valuation of native wild products, as well as traditional medicine to contribute to food security and economic income (raw and processed nutrition and marketing) • Training for farmers - 3 trainings per year in the first year and 2 per year in the remaining years, according to the agricultural calendar (34 model plots x 25 farmers (FC representatives) x 11 sessions) • Awareness and information actions with communities about the value of native wild products for health and family economy - preservation of forests (34 communities x 50 people x 2 actions per year = 3,400 people x 5 years = 17,000 people) • For budgeting purposes define/quantify with NHQ the needs of these training	
12/2	Activity 2.2.1.3 Promotion of alternative livelihood options through post-harvest activities, including the establishment of small processing centres, and marketing of products and connection to the market.	Creation of community agricultural units (Community Processing and Marketing Centres - CCP), with systems for the conservation, transformation, packaging and transportation of agricultural products, from the beneficiary communities. These centres will be equipped with the technologies, machines and tools necessary for the activities of conservation, transformation, packaging, transport and marketing. The products resulting from agricultural campaigns may follow different routes, considering the need for diversification of food products and nutritional enrichment in the family diet, the intrinsic characteristics of the products, the quantity and diversity of the products obtained, the supply/demand in local markets, the possibility to generate income from the sale of products. • EP (ADPP) - define/quantify the needs with NHQ • Creation, organization and commissioning of a trade association/cooperative covering the beneficiaries of the project in the Cacheu region (mobilization, organization, planning, training, etc.) • Reorganization and reinforcement of the ACACB in Oio (reorganization, planning and strategy, review of operating methodology, training and recycling, etc.) • Construction of at least 2 CCPs (Watine type) in Cacheu - place to be defined according to the selection of the target communities	

		• Reactivation of 2 EU Energy Processing Centres in Bissorã (including Watine) • Selection and training of the CCPs management teams and the Management Model, already counting on their resilience for the exit strategy • Training in centre management, product conservation processes and marketing for the teams of the centres. • Marketing plan for processed products and access to markets	
	Component 2 / Result 2 / Output 2.2.2		
13/2	Activity 2.2.2.1 Water management interventions in areas prone to floods, droughts and other extreme situations due to the impact of climate change, with simple earth works to retain water and control saline water intrusion.	Hydro-agricultural technical measures for water management in plots identified as most prone to flooding, in order to guarantee water retention systems and control of saline water intrusion in fields and water plots. Conduct hydro-agricultural planning of the plots involved with the construction of mini-dams, allowing the dynamics between water resources and agricultural campaigns to guarantee and expand the scale of sustainable production in the rice and vegetable fields. • Intervention by the farmers themselves organized in intervention brigades with monitoring of the EP (ADPP) and supervision of Min. of Agriculture, provide basic material - ploughs + hoes + buckets, etc. • 5 previous work sessions with Min. of Agriculture and IBAP to identify and plan interventions	Ministry of Agriculture, IBAP
14/2	Activity 2.2.2.2 Establishment of micro-scale irrigation systems to maintain agricultural and livestock production during periods of drought and/or when groundwater is salinized. Establishment of systems of access to drinking water for communities.	Identification of geo-hydric planning needs in relation to drought and saline groundwater, with identification of existing water points and their needs for rehabilitation and construction of new structures for access to water that allow improvements in the irrigation of soils for cultivation, access points to water for livestock and human consumption. With the identification of access points to water, its quality and the necessary improvement plans, alternative solutions will be implemented for access to quality water, eventually recovering and improving existing wells and boreholes. Water access systems will be promoted, preferably through water pumps, if possible, with renewable energy extraction systems, in wells, rainwater retention tanks, and more efficient irrigation. • EP (ADPP) - define/quantify the needs with NHQ • Identification of existing water points - agriculture, livestock and human consumption; Planning work and field work with Min. of Agriculture	Ministry of Agriculture, Ministry of Natural Resources

		• Recovery of existing water points - agriculture and human consumption (estimate number of water points with NHQ for budgeting purposes - after defining the target communities • Improvement of water points for human consumption - drinking water + deposit for treatment (estimate number of water points with NHQ for budget purposes - after defining the target communities) • Joint planning with the Min. of Agriculture and the Min. of Natural Resources on the additional needs and sustainability of the operation of new access points to water - agriculture, livestock and human consumption; 3 sessions of joint work • Opening of new access points to water, according to the planning carried out • Introduction of improved irrigation systems adapted to specific situations, in the beneficiaries' vegetable plots	
15/2	Activity 2.2.2.3 Recovery of damaged mangroves in the intervention area.	• Creation of procedure manuals for mangrove recovery in conjunction with IBAP (2 work sessions) • Creation of good practice manuals for anthropogenic activities in the natural areas of the mangroves - fishing, rice, oysters and others; EP (ADPP) with IBAP + Min. of Agriculture + Min. of the Environment (2 work sessions) • Creation of mangrove protection and recovery brigades in communities - brigade training - associated with the permanent activities of the CCC (1 brigade per CCC = 34 brigades) • Awareness and information campaigns on the problem of mangroves with communities (1 campaign per year)	Ministry of Agriculture, Ministry of the Environment, IBAP
16/2	Activity 2.2.2.4 Establishment of rainwater retention systems to improve water supply for agriculture and livestock.	Conduct hydro-agricultural planning with the construction of rainwater retention systems and techniques in the rainy season for use in the dry season, allowing the dynamics between water resources and agricultural campaigns to guarantee and expand the scale of sustainable agricultural and livestock production throughout the year, despite evident and identified effects of climate change. • 5 work sessions with Min. of Agriculture and IBAP to identify and plan interventions • Basic manual for farmer of current solutions to current problems related to various accesses to water resources, as well as entities to contact for technical support	Ministry of Agriculture, IBAP

		• Intervention by farmers themselves with monitoring of EP (ADPP) and supervision of Min. of Agriculture; provide basic and mechanical/specialized material when necessary (by contracting a company if necessary)	
	Component 2 / Result 2 / Output 2.2.3		
17/2	Activity 2.2.3.1 Agribusiness training.	Training in agribusiness also addressing components of resource optimization, such as use/waste of raw agricultural products, conservation and transformation techniques, marketing of products and services, quality systems and differentiation in the product market, management and use of inputs and assets, maintenance plans, acquisition plans, among others. It will include basic and useful information to help graduates discover and understand basic business management, the basic tools that exist, the most important factors to take into account in organizing a business, how to prepare a business plan and loan application, what are the existing legal mechanisms in the region and in the country, what are the advantages of belonging to the formal economy, where can they access these mechanisms, how to organize a basic dossier, etc. • EVB training - defining EVB possibilities - from the 2nd year on • 6 months of training and monitoring of the business after graduation • 20 every 6 months = 40 per year - 40x4 years = 160 students (minimum 50% women)	EVB
18/2	Activity 2.2.3.2 Support for the establishment, acceleration and monitoring of the activities of 40 micro-enterprises along the agricultural value and environmental protection chain(s).	Creation and formation of a wide range of new micro-enterprises (IGAs) for young women and men (minimum 50% women). Micro-enterprises or entrepreneurs of services and products will be formed and will receive the initial equipment/investments necessary to start their commercial activities. There will be monitoring and orientation of their activities during the duration of the project, in order to support entrepreneurs to base their activities/capacities. • EP (ADPP) + EVB + EVB Entrepreneurship Office • Include environmental factors and adaptation and resilience to climate change and Environmental Protection (Green Business) in the entrepreneurship projects promoted by the project • Mapping of structured organizations that operate in agribusiness in the regions of Cacheu and Oio	EVB

		• Form and finance in materials - 20 new micro-enterprise and small cooperative agribusiness projects in the Cacheu and Oio region - prioritize led or inclusive ventures (guiding amount of financing per project 5.000EUR - 7.000EUR) • Form and finance 20 existing micro-enterprises in agribusiness in the Cacheu and Oio region; (guiding amount of financing per project 5.000EUR - 7.000EUR) • Promote 2 awareness campaigns per year, on the importance of creating income-generating activities in the rural context and adapted and resilient to climate change and Environmental Protection; campaigns through "bootcamp" sessions (discussion and training sessions on activities, ideas and issues related to sustainable entrepreneurship in rural areas)	
	Component 3 / Result 1 / Output 3.1.1		
1/3	Activity 3.1.1.1 Training of decision makers at national and sub-regional level on climate-resilient practices, technologies, water and soil quality monitoring system.	Through workshops and training in webinars, training of decision makers, at national and sub-regional level, in terms of climate-resistant practices, technologies, water and soil quality monitoring system. Other training gaps in other sectors related to the main content will also be addressed. • 1 x year - Central Authorities, Deputies - GO + Project Coordination - National level • 1 x year - Local and Central Authorities, Governors, Deputies - OSS + GO + Project Coordination (ADPP) - Sub-regional level	OSS
2/3	Activity 3.1.1.2 Training of local decision-makers on climate-resilient practices, technologies, water and soil quality monitoring system.	Through the facilitation of workshops and trainings, a strengthening of the capacities of decision-makers will be promoted, at the local level, with respect to climate-resistant practices, technologies, water and soil quality monitoring system. Other training gaps in other sectors related to the main content will also be addressed. • 1 x year - Local Authorities, Governors, - GO + Project Coordination - Local level	
	Component 3 / Result 1 / Output 3.1.2		
3/3	Activity 3.1.2.1 Awareness campaigns on climate-resilient agriculture, water and soil quality monitoring system, sustainable agricultural practices, management, benefits from	Promotion of different awareness actions on climate-resistant agriculture, particularly on the water and soil quality monitoring system, sustainable climate-resistant agricultural practices, management, benefits of consuming diversified food products and increasing nutritional quality. • EP (ADPP) - 2 campaigns per year - start of rains and start of dry season • Awareness-raising and information actions with communities on climate-resistant agriculture, particularly on the water and soil quality monitoring system,	

