MANGROVE RESTORATION PROJECT WITH SINE-SALOUM AND CASAMANCE COMMUNITIES, SENEGAL

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Project Title	Mangrove Restoration Project with Sine-Saloum and Casamance communities, Senegal
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Project Location	Senegal, Casamance and Sine-Saloum Regions
Project Proponent(s)	WeForest: Natasha Watts: natasha.watts@weforest.org Germaine Neyra: germaine.neyra@weforest.org
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Project Lifetime	July 10, 2020 – July 9, 2049; 30-year lifetime
GHG Accounting Period	July 10, 2020 – July 9, 2049; 30-year lifetime
History of CCB Status	N/A
Gold Level Criteria	N/A
Expected Verification Schedule	There is no expected schedule

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1 SUMMARY OF PROJECT BENEFITS

This chapter highlights some of this project's important benefits. Section 1.1 (Unique Project Benefits) should be aligned with a project's causal model and is specific to this project. Section 1.2 (Standardized Benefit Metrics) is the same quantifiable information for all CCB projects. This section does not replace the development of a project-specific causal model or the monitoring and reporting of all associated project-specific impacts (positive and negative) that are described in Sections 2-5 of this document.

1.1 Unique Project Benefits

Outcome or Impact Estimated by the End of Project Lifetime	Section Reference
1) Restore the degraded mangrove ecosystem in the project area and mitigate climate change through the removal of GHG	2.1.11
2) Improve the well-being of local communities by creating job opportunities, increasing available natural resources, improving livelihoods, and enhancing the capacities of residents	4.2
3) Improve environmental conditions, restoring ecological services, and enhancing biodiversity index	5.2
4) Increase mangrove knowledge through scientific research activities	5.3

1.2 Standardized Benefit Metrics

Category	Metric	Estimated by the End of Project Lifetime	Section