	the consumption of diversified food products and increased nutritional quality at community level.	sustainable climate-resistant agricultural practices, management, the benefits of consuming diversified food products and increasing nutritional quality • 34 communities x 50 people x 2 actions per year = 3,400 people x 5 years = 17,000 people • Production of illustrative awareness manuals	
	Component 3 / Result 2 / Output 3.2.1		
4/3	Activity 3.2.1.1 Development of a knowledge management and dissemination strategy.	Create coherence, collaboration and trust among civil society to work together to demand access to and improve the quality of climate-resistant agriculture in Guinea-Bissau. This activity aims to create a local, regional and national strategy to promote platforms for the dissemination and management of knowledge linked to the value chain of climate-resilient agriculture by and for the main actors and stakeholders in the environmental and agricultural sector. A strategy will be devised to create a "space" where actors can concentrate concepts and experiences to learn, discuss and contribute to overcome challenges through innovative approaches. • 4 work sessions per year, in the last 3 years = 12 sessions - EP (ADPP) + IBAP + OSS + Min. of the Environment + Min. of Agriculture	Ministry of Agriculture, Ministry of the Environment, IBAP, OSS
	Component 3 / Result 2 / Output 3.2.2		
5/3	Activity 3.2.2.1 Implementation of a knowledge management strategy.	Implementation of the knowledge management strategy with the collection, discussion and validation of knowledge related to the climate-resilient agricultural value chain by and for the main actors and stakeholders and its various aspects at local, regional and national level. There will be participation and consultation with local and central authorities, with actors from various sectors (private sector, CSOs, CBOs, Min. of Agriculture, Environment, Education, among others). Workshops will be held to share experiences, lessons learned, and tools created that will allow the production of information and the compilation of knowledge. • 2 campaigns to disseminate the knowledge acquired per year, in the last 3 years = 6 campaigns + communication material - EP (ADPP) + IBAP + OSS	Ministry of Agriculture, Ministry of the Environment, IBAP, OSS
6/3	Activity 3.2.2.2 Knowledge and information are disseminated.	Once the information and knowledge has been compiled, it will be disseminated to the main actors and stakeholders at local, regional, national and sub-regional levels, as well as to the general public. Information and knowledge will be available for use by all stakeholders. The dissemination of information and knowledge by beneficiaries	Ministry of Agriculture, Ministry of the Environment,

		on an individual basis will be done in practice and in a natural way for the other members of the families and communities where they operate. • Disclosure in all partners' own means of communication - annual disclosure value - all, including OSS • 1 dissemination seminar at regional level (20 in Oio and 20 people in Cacheu) - EP + Min. of the Environment + IBAP + Min. of Agriculture • 1 dissemination seminar at national level - in Bissau - to invite relevant LA + CSO representatives from the rest of the country - EP + Min. of the Environment + IBAP + Min. of Agriculture; 40 guests • 1 seminar at sub-regional (virtual) level to disseminate knowledge - EP + OSS + IBAP	IBAP, OSS
	Component 3 / Result 2 / Output 3.2.3		
7/3	Activity 3.2.3.1 Development of a collaborative electronic platform as a knowledge base for climate resilience and adaptation practices.	Creation of a collaborative database, with information and knowledge that is existing, produced and under investigation, in the climate resilient agriculture sector. Geo-referenced points of agricultural perimeters, management and remote access to the agricultural value chain (quantities, species, techniques used, applied agricultural products, etc.) will be included within the project's intervention perimeter, systematizing information on cultivation, harvest, post-harvesting, processing and marketing, agricultural calendar, main impacts of climate change and solutions to mitigate them. The collection and handling of this information will allow the elaboration and dissemination of "Dashboards" (indicator panels) with the compilation of relevant information for the operation of future actions with an evidence-based and integrated intervention (from the agriculture, environment and biodiversity, water, soil, health, accessibility sectors, among others) and considering the bibliography of best practices compiled. It will be linked to other existing tools and powered by existing and under construction Early Warning mechanisms, identified at national and regional level, through the incorporation of the project's collaborative electronic platform with other sites of executing entities. This will ensure that useful tools are replicated, and that new data can be incorporated into future projects and programs. • Project team with Min. of Agriculture + Min. of the Environment + IBAP - OSS input - 20 working sessions • Definition of relevant elements to be included in the electronic tool to be created	Ministry of Agriculture, Ministry of the Environment, IBAP, OSS

		• Existing bibliographic compilation • Survey and critical analysis of the relevant tools and information existing at national and sub-regional level on the selected topics • Creation of an interactive website • NOTE: All assets, infrastructures, plots, constructions etc. should be geo-referenced at the time of construction/intervention	

Annex 2: Climate Change Questionnaire

Part I: Impact of human actions on the environment

Nº	Damage to natural resources by human needs	Yes	No
1	Do you use natural resources to satisfy basic needs (cooking, food, etc.)?		
2	What are the main resources you use to satisfy basic needs and how do you access these resources?		
3	Do you practice agriculture?		
4	For what purpose is agriculture practiced (subsistence or income)?		
5	What type of agricultural production system do you use (pampam, Mangal or Bas-fond?		
6	How do you prepare the land for agricultural practice?		
7	Do you have any knowledge about the danger and environmental damage that your actions can cause?		
8	Do you know any environmental protection laws or rules issued by the Government?		
9	Was the knowledge, laws or environmental rules that were accessed, disseminated by the Government, NGO or grassroots associations?		

Part II: Impact of climate change on the human life of communities (Health, Economy and Society)

Nº	Adverse effects of climate change on agriculture/economy, society and health	Yes	No
	Agriculture / Economy		
1	Has the amount of rain per season been sufficient for cultivated crops (rice, mangrove, corn, etc.) in the last 5 years?		
2	Are there bolanhas cultivated near rivers?		
3	Are there flooded bolanhas when there is an abnormal increase in precipitation?		
4	Are there bolanhas that suffer from salinisation due to rising sea waters?		
5	Has the variation in temperature affected crops and yields?		
6	In what months of the agricultural season does the temperature rise abnormally?		
7	Which crops are most harmed due to water stress and temperature variation?		
8	Are there strong winds, and if so, in what months of the agricultural season, in this community?		
9	Have pests been a problem for crop growth and yield?		

10	What kind of pests and in what months of the agricultural season does they appear?		
11	Do these adverse effects of climate change have an impact on your economic life?		
12	What economic activities do these effects affect most?		
	Health		
13	Have climate changes (variation in temperature and precipitation, the appearance of pests and insects and degraded quality of drinking water due to salinisation) caused diseases in the population?		
14	What kind of diseases have they caused?		
15	What are the main consumption foods?		
	Society		
16	Has the production of cash crops been sufficient to ensure the children's food and education?		

17. How many harvests can you get in a year?

One ☐

Two ☐

More than two ☐

18. What are the varieties of rice grown the most?

19. Where and how are seeds obtained, are they improved seeds, etc.?

20. Can you practice horticulture or alternative agriculture covering agricultural production all year round? What are they?

21. How has climate change affected animal production and animal health?

22. How many meals do children eat per day?

None ☐

One ☐

Two-Three ☐

Four-five ☐

☐

More than five

23. How many meals does a pregnant woman eat each day?

None ☐

One ☐

Two-Three ☐

Four-five ☐

More than five ☐

24. How many meals do elderly women eat a day?

None ☐

One ☐

Two-Three ☐

Four-five ☐

More than five ☐

Part III: Adapting to the impacts of climate change

Nº	Adaptation to the impacts of climate change in the community	Yes	No
1	Are there any alternatives when water is scarce during the agricultural season?		
2	What techniques are used when water is missing for the life cycle of plants/crops and animals?		
3	Are there any alternatives when there is excessive temperature increase during the agricultural season?		
4	What concrete actions are used to protect plants/crops from this increase in temperature?		
5	Do you use compost to enrich the soil of cultivated land?		
6	What types of fertilizers do you use for this purpose?		
7	Are you aware of application of fertilizer doses according to soil fertility?		
8	Can you fight pests when they appear?		
9	What techniques are used for this combat?		

10	What techniques do you use when the bolanhas are flooded?		
11	What are the techniques used when there is saltwater intrusion in the bolanhas?		
12	Have you received any training or awareness from the government, NGOs or grassroots associations on the subject of adaptation to climate change?		

Part IV: Mitigation of Greenhouse Gases

Nº	Greenhouse gas mitigation	Yes	No
1	Do you know any techniques for carbon sequestration, nitrogen fixation and non-methane emission in agricultural activities?		
2	Can you list any techniques used in the community?		
3	Have you received any training or awareness from the Government, NGOs or grassroots associations on the subject of mitigation to climate change?		

Annex 3: Gender Questionnaire

Adaptation of agricultural production systems in Coastal Areas of Northwest Guinea Bissau
QUESTIONNAIRE - KEY INFORMATORS

Name of person conducting the survey		
Date		
Tabanca/village/community		
Ethnicity (natural or behavioural) of person interviewed		
Interview start/end time	Start time:	End time:

Name of person interviewed	Sex (M/F)	Age	Title	Contact details	Signature

A. Gender Norms
1. What are some of the commonly held beliefs, perceptions and stereotypes related to women in your community? ¤ Women must take care of children and the elderly ¤ Women must not speak too much in public ¤ Women must not contradict their husbands ¤ Women must not control money or goods ¤ Women should not be overly educated ¤ Others - specify:
2. What are some commonly held beliefs, perceptions, and stereotypes related to men in your community? ¤ Men must take care of their families financially ¤ Men must not get sick ¤ Men are responsible for / must control their wives ¤ Men need more time than women to rest ¤ Others - specify:
3. What are some of the roles of women in your community? ¤ Worker ¤ Teacher ¤ Leader ¤ Entrepreneur ¤ Other - specify:
4. What are some of the roles of men in your community? ¤ Worker ¤ Teacher ¤ Leader ¤ Entrepreneur ¤ Other - specify:
5. Who in the family takes care of housework (cooking, looking after children, washing, fetching water or firewood)? ¤ Male ¤ Female ¤ Shared responsibility
6. If the answer to number 5 is not "shared responsibility", does the other person help with household chores? ¤ Yes ¤ No

B. Access		
7. What resources do women and men have access to?		Who manages or controls?
Economic	¤ Cooperative ¤ Others - specify:	¤ Women ¤ Men ¤ Both
Financial	¤ Money ¤ Loans ¤ Others - specify:	¤ Women ¤ Men ¤ Both
Physicist	¤ Agricultural equipment/products ¤ Others - specify:	¤ Women ¤ Men ¤ Both
Natural	¤ Agricultural land ¤ Livestock ¤ Others - specify:	¤ Women ¤ Men ¤ Both
Others	Please specify:	¤ Women ¤ Men ¤ Both
8. Are you currently involved in any income-generating activity? ¤ Yes ¤ No		
9. If not, what is the reason? ¤ I don't have time ¤ It is my partner's responsibility ¤ There are no opportunities		
10. Do women have equal access to education, technical knowledge, and/or skills upgrading? ¤ Yes ¤ No		
C. Decision-making		
11. Do women participate in decision-making processes? ¤ Yes ¤ No		
12. If you answered "yes" to the above, they participate: ¤ Same as men ¤ More than men ¤ Less than men		
13. What types of decisions are made by women? ¤ Financial ¤ Family ¤ Income generation ¤ Education ¤ Health ¤ Agriculture ¤ Others - specify:		
14. Do any of these things restrict women's participation in decision-making processes? ¤ Husband ¤ Family ¤ Income-generating activities - that is, too busy to work ¤ Community opinions ¤ Others - specify:		
15. Will there be opportunities to promote women's leadership? ¤ Yes ¤ No If yes, what are they? ¤ Village Development Committee ¤ Village Natural Resources Management Committee ¤ Club / organization ¤ One group ¤ Other CBOs		
16. If you answered "no" to # 15, what are some constraints that prevent women from taking leadership roles? ¤ Husband		

¤ Family
¤ Income-generating activities - that is, too busy to work
¤ Community opinions
¤ Others - specify:

D. Needs and Vulnerabilities

17. What are some of the needs of women in your community?
¤ Employment
¤ Training
¤ Support for the provision of care
¤ More time
¤ More opportunities to lead
¤ Others - specify:

18. What are the needs of men in your community?
¤ Employment
¤ Training
¤ Support for the provision of care
¤ More time
¤ More opportunities to lead
¤ Others - specify:

19. Are there groups in your community that are more vulnerable than other groups? ¤ Yes / ¤ No
If yes, which ones?
¤ Children
¤ Girls
¤ Women with disabilities
¤ Men with disabilities
¤ Elderly
¤ Widows
¤ Others - specify:

20. What are some of the challenges that each of these groups of people in your community faces?

Group	Challenges
Kids	¤ Poor access to education / training ¤ Lack of skills ¤ Lack of respect ¤ Others - specify:
Girls	¤ Poor access to education / training ¤ Lack of skills ¤ Lack of respect ¤ Others - specify:
Women with disabilities	¤ Poor access to education / training ¤ Lack of skills ¤ Lack of respect ¤ Others - specify:
Men with disabilities	¤ Poor access to education / training ¤ Lack of skills ¤ Lack of respect ¤ Others - specify:
Seniors	¤ Poor access to education / training ¤ Lack of skills ¤ Lack of respect ¤ Others - specify:
Widows	¤ Poor access to education / training ¤ Lack of skills ¤ Lack of respect ¤ Others - specify:

21. How has climate change affected women in your community?
¤ It gave them less income opportunities
¤ It made access to water more difficult/time consuming
¤ It added stress to your family life ¤ Others - specify:

22. How has climate change affected men in your community?
¤ It gave them less income opportunities
¤ It made it harder/too long to get water

¤ It increased the stress in their family life
¤ Others - specify:

23. In recent years, when harvests have been poor due to drought or flooding, what has been your family's reaction?
¤ Sale of goods (livestock, grain stocks, others) ¤ Reduce food consumption ¤Emigration of family member to find work ¤ Others - specify:

24. Who made the decisions about how to react and adapt to the shock/scarcity situation in relation to # 23?
¤ Male ¤ Female ¤ Both

E. Related to the project

25. In the proposed project, women are expected to participate in activities related to agriculture, income generation and other activities. Can they easily be part of these activities?
¤ Yes ¤ No
If not, why not?
¤ They are already too busy with income-generating activities
¤ They are too busy with care
¤ They must not participate in such activities
¤ Others - specify:

26. In the proposed project, men are expected to participate in activities related to agriculture, income generation, and other activities. Can they easily be part of these activities? ¤ Yes / ¤ No
If not, why not?
¤ They are already too busy with income-generating activities
¤ They are too busy with care
¤ They must not participate in such activities
¤ Others - specify:

27. Is there anything else you would like to share?

SECTION B - GENDER

12. On average, how much time do you spend each day looking after someone else (a child, an elderly relative, etc.)?
¤ Less than 1 hr.¤ 1-3 hrs. ¤ 3-5 hrs. ¤ More than 5 hrs.
¤ I don't know/prefer not to answer

13. If you are married or have a partner, on average, how much time does your spouse/partner spend each day looking after someone else (such as a child, an elderly relative, etc.)?
¤ Less than 1 hr.¤ 1-3 hrs. ¤ 3-5 hrs. ¤ More than 5 hrs.
¤ I don't know/prefer not to answer

14. Which of the following activities do you carry out?
¤ Sale of crops and livestock
¤ Sale of natural resources (wood, firewood, coal vegetable)
¤ Housework

15. If you are married or have a partner, on average, what activities is your spouse / partner involved in?
¤ Sale of crops and livestock
¤ Sale of natural resources (wood, firewood, coal vegetable)
¤ Housework

16. Which of the following activities controls/has direct access (that is, you do not need to ask your spouse/partner for authorization and/or you can make a decision for yourself):

¤ Agricultural equipment/products ¤ Livestock ¤ Money ¤ None ¤ Prefer not to answer
17. Which of the following activities does your spouse/partner control? ¤ Agricultural equipment/products ¤ Livestock ¤ Money ¤ None ¤ Prefer not to answer
18. If you wanted to access an education or training opportunity, would you be able to do so? ¤ Yes ¤ No ¤ I don't know/prefer not to answer
19. If you answered "no" to # 18, why? ¤ Because I am a woman / man ¤ Because they are expensive activities ¤Because I don't have the necessary knowledge¤ Others ¤ Prefer not to answer
20. If you have a strong opinion about something that affects you and/or your family, is there a place where you feel free to express that opinion, and where do you believe others will hear it? ¤ Yes ¤ No ¤ I don't know ¤ Prefer not to answer
21. If you answered "yes" to # 20, where is that? ¤ the VDC ¤ a Group of Women ¤ other CBOs
22. If there is a woman in your community who wants/has the ability to be a leader in something, does she have the opportunity to become a leader? ¤ Yes ¤ No ¤ I don't know
23. If you answered "yes" to # 22, what are these opportunities? ¤ Participate in the VDC ¤ Start a business ¤ Lead a CBO ¤ Others - Please specify:

Annex 4: List of contacted institutions

1. Alexandre Cabral, Director of the Environmental and Social Impact Study Office (Eco Progresso SARL)
2. António da Silva, Deputy Director of the National Park of Tarrafes do Rio Cacheu
3. Domingos Gomes Beteunde, Director of the National Park of Tarrafes do Rio Cacheu
4. Filomeno Domingos Neto, General Director of Engineering and Rural Development
5. Esther Samper, Coordinator of the Ianda Guiné Arruz project
6. Júlio Malam Injai, Director General of Agriculture
7. Laurentino Rufino Gomes, General Director for the Environment
8. Leandro Pinto Junior, Director of the COAJOC Cooperative
9. Rui Daniel Barbosa de Andrade, Coordinator of the rice and mangrove project / IBAP
10. Sidney dos Santos, Administrator of the NGO Peasant Federation KAFO

Annex 5: List of populations of the communities consulted

1. Mr. Régulo (King) of Pelundo.
2. Mr. Chief of Tabanca of Pelundo
3. Pelundo Women Association
4. Pelundo Youth Association
5. Mr. Committee tabanca of João Landim
6. Sr. Professor of João Landim
7. Mr. Aliu of the Nhoma
8. Nhoma Youth Association
9. Mr. Committee ot Ensalma
10. Ensalma Women's Association
11. Mr. Taba de Gã Lomba Committee
12. Association of Women of Gã Lomba
13. Mr. Saliu, Head of the K3 board
14. Mrs. President of Aprosal K3
15. Mr. Gastão Nhari President of Association AJOFIAMA
16. AJOFIAMA Association
17. Mr. António, Djugudul Committee
18. Djugul Youth Association
19. Mr. Ussumane, Missira Mansoa tabanca committee
20. Women's Association of Missira de Mansoa
21. Mr. Collaborator ADPP of Watini
22. Mr. Committee of Watini
23. Watini Youth Association
24. Youth Association of the tabanca of Missira Bissorã
25. Mr. Committee of the Missira Bissorã tabanca
26. Mr. Committee of Tabanca de
27. Co Section Secretary
28. Có Women's Association
29. Bulol Women Association
30. Odjamoral Women's Association
31. Elia Women's Association
32. Friendship Association
33. Djobel Women's Association
34. Mira Muni Women's Association

Annex 6: Comments by participants in the workshop held on 16/01/2020

All participants consulted the team for the report presented and expressed their interest in collaborating with ADPP-GB in the implementation of the project. However, during the interventions, they made some comments, mentioned below.

1. Amadu Tidjane Sal - (ONG-Tiniguena)
    - Pay attention to the name of the Ministry of Environment that is presented in the report. Substitute for Ministry of Environment and Biodiversity;
    - Include in the report the National Institute of Meteorology, in the chapter of partner institutions in the implementation of the project;
    - Regarding the funds, proposes that they be allocated to ADPP-GB every six months instead of quarterly as proposed by the consultant in the report.

2. Bacar Sila Dafe - (National Association of Guinea-Bissau Farmers. ANAG-Oio)
    - Attention should be paid to the operation of agricultural services in the region. Strengthen their capacities;
    - Create an agricultural credit bank at the level of the peasants;
    - Instead of thinking about creating new infrastructures, it would be better to recover those that exist in the regions, however many of these infrastructures are in an advanced state of degradation;
    - The policies, programs and projects that are developed must have a minimum duration of 5 years for sustainability reasons;
    - One of the main problems in the development of agriculture in Guinea-Bissau is the commercialization of agricultural products, he thinks that the project should pay attention to this aspect;
    - Technical follow-up of activities is extremely important. Thanks the consultant for talking about this in the report;
    - Creation of an agricultural information service;
    - Project completion policy.

3. Augusto Pansau Pacho - Wetland Development Organization (ODZH)
    - Environmental impact studies do not take waste management (garbage) into account.

4. Avito Sanches Vaz - Ministry of Agriculture and Rural Development (MADR)
    - Add the word “quantity” to the water quality monitoring system. Proposes that it be called in the report “Water Quality and Quantity Monitoring System (SMQQA).

5. Manecas A. da Silva - ONG-WECAM
    - Restoring and restocking the mangrove to allow the defence of the coasts is one of the activities mentioned in the report. Suggests that the project create synergies with the rice and mangrove project implemented by IBAP with the support of IUCN.

6. Sauda Nacoltte - DRA-Oio (Regional Director for Agriculture Oio)
    - Carry out sensitization activities in order to avoid cutting trees at the head of the bolanhas which leads to the sedimentation of rivers;
    - Involve the DRA in the follow-up and follow-up of actions in the beneficiary communities.

7. Jorge Euclides Gonçales - Competent Environmental Assessment Authority (AAAC)
    - Regrets the fact that the document is not shared to allow workshop participants to get an idea of the document and make their deepest contributions to the document;
    - Questioned whether before the project starts to be implemented, an environmental and social impact study should be carried out.

8. Malam Bida - (Commercial Farmers Club Association of Bissorã (ACACB)

- It is in line with all the capacity building actions foreseen by the project. However, he thinks that this aspect goes beyond the project, should be seen by the Government as a continuous action;
- It is in accordance with the number of perimeters proposed by the consultant in the report (175), but one should not forget the horticultural perimeters for women;
- Regarding credit for producers, he thinks that this aspect should be well studied to avoid past mistakes. This goes beyond the scope of this project.

9. Feliciana Mendonça – National Institute of Meteorology (INM)
    - Include in the chapter of institutions the National Meteorological Institute and the National Civil Protection Service in the report;
    - Meteorological information is extremely important for the implementation of projects of this type;
    - Questioned whether the project reports should be semi-annual or annual.

10. Isnaba P. Merba - NGO Palmeirinha
    - The magal's reforestation strategy must be carried out in synergy with the Rice and mangrove project implemented by IBAP;
    - This project must establish synergies with other interventions in the area;
    - The training aspect in the manufacture of improved stoves is very important, because its diffusion and use avoid large consumption of coal, mainly from the cutting of mangroves;
    - Betting on the dissemination of documentary about good practices, especially using the cinemas debate with the communities;
    - Investing in environmental education programs in schools, such as children and teachers.

11. Mário Dias Sami - Advisor to the President of the National Popular Assembly (ANP) for Agriculture, Fisheries, Natural Resources, Environment and Transport (A.P.R.N.A.T)
    - This workshop is of great importance because not all organizations organize consultations with partners for project design;
    - It is a very important project for communities given the situation of degradation in coastal areas with negative aspects for the environment;
    - Create a communication platform between MADR ministries; MAB; IBAP and other partners in the area;
    - Conduct an environmental impact study before the project starts;
    - Government engagement on all MADR and MAB must be clear and encouraging;
    - You can count on my support and that of the ANP with regard to advice and influence with other deputies.

In conclusion, the participants approved the report and suggested the consultant to integrate the comments he deemed pertinent in the report.

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Annex 8 Responses provided to CIC2 in March 2021

OSS Responses to the raised comments on 21-03-23 & 25

1. The major problem that this project aims to address is saline intrusion on agricultural fields and groundwater. The proposal is not very clear which actions will directly address the issue of salinization of water. Can you make it clear?

Concretely, the project will address the issue of saline water intrusion in fields by conducting hydro-agricultural technical measures for water management in plots identified as prone to flooding (Activity 2.2.2.1. Water management interventions in areas prone to flooding, drought and other extreme conditions, with simple earthworks for water retention and control of saline water intrusion). This will strengthen water retention systems and control saline water intrusion in water brakes and plots. Hydro-agricultural planning will be conducted and mini-dams and dykes (traditional and modern) will be constructed or rehabilitated, allowing the dynamics between water resources and agricultural campaigns to guarantee and expand the scale and calendar of sustainable production in rice and horticulture sectors. Working sessions with project partners will identify and plan interventions. Intervention will be conducted in cooperation with the farmers themselves and basic materials, equipment, and inputs will be provided.

These concrete interventions will be embedded in plans designed under Outcome 1, Output 1.2.2, as follows:

Activity 1.2.2.1. Development of adaptation and contingency plans for saline water intrusion in rice fields and salinized groundwater management): project plans will be developed that are necessary for the recovery of dykes, water management interventions in rice fields, and planning to counter salt water intrusion (including salinized groundwater). Two overall contingency plans will be developed, one per each target region (Oio and Cachéu Regions).

Activity 1.2.2.2. Development of on-site agricultural and water management adaptation plans: The activity will include (i) operationalization and monitoring of plans to improve water management and to introduce CRA practices for selected rice fields. 34 plans for agricultural adaptation and water management on site (bolanhas) will be created, one per target community. The activity will also include (ii) operationalization and monitoring of plans to improve water management CRA practices for other crop- and horticulture fields.

The intervention will furthermore be strengthened by Activity 1.2.3.1. Capacity building of government extension workers and CSO field staff on adaptation regarding water and soil salinization, which will support the professional skills of government and other public structures in the target sectors. It will strengthen the technical capacities of producer organizations and field staff of CSOs. The project will train 30 people per year, and women's participation will be encouraged.

2. Can you please specify what are the uses of the 'Water and Soil Quality Monitoring (WSQM)' in this project? How will be used and who will use it? Can you make it clear?

The WSQM will be conducted by communities (Community Observer teams), linked to Proximity Monitoring Stations (20), and supported by the Observatory Groups (2), to be established by the project. The Monitoring Stations will be integrated in the functioning of the Community Climate Centres (CCCs) (Output 2.1.3), and will hence be community-based. The observations / data will both feed into regional and national monitoring systems, and will also serve for communities to be aware of water and soil quality changes, allowing farmers to adapt accordingly (with increased capacities within the scope of the project). The structures for this are established under Outcome 1.1 Climate-resiliency Observatories are established and operational, with the following activities:

Activity 1.1.1.1. Design/Concept of The Observatory Group (OG) for climate-resilient and low-emission practices and technologies and water and soil quality monitoring: This activity will cover the design and development - in coordination with key stakeholders and partners - of two Observatory Groups (OG); this will include both technical aspects (infrastructure, tools, equipment, etc.) as well as operationalization (personnel, Operation and

Maintenance Manual [MO&M], long-term sustainability, methodologies and operation). Systems for overall management and monitoring of data collected will also be included (at community-level as well as at Community Climate Centers (CCCs)). The detailed scope of the OGs will be defined during project implementation and in collaboration with community members, the OG's focus areas will include monitoring of water, soil quality and salinity levels. Two OGs will be established, one per target region: OG-Cacheu and OG-Oio. The main scope of work and focus of the OG will be developed with the Technical Support Teams (TST) and the project partners, and will be defined by a ToR. Special attention will be paid to ensure that women and people living with disabilities (PWD) are mobilized to form part of the OG teams. The OGs will consist of two technical cells on climate trends, observation and monitoring, data collection and analysis. Each regional OG will train, manage and oversee the field observation, monitoring and data collection that will take place by the Community Observers (OCs). These OCs will be linked with Proximity Observatory Centers, connected to the project's 20 CCCs, which will be located strategically in the target regions. The OGs' work will be coordinated, from its inception, with the efforts of National Authorities, and will be integrated into their operations.

Activity 1.1.2.1. Establishment of the Observatory Groups, including provision of equipment: Establishment and provision of equipment and necessary assets for the 2 OG and the Proximity Monitoring Stations, considering the functionality of the intended monitoring systems and the proximity of the CCCs. The equipment will include, among others: office and IT equipment, vehicles, technical equipment for monitoring of water and soil quality and salinity levels; sets of Soil Quality Monitoring Kits and Equipment will also be provided for each of the targeted communities.

Activity 1.1.2.2. Development of a Manual of Operation and Maintenance (MO&M) for observatory tasks: Creation of guidelines for the MO&M. This will include observatory tasks and equipment, including: monitoring the correct functioning of each piece of equipment to promote preventive and corrective maintenance; repairs; inspections; and cleaning, among others. This activity will include the training of the OG teams on the MO&M content and functional use. It also includes the MO&M printing and distribution to the target stakeholders, including project partners and target beneficiaries.

Activity 1.1.2.3. Training of community members and individuals on MO&M: Training of the key stakeholders/people involved in the OG's operation and maintenance; training will utilize a community-based approach and will be done with the Proximity Monitoring Stations (hosted by the CCCs.) Training sessions will be provided to the project team, the OCs and the CCCs' management teams. Special attention will be given to promote gender-balanced working groups.

Under Outcome 1.2. Increased technical capacity and integrated knowledge of CRA practices and WSQM will further inform national stakeholders and be progressively integrated in the national monitoring systems:

Activity 1.2.1.2. Integration of observatory activities in national monitoring systems: Alignment of the operational strategy for the regional OG into the national monitoring system. This activity will involve the National Authorities of interest and target all sectors involved (water, soil, seeds, environmentally sensitive agricultural practices and technologies). There will be continuous collaboration with the target authorities from year 1 of the project and throughout implementation.

3. Under Activity 2.2.1.1: Can you clarify which model plots? Please add a bit more details.

The project will set up model plots with each Producer Organization established and/or strengthened by the project (encompassing 8,500 farmers), which will serve as Farmer Field Schools, communal production plots and meeting places for the organizations. The activity is defined as follows:

Activity 2.2.1.1. Establishment of model plots: Identification and assignment of the plots to be used as model fields, in consultation with authorities, communities and producers. Field selection criteria will be considered, namely, the area of the plots, land ownership, accessibility and proximity to target communities and local markets, access to water, soil quality and fertility, climate impact/resilience, the presence of external agents that interfere with production, and perimeter potential, among others. Development plans will be drawn up, and will consider

the necessary investments and local applicability of techniques. (Handing over and legalising land use according to national land use law). 170 model fields (at least 2 per target community - 1 for horticulture and 1 for rice production) will be established, and each will be subdivided into 8 model plots of 40m2 each. The 170 model fields are estimated to be distributed along 35 horticulture model gardens per 50 rice model plots, covering the needs of the 34 target communities.

Trainings on the model plots are defined as follows:

Activity 2.2.1.2. Trainings and on-farm assistance of farmers on climate-resilient farming practices (including diversification of crops): The model fields will serve as demonstration plots for: (both for water and soil management works), land preparation, potholing for water retention, rain retention simple techniques, sustainable watering, application of inputs, methods of preparing nurseries, transplanting, pit spacing, seed quantity selection, plant families and companions, companion planting and crop rotation, green manure cover crops and permanent soil cover or mulching, plagues and pest treatment and natural and environmentally friendly fertilization, and use of compost, among other climate resilient agriculture, conservation agriculture and agronomic practices.

Particular focus will be placed on diversification of production, tree (functional trees) planting management, horticulture crops, mangrove rice row and sustainable co-existence and mutual benefits between natural forests, mangroves, agriculture and pastoralism practices. The training will reinforce general and basic knowledge and will focus on improving productive techniques and diversifying crops, considering climate change impacts, the time of planting and harvesting and the characteristics of the soil. Production techniques will be adapted and resilient to climate change. Practices will be shared with each targeted private household, and the project implementation team will provide regular follow-up to support individuals in the use of new practices. Products and processes that allow a greater variety of processed by-products will be valued – including conservation methods and value-addition of native wild products as well as traditional medicine – and these will contribute to food security and greater economic income (nutrition, raw and processed produce marketing).

4. Can you clearly specify the sources of water for the irrigation? It is assumed that water saved under output 2.2.2 will be used, but it needs to be clear.

Water used for irrigation will include both the water saved from rain and storm water retention systems, as well as from new and existing water points in the targeted communities, which will be rehabilitated were applicable. The activities are further defined as follows:

Activity 2.2.2.2. Establishment of micro-scale irrigation systems to maintain agricultural and livestock production and access to drinking water systems for communities: Identification of needs for geo-hydric planning concerning drought and salinized groundwater. This will include identification of existing water points, as well as an analysis of quality and needs for rehabilitation. It will also identify, where necessary, new structures to be constructed to increase access to quality water; this will improve soil irrigation for agriculture, as well as increase access to water points for livestock and human consumption.

Alternative solutions will be implemented for access to quality water, recovering and improving wells and boreholes whenever necessary. More efficient systems of access to water will be promoted, preferably through renewable energy powered water pumps in wells, lakes/lagoons, rainwater retention tanks, and other necessary means for more efficient irrigation systems. This activity will take place in the 34 target communities, 17 per target region.

The activity will additionally include: the improvement of water points for human consumption - drinking water with access to water analysis systems and treatments and tank for treatment; opening of new water access points, construction of an estimated 10 new water points, with tanks, for drinking water in the target communities; and the introduction of improved irrigation systems appropriate to the specific situations in the participants' horticultural and rice plots.

Activity 2.2.2.3. Establishment of rain and storm water retention systems for improved agriculture and livestock water supply: Conducting hydro-agricultural planning of plots including the construction of rain and storm water retention systems. This will allow the dynamics between water resources and agricultural campaigns to guarantee and expand the scale of sustainable production, both agriculture and livestock through the year, despite the impacts of climate change. The activity includes working sessions to identify and plan interventions. It includes the production and dissemination of a basic manual for farmers on solutions to problems concerning access to water resources, including entities to be contacted for technical support. Farmers themselves will establish the systems with the support of the project team and partners. Basic and mechanical/specialized material and procurement of specialized services will be provided where needed.

5. In section C.1, can you specify the name of the co-financier (in section A, you said "DEVELOPMENT AID PEOPLE TO PEOPLE-GB"). Also, for the financial instrument, can you please specify whether it is grants or in-kind?)

The co-financier is Ajuda de Desenvolvimento de Povo para Povo Guiné-Bissau (ADPP-GB), which in English translates to 'Development Aid from People to People', the Executing Entity of the project. ADPP-GB is the largest NGO in the country, working closely together with government and communities since 1981.

Co-financing from ADPP-GB will be mostly in-kind, and may include a small amount in grants (TBD).

6. What is the land tenure arrangement in the project areas? Who owns the land and how will the farmers get access to the lands?

According to the Law (Lei da Terra, 1998) all land belongs to the people of Guinea-Bissau. In practice, land in Guinea- Bissau is state owned, where the state grants individuals the right to use the land (Lei da Terra, 1998). Accordingly, land-use rights are passed on from generation to generation.

Land ownership itself is established through land registration, a legal procedure which the vast majority of rural populations in the country hasn't had access to (5 procedures with high costs, relative to their income).

All families in the target areas (99% of the population works on small-scale agriculture) have user rights for land that they can use for farming activities, most have no official legal ownership.

For the demonstration plots, the project will enter into an agreement with the communities about the use of the land for the purpose of the project.

The project will furthermore assist the smallholders, where possible, to legally register their ownership of the land. This is condition to the willingness of families to invest time in procedures, and can be hindered by limited financial means and illiteracy.

7. What are the uses of co-financing? Which activities will the co-financing cover?

The EE will provide co-finance as follows:

- Training costs for youth in climate-resilient agriculture courses (11- and 3-month vocational training course) (Activities A2.1.2.1 and A2.1.2.2), contributed by the Vocational Training School (managed by the EE);
- Providing staff (labor) for the establishment of small-scale infrastructures/assets:
    - Community Climate Centers (A2.1.3.1)
    - Model Plots (A2.1.3.3)
    - Water management interventions on the farms (A2.2.2.1)
    - Establishment of rain and storm water retention systems (A2.2.2.3)
- Providing staff (trainers) for the organization and training of women in functional literacy classes (A2.1.3.3)

8. Clarify whether the NDA of Guinea-Bissau has been fully informed about the proposal? Will you be receiving the NOL? Do you have full support from the Government on this project?

As per the Country Program of Guinea Bissau, we would like to inform you that this project is included in the latest version of the CP developed under the Readiness Project. In this same context a tripartite meeting was held on September 30, 2020, with the participation of Mr. Viriato CASSAMA H.E. the Minister of Environment and GCF

National Focal Point of Guinea-Bissau, the representatives of the GCF Mr. Eduardo FREITAS, and Mrs. Sofia SANTOS, and the experts of the OSS. The objective of this meeting was to discuss the priority projects to be implemented in the country and to be included in the Guinea-Bissau country program. At the end of this meeting the Minister defined the two priority projects of the country which are by order of importance the following:

1. Restoring ecosystem services based on adaptation to climate change - the case of Insalma
2. Scaling up climate-smart agriculture in Coastal Areas of Northwest Guinea Bissau

The NOL (attached) was signed in January 2019 by Mr. Viriato Cassama, focal point of the NDA, and current Minister of Environment and Biodiversity.

The Ministry of Environment and Biodiversity (MEB) is an executing partner in the project, and will have an important strategic role for, among others, the establishment and management of the observatory groups. Therefore, the MEB has been very closely involved in the development of the project. Hence, the focal point Mr. Cassama and his team have been continuously consulted and involved in the formulation of the proposal.

1. Measures to address saline intrusion (water retention):

- Will there be sufficient rainfall in the future? Any evidence? Saline water intrusion and groundwater salinization are very difficult to tackle. In the long term, groundwater will no longer be available due to salinization and the land will be less productive. Will there be water to do agriculture? There should be modelling to see if water will be available.
- It seems like the project still uses groundwater (water points). Can the project avoid using the groundwater?
- The key question is sustainability (in terms of water availability for farmers). What will happen after 10 years?

Response: there is no indication in existing climate change models that there will be very strong decreases in precipitation. For the targeted regions of Oio and Cachéu, models indicate a slight increase in total rainfall (+3%) for the period 2045-75 under a low-emission scenario (RCP4.5) and a slight decrease under a high-emission scenario (-5%) (RCP8.5). Variability is projected to increase, with indication of later onset and earlier cessation of the rainy season, a trend already observed.

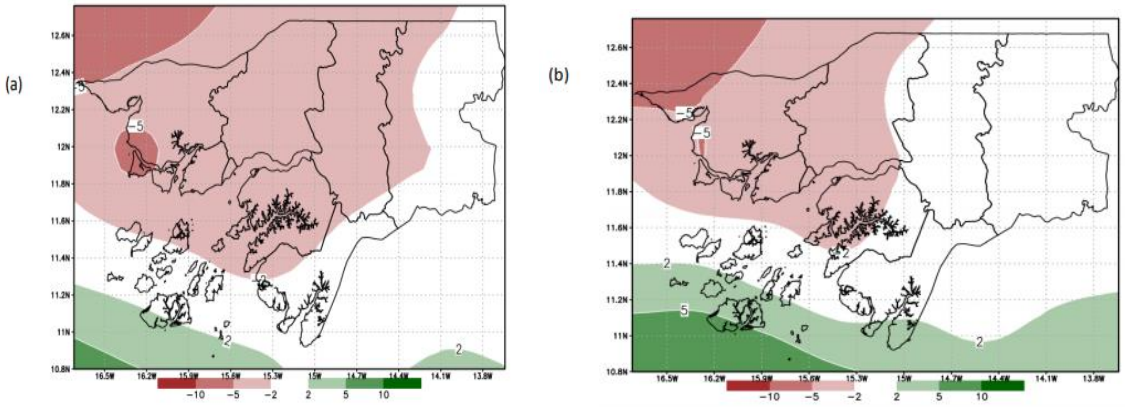


Figure 55. Distribution of projected precipitation changes for the average daily precipitation obtained from the regional climate models performed under scenario (a) RCP4.5 (low emissions) and (b) RCP8.5 (high emissions) scenario for the period 2046-2075

The targeted regions are not areas in which significant shortages of rainwater present nor are projected, considering their geographic location. This is different in the Northern part of the country, which borders to the Sahel.

As such, there is no reason to assume that, in terms of sufficient overall rainfall, sustainability of the interventions is at risk.

As for avoiding to use groundwater, the risk is well understood, but this is challenging within the scope of this project:

- More significant infrastructure interventions (nothing close to eligible under SAP/ Category C) would need to be made to establish rainwater systems that have sufficient capacity for serving communities throughout the dry season. Under the current development situation, curve or scenario, it would be very unrealistic to assume that the country will be able to establish such systems within the coming decades. Through the rainwater harvesting structures and the new

irrigation practices that will be adopted by small farmers, the pressure on groundwater will be significantly reduced.

- Small-scale rainwater retention systems will never be sufficient to store enough water to get through a 6-month dry season, hence farmers will always use groundwater for consumption and certain productions – project or no project. It would not be realistic to think that this behavior could be changed – it is in some situations, a matter of life and death. The project intends, through improved water quality monitoring and improved systems for safe water use, to establish improved systems that take the risks (e.g., consumption of contaminated water) into account much better.

2. Agriculture:

    - How resilient are the mangos, compared to rice?

    - Communities are not very open to shifting their crops, and it may take very long. How will the farmers be incentivized to shift to mangos?

    - What are the measures to keep soil quality fertile, in the midst of saline water intrusion?

Response: There is no specific focus on mango production in the project. The project will not shift production away from rice and cashew as such (the 2 main productions in the country). There will be, however, a focus on diversifying production, with the promotion of horticulture and fruit production (including mangos).

It has to be noted that rice production is a key priority for the country, being the main staple food of the population. Due to political and financial challenges since the post-colonial era, Guinea-Bissau changed from being a rice exporter to a rice importer, despite conditions for rice production being abundant. It would be very unrealistic to assume that communities would entirely shift away from production systems that have been in place for decades (if not centuries), within the scope of a 5-year project.

Therefore, the project seeks to improve and adapt rice production systems to climate change impacts, such as sea level rise (by infrastructure interventions, improved water management, improved monitoring, improved mangrove management, among others).

It should be noted that the annual needs of Guinea-Bissau in terms of rice are estimated at 240,000 tons/year while the current national production by small farmers is estimated at 100,000 tons/year. Therefore, the unmet need is of 140,000 tons/year.

The project will greatly contribute to strengthening the Government of Guinea Bissau's strategy for agricultural expansion in a liberalized economy, which aims to restore agricultural productivity, rural development, and food security in the country. The orientations of the strategy that are related to our project are the following :

- The resumption of investments in hydro-agricultural developments, giving priority to small-scale developments that are simple to design and build, inexpensive, controllable, and self-managing by the communities
- The continuation of efforts to intensify irrigated and rainfed rice production, which will reduce imports
- The diversification of agricultural production, including horticultural production, would lead to the increase and security of income in rural areas

- The support to farmers' organizations to strengthen their capacities and to allow them to progressively ensure the management of the rural economy

With the will to contribute in reinforcing the rice production and encourage the diversification of agriculture production, the project is in line with the national strategy for agricultural expansion.

In order to maintain and improve soil fertility, among others the project will promote climate-resilient agricultural practices based on conservation agriculture (composting, crop rotation, companion planting, mulching, etc.) and agroforestry principles (fertilizer trees, among others), on model plots and with on-farm assistance from extension workers.

For the agricultural plots that are severely affected by salinization and have become unproductive, the project will support adapted cultivation methods. In fact, the project will for example promote the soilless culture which has given excellent results in other regions of West Africa with the same problems. This technique is inexpensive and accessible to small farmers. It also allows reducing the volume of water used for irrigation. In addition, the yields recorded through soilless cultivation are significantly higher than those in direct contact with the soil.

Farmers will be incentivized in multiple ways: inputs will be provided for the Producer Organizations for production and for irrigation, farmers will gain access to improved services, knowledge and small credits, inclusion in value chains will introduce opportunities for income-generating, etc. The project builds on successful projects by the EE, in which farmers have made significant improvements in their production systems. The EE, being the largest NGO in the country, is well known and respected for its project results (in a small country, where 'everyone knows everyone'), which will also contribute to the willingness of farmers to participate in the project.

3. Why is drinking water added? It doesn't seem to be linked to the project outputs. Will all the project direct beneficiaries will be benefitted from this activity?

Response: Access to drinking water was added after a baseline assessment, and consultations with communities were conducted. Considering that water management is a key aspect of the project, it was included based on the following rationale:

- To secure safe water use of target communities (limited access to drinking water risks that communities would use water for agriculture as drinking water, unsafely);
- To contribute to general resilience of communities, for which access to safe drinking water is a key challenge;

All beneficiaries in the 34 target communities will benefit from the activity.

4. Will you have sufficient data and evidence to prove climate change (i.e. climate rationale) particularly water salinization in relation to sea level rise? This will be the key question for ITAP.

Response: There are sufficient data and projections available for sea level rise (7cm rise between 1990 and 2020; projected 20cm by 2050), while salinization of water and soils is highlighted as a key risk throughout the most recent climate change documents from Guinea-Bissau (Third National Communication, 2019; INDC; 2015), which is also common sense considering sea level rise and the topographic conditions in the target areas.

On-site data of salinization levels are not currently available, which is also why the project will establish monitoring stations / observatories. Considering the socio-economic situation (one of the least developed countries in the world – ranked 175th on the Human Development Index 2020), and political instability (since decades) of the country, it cannot be expected that such data will become available otherwise any time soon.

5. How were the lessons learned from Adaptation Fund incorporated into this project?

Response: The project is mainly built on the baseline assessments and implementation models developed by the Adaptation Fund (AF) project. The AF project is still in early stages of implementation – In 2020, the PMU was established and the project is only now being rolled out to the communities, hence there are not many "lessons learned" available.

That being said, the executing partners of this proposed project (Ministries of Environment and Agriculture) are also executing partners in the AF project. Considering that it is a very small country with the same staff involved in several project, this will secure that lessons learned are transferred / taken into account, by the time that this proposed SAP project goes into implementation.

6. From which activities "direct" and "indirect" beneficiaries will be benefited, separately (i.e. what are the differences)?

Response: Direct beneficiaries are considered (i) the 8,500 farmers (and their households) who will be organized in Producer Organizations, and as such be reached by the concreted adaptation and resilience-building interventions, and the (ii) 450 youth (and their households) that will be trained in climate change resilience and adaptation related Vocational Training courses. The total number of direct beneficiaries amounts to 82,450 people.

Indirect beneficiaries (estimated at 120,000) will benefit from the Communal Climate Change Centers and their respective activities such as awareness raising and knowledge enhancement, from generally more climate-resilient communities, and from an improved enabling environment (observatories and monitoring systems, enhanced capacities of extension services, etc.).

7. What is the scale up plan? How can this project be scaled up to other regions? Any financial plan?

Response: It has to be noted that Guinea-Bissau has a very diverse ecosystem with a variety of climatic conditions and contexts, and the project cannot just be "copy-pasted" to other regions (e.g., the

Northern part is more prone to drought and desertification, the archipelago small islands face more impacts of extreme weather, etc.)

Nevertheless, the project model, with observatories, enhanced adaptive capacities at community-level, adapting traditional farming systems, can be scaled up. Equally, the project can be scaled up to other communities in the target regions which face similar challenges. Here it has to be noted that a large proportion of these communities live in protected areas, which requires a higher level of environmental impact assessments and management plans.

Considering the significant political and economic fragility of the country, as well as its high level of indebtedness, it cannot be assumed that national budgets will have capacity to make a significant scale-up. Hence, external funding will need to be sought for scaling up. There is currently no financial plan in place for this.

8. The ToC looks complicated with too many activities Need to streamline the activities.

Response: This is noted. It will be further addressed during full proposal development. Making changes in the project needs to go through the proper channels, and requires consultations with local partners, which cannot just be done in an extremely tight turnover of 1 or 2 days.

Annex 9 Technical Note on Concrete Adaptation Measures and Best Practices for CRRP (SRI and SLWM) to be promoted by the GCF SAP project

1. The Climate-Resilient Rice Production (CRRP) approach

The concrete adaptation actions of the project focus on the implementation of Climate-Resilient Rice Production (CRRP) practices with 153,131 farmers on 71,240 hectares in 13 countries of West Africa. The CRRP approach, as used in the proposed project, is based on the best practices for the System of Rice Intensification (SRI) methodology in combination with location-specific Sustainable Land and Water Management (SLWM) practices, and if indicated with Integrated Pest (and disease) Management (IPM). Entry-point for the project is the scaling-up of SRI, an agro-ecological and climate- smart rice production methodology. SRI is based on optimizing ecological and biological processes to improve rice plant growth h and productivity. The SRI-WAAPP project developed and adopted a conceptual and operational framework that allowed partners in all 13 countries to use a harmonized implementation approach. The conceptual framework identifies four guiding crop production principles that define the SRI methodology.

They are:

1. Encourage early and healthy plant establishment.
2. Minimize competition among plants.
3. Build up fertile soils rich with organic matter and beneficial soil biota
4. Manage water carefully to avoid both flooding and water stress

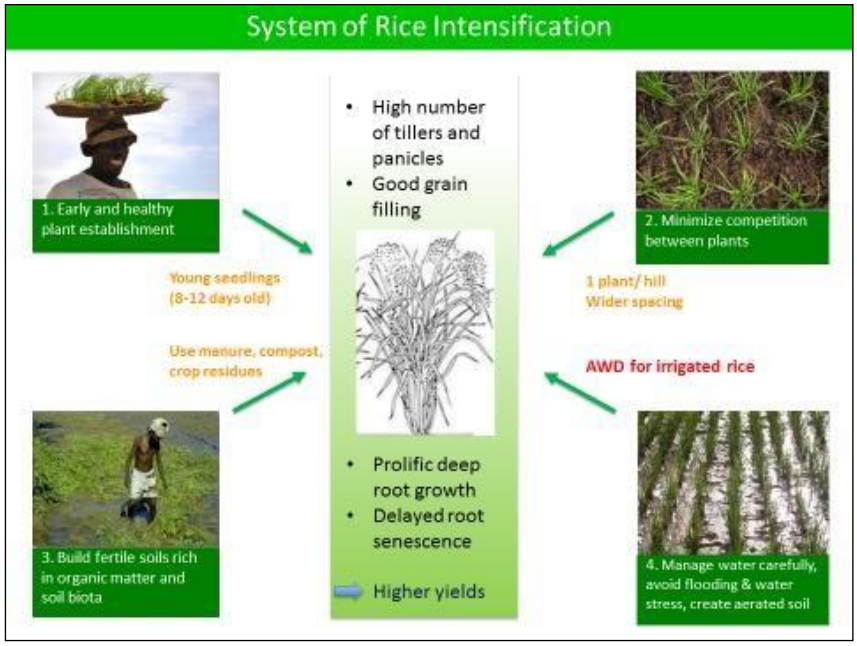


Figure 56. Principles of the System of Rice Intensification, their impact on the rice plant and some indicative practices to implement the principles.

These four principles interact synergistically and if followed, rice plants become healthier and more productive with more tillers and panicles, longer panicles carrying more and fuller seeds, and with deeper and larger roots. These principles remain the same for all rice systems and climate zones. However, the practices to implement the four principles can vary slightly depending on location and can be adapted to farmers' local conditions. Best practices for different environments and systems have been developed globally and in West Africa for the past 20 years.

Differences in rice plant appearance and performance when grown with the SRI methodology compared to conventional, permanently floo ded rice plantings are illustrated in the following figure.

Figure 2. Comparison of appearance and performance of SRI plants and conventionally grown rice plants

Some of the rational how these principles translate into improved plant performance is explained hereby.

i) Encourage early and healthy plant establishment.

Careful and early plant establishment maximizes the plant's potential for shoot and root development, largely by minimizing early stress from both excessive competition among plants in the nursery and from transplanting. The earlier plants can be established in a rich soil, with plenty of space, the sooner they can develop roots and start tillering, and the healthier and more resilient towards stress they become. Most commonly, this translates in transplanting much younger seedlings, and if further pushed back can also include direct seeding.

Comparison SRI (left) vs conventional rice (right) plots planted at the same time and with same variety: SRI plants are taller, have more volume compared tillers, more biomass and grow more vigorously.

Comparison rice plant roots: SRI (right) vs conventional rice (left): SRI roots grow in aerobic soils and can grow deeper and double in to conventional rice, where roots are flooded and die back early in their development, thus are less efficient in supporting plant growth and in providing nutrients to plants.

ii) Minimize competition among plants.

Minimizing competition for resources—such as nutrients, water, sunlight and soil volume—helps plants grow quickly and healthy and become more productive with better panicle and grain development. This principle is highly interactive and dependent on Principle 1 and 3, early and healthy plant establishment and building fertile soils, respectively. Under SRI management, competition is minimized by reducing the density of the plant population, by both i) increased spacing between plants, and ii) planting only 1 plant/hill instead of 3-5 plants/hill.

iii) Build up fertile soils rich with organic matter and beneficial soil biota

This principle strives to create a healthy soil that supports and provides a number of functions and benefits, among others: i) a good and deep substrate for roots, and for microbial life to develop and support plant growth, ii) improve nutrient and water holding capacity of the soil, iii) improve fertilizer use efficiency, iv) create favorable aerobic soil conditions, and iv) protect and buffer against conditions created by climate change, be it variable rainfall patterns, increased temperature, pest and disease pressure. Improving soils with organic matter is the only viable solution in the long run to create and maintain productive and healthy soils. Integration of conservation agriculture principles and practices is highly beneficial to reach the objectives of this principle.

iv) Manage water carefully to avoid both flooding and water stress

The core point of this principle is that while rice plants can survive in flooded conditions, they don't thrive in them, as roots lack oxygen to develop comfortably. Under non-flooded and aerobic soil conditions, roots grow more proliferous and deeper (as seen in figure 2). Aerobic soil microbes support healthy plant development, and the plants tiller more and better. All this translates into better panicle development and a longer grain filling period. Aerobic soils are greatly enhanced by organic matter additions. Mineralization of nutrients found in organic matter are improved in aerobic soil conditions, making nutrients better accessible to both soil microbes and plant roots. With aerobic soil management, methane emissions —a potent greenhouse gas—from rice fields are drastically cut and arsenic uptake in rice grain is also reduced. This principle translates into different practices depending on the rice system, be it irrigated, rainfed lowland or rainfed upland rice systems. The practices are described below.

2. CRRP practices and measures tested, promoted and scaled- up by the GCF-SAP project

Overview

Over the past 20 years, a large set of best practices for SRI for different rice systems and climate zones has been developed at the global level and in West Africa. The project will provide trainings, create technical manuals, and assist farmers directly in their fields to implement these best practices for SRI and to scale them up. Additionally, the project will integrate locally appropriate SLWM and IPM practices, based on identified existing best practices and based on farmers' traditional practices that both support and reinforce the resilience and adaptation capacity of the rice systems to climate change.

The outcome will result in adopted CRRP practices by 153,131 farmers on 71,240 ha producing about 360,000 additional tons of rice (compared to conventional rice production) over the project period of 4 years. Beyond the project timeline, these results will be continuously repeated annually, and further expanded through farmer-to-farmer sharing of best practices and through the establishment and running of PPP, thus creating cumulative benefits and impacts that continue with each year after the project has ended.

SRI was initially developed for irrigated rice production but has successfully been adapted to rainfed systems. The best practices and concrete adaption measure concern all the steps of the rice planting process. The combination of the practices results in synergetic effects that allow for healthy crop development and for plants to express their genetic potential (see figure 2 above). Other best practices for SLWM and IPM will be associated throughout the crop production process from soil preparation to harvest. These best practices will be continuously improved, and the GCF-SAP project will encourage further adaptation and innovation and will remain open to improvements. The project will therefore periodically update the training modules to expand onthe improved best practices.

The CRRP process involves many implementation steps during the crop production season. CRRP is knowledge intensive, and its implementation success will depend on how well farmers understand the biological processes behind the use of certain practices, and how well they are able to best implement the CRRP practices in their own fields. This will require a lot of technical exchange and fine-tuning. The GCF-SAP project strives for i) highest quality ofknowledge-sharing, be it via trainings, assisting and advising farmers directly in their fields, or facilitating knowledge-sharing events, ii) participatory development of locally adapted best practices for CRRP, and iii) providing access to processes, tools and equipment that support the CRRP production and post-harvesting activities. These elements are key for a sustainable and effective scaling-up of CRRP as farmers will have obtained the capacity and means to pursue climate-resilient rice farming beyond the project's timeline.

CRRP best practices implemented by GCF-SAP

The following best practices represent the core practices for SRI and SLWM the project will promote and scale-up under Component 2. The module approach adopted by the project allows to be flexible and participatory. It is expected that additional practices will be added, tested with farmers and expanded as the project is implemented. The categories of best practices include:

1. Seed management and seedling production for SRI
- Seed management
- Seed production
- Raised-bed nurseries

2. Plant establishment in the field
- Transplanting

- Direct seeding

3. SRI-CRRP water management
- Irrigated systems
- Rainfed systems

4. CRRP soil and nutrient management
- Soil preparation and soil management
- Nutrient management and fertilization

5. Weed, pest and disease management
- Weed management
- Pest and diseases management

SRI best practices for seed management and seedling production

Seed management is part of the first SRI principle of early and healthy plant establishment. Good seed management is key to crop production success. GCF-SAP will promote best practices for seed harvesting, seed storage, seed sorting and seed soaking before planting. Implementing these steps will result in high seed quality, viable seeds, high germination rate, and high seedling quality. This allows the farmers to have very good control at the start of the planting season.

Seed production with SRI: There are very compelling advantages to using SRI for seed production. Farmers in many countries have adopted SRI to do this. SRI can be used to produce seed for farmers'own needs or to produce seed for the market. The project will provide specific trainings on seed production with SRI and assist farmers to develop seed production businesses.

Raised bed nurseries: SRI uses raised-bed nurseries to produce vigorous seedlings in only 8 to 12 days. Raised bed nurseries differ from conventional flooded nurseries that use more land, water, fertilizer, time and much more seed. Low density seed sowing is a characteristics of SRI nurseries. This responds to the first and second SRI principles to favor quick and healthy plant development and to reduce competition among plants. This results in theproduction of uniform, vigorous and healthy seedlings that are easy to transplant. Seedlings are ready to be transplanted at the 2-leaf stage, only 8 to 12days after germination

Picture 20. Preparing the raised bed nursery

Picture 21. Sowing of rice seeds

Picture 22. Watering the seedlings in the raised bed nursery

Plant establishment in the field

Planting (either transplanting or direct seeding) is one of the key operations that determine the success of an SRI field. Best practices are well known that make the transplanting process easier and faster for the SRI methodology. The GCF-SAP will promote these best practices to ensure good success of the SRI fields. SRI transplanting involves three main activities: field marking, uprooting and transporting the plants, and the actual transplanting. SRI uses a precise grid to space the plants. This ensures that each plant has enough space to grow, and that mechanical weeding is effective and can be done inboth directions (horizontal and perpendicular).

Marking strategies: The three most common marking strategies are roller markers, rakes and ropes. Farmers have also developed their own effective marking prototypes (see figure below).

Marking tool models such as rakes and rollers will be made accessible by the project to farmers for more efficient and quick transplanting process. These are simple tools and some farmers might be able to produce these tools themselves or to acquire them locally at an acceptable price. The project will introduce farmers to different marking tools and techniques. Examples for three marking techniques are shown below:

Marking rakes can be used in irrigated and rainfed conditions (two passages are needed for marking

Roller markers are most efficient tomark a grid in only one passage

Farmer innovation of a simple bamboo grid,which is easy to build and at no or only low cost to farmers

Uprooting of seedlings: Contrary to conventional seedling production - where seedlings are pulled out of the nursery, which is breaking off the roots - theSRI nursery and uprooting practices focus on keeping roots fully intact throughout the entire plant establishment

phase. Seedlings are uprooted by using a shovel below the root horizon and lifting the small seedlings with their entire root system and soil attached onto a plate, transported to the field and transplanted ideally immediately. Because the roots of SRI plants remain intact and the seedlings are still small, the transplanting shock is minimal, and plants establish fast.

Transplanting is done with single young seedlings at the 2-leaf stage, usuallybetween 8-12 days old, in a grid pattern with wide spacing between hills of 25cm x 25cm. Seedlings are planted superficially, which favors good tillering.

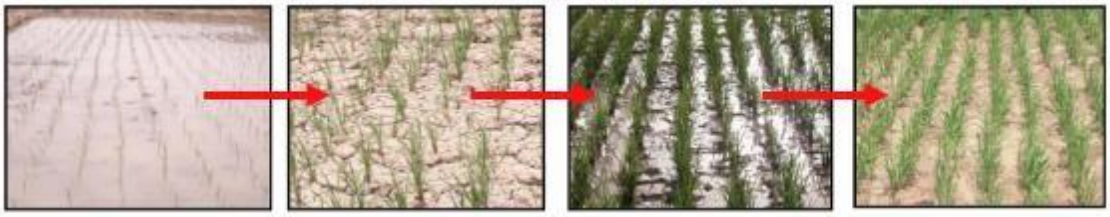
Direct seeding of rice: In rainfed conditions (but also in some irrigated conditions), direct seeding of rice is more suitable and profitable. For this theproject will support access to i) SRI direct seeders (developed and availableby SOCAFON and IER, Mali), and ii) drum seeder (adjusted by IER from thePhilippines' model to West African conditions and available through IER andSOCAFON, Mali).

3. CRRP water management

Good SRI water management provides the rice plants with enough water for optimal plant development. There should be no permanent flooding or drought stress. Rice can tolerate but does not thrive in stagnant water, as rice roots need to breathe to grow well.

CRRP water management in irrigated systems

By using the Alternate Wetting and Drying (AWD) method, it is possible to save up to 30-50% of water, which can reduce a large input cost, especiallyin the Sahel. With AWD a rice plot is irrigated with only a shallow layer of water



of about 2 cm, followed by letting the plot dry out, before another shallowlayer of water is added. This is repeated throughout the vegetative rice production process, and allows plants to tiller well, and for mechanical weeding operations to take place. During the flowering and grain filling period, a shallow layer of water is maintained in the field.

CRRP water management in rainfed conditions

Lowland rice systems might be similarly set up as irrigated fields. AWD might be fully or partially implemented depending on water control. In systems where extensive flooding occurs in the second part of the rainy seasons, advancing the time of planting has shown to work well in Liberia. It allows the rice crop to benefit from non-flooded conditions during the vegetative phase, which promotes tillering and results in increased yields. The SMART Valley approach (as developed by AfricaRice) will be promoted by the project especially in rainfed lowland systems. This approach allows farmers to analyze the water flow within the landscape, and with simple interventions of earthen bunds to channel, retain or evacuate water within the landscape for optimalirrigation and water control purposes.

For upland rice systems that are drought prone, the goal of water management is to keep soils moist and retain water throughout the rainy season with in the plot. Best practices to support this include, among others, i) bunding of fields to store rainwater within the plot, ii) organic matter application and surface mulching to store and maintain soil moisture, and iii) create water storage tanks or small ponds, or dig wells that can assure additional irrigation and bridge periods of lacking rainfall.

Conservation agriculture practices as adapted to rice systems (reduced soil preparation, soil surface coverage) have not only important implications for soil health and soil nutrients, but also for managing water. The project will promote these practices of minimum-tillage and soil protection whenever possible. A specific technical module will be developed show-casing these practices as they are adapted to the respective rice systems in the different climate zones.

4. CRRP soil and nutrient management

Soil preparation and soil management

Incorporation of crop residues during plowing is an efficient way to add organic matter to the soil. The straw residues should be incorporated at least 30 days before the actual planting, giving it time to decompose. Allowing cattle to graze on straw stubbles and weeds between rice seasons adds valuable animal manure to the field

Field levelling: After plowing, levelling of plots is a critical step for SRI field preparation. If a field is well levelled, multiple benefits are created: I) reduction of irrigation water amount needed, ii) irrigation water and fertilizer are distributed more evenly across the field, iii) crop management operations, such as transplanting, weeding and harvesting, become easier and faster, iv) crops grow and mature more uniformly, v) yields are increasing.

Earthen bunds around the fields are needed for irrigated rice, but they are also highly beneficial in rainfed rice production. In both systems they allow for:

Improved water control for irrigation and drainage of a plot, ii) help reduce water and soil erosion, iii) retain organic matter and *Incorporation of straw, compost, biomass* Levelling the field
Bunding around field boundaries

Nutrient management and fertilization

Building fertile soils enriched with organic matter and rich in soil biota is one of the principles of SRI. With SRI, fertilization is based on additions of organic matter and supplemented with chemical fertilizers as needed.

The use of organic fertilization improves soil fertility and health, enhances soil biological life, improves nutrient turnover in the soil, improves fertilizer use efficiency and water retention, reduces input costs, and can suppress pests, diseases and weeds. It also provides micronutrients not found in chemical fertilizers.

Use of farm-based organic matter resources: Different types of organic matter can be applied to rice fields, alone or in combination:

Straw or other crop residues: this is the most available source of OM and should be used whenever possible.

Animal manure: well-decomposed chicken, cow, goat or sheep manure, or manure deposited directly in the field during grazing.

Compost: locally available biomass and crop residues can be composted, ideally in combination with animal manure. Different methods will be promoted by the project, e.g. pit or heap composting methods are appropriate in different climate zones.

Green manures: green biomass from fast-growing trees or plants can be cut and applied directly to the fields, for example from the leguminous shrub Gliricidia sepium or Cajanus cajan grown on the edges of fields.

Cover crops: fast-growing, nutrient-rich legumes can be grown in the rice field during the fallow period between cropping cycles. The advantage is that high quality organic matter is produced directly on site, without transportation costs. The cover crops will either be incorporated during plowing or can be used as mulch and directly been planted into it. This method is especially important for upland systems that are more drought- prone and where soils are often low in soil organic matter.

Intercropping or relay cropping with legumes, for instance with cowpeas (Vigna unguiculata)

Use of industrial organic fertilizers (Fertinova, Organova, Biostimulant) as used in Mali, Burkina Faso and Senegal (use only 1 t/ha instead of 10 t/ha), is an additional source of organic matter if farmers are not able to produce their own organic fertilizers.

Use of chemical fertilizers can complement the organic fertilization as needed depending on local soil conditions. With SRI, application rates of chemical fertilizers become half or at times even less than half of the recommended dosage. This because fertilizer nutri ents are not leached and become better available in organic matter enriched soils. Informed decision-making by farmers how, when and what types of fertilizers to apply also helps to reduce the dose of application. Methods such as slight incorporation of urea into soil instead of broadcasting or the deep placement of urea in association with SRI have shown to create significant yield benefits in Liberia, Mali and Burkina Faso. Other amendments have also been showneffective in climate-smart farming, such as the use of phosphgypsum to reduce methane emissions, as used in Senegal.

5. Weed, pest and disease management

Weed management: In conventional flooded rice systems, standing water is used as a primary means of weed control. Because SRI doesn't use flooding to control weeds, a different strategy is required. Weed suppression can be achieved by using a mulch layer as it is done in conservation agriculture, or through mechanical weeding. Both weed control strategies have secondary benefits besides simply preventing weed competition. Use of herbicides will not be encouraged by the project, given the toxicity to people, animals, plants, microbes and the environment, and based on high water usage in rice production where pesticides will be readily transported beyond the rice fields.

Mechanical weeding has become popular with SRI farmers in West Africa. The SRI-WAAPP Project imported new weeder models from India, which are available in the region and can be used for irrigated and upland conditions.

The Cono-weeder has two cones, is a heavier weeder and used in lighter to medium heavy soils.

The Mandava-weeder was imported from India by SRI-WAAPP. It has only one cone, is lighter, easier to use and less expensive to manufacture. The Mandava is also easier to use in heavy soils. (Picture below on the left)

The upland weeder was also imported from India by SRI-WAAPP. It can be used in dryland soils and is therefore a good tool for rainfed rice production, both upland and lowland (when not in flooded conditions). The weeder is light and easy to use. (picture below on the right)

Other weeders have been introduced in West Africa and will be considered by the project. Weeding efficiency and farmer preference will be evaluated. The project will support weeder multiplication, and distribution of the best weeders to the CRRP farming communities.

Pest and disease management: Pest and disease pressures are generally lower in SRI fields due to:

Plants that are stronger and healthier (see introduction for details)

The rice field environment is less humid. Pests and diseases multiply and develop better and faster in wet environments, which is favored by permanent flooding and the high density of the plant population. On the other hand, the moisture level in SRI fields is reduced by:

- Periodic drying of rice fields when using the AWD irrigation method
- The reduced plant population and wider spacing promotes air circulation through the rows of plants, which reduces the moisture level of the canopy.

The project will support the use of Integrated Pest Management (IPM) methods adapted to local conditions and rice systems before reverting to the use of pesticides. Fact sheets on major pests and diseases and their integrated management approaches exist with various research organization in the region. An integrated management approach starts with the correct identification of the pests and diseases, by understanding their life cycles, and by identifying options for an integrated management.

- This starts with using healthy seeds, free of weed seeds and treated before sowing against seed-borne diseases.
- Managing weeds, surrounding vegetation to the fields, as well as crop residues can be critical in reducing host plants. These host plants can harbor pest and diseases that can move over to the newly established rice crop.
- Efficient and timely fertilization is critical for pest and disease control. The SRI system is based on using organic fertilization, such as farmyardmanure. This improves soil health, which strengthens the resilience of the rice system towards pest and disease pressures. Efficient, timely and reduced use of nitrogen fertilizer is to be considered, as high nitrogen rates can favor the proliferation of pest and diseases.
- Soil preparation can be strategically used to control pest and diseases, including weeds. Plowing at the end of the season (and not at the beginning) can assist in burying and eliminating weeds and insect eggs. Puddling can have the similar effect with burying and suffocating pathogens ahead of rice planting.

It is often a combined approach of several techniques that results in achieving improved health and resilience of the rice production system. GCF-SAP will capitalize on the existing expertise and promote the best IPM practices as indicated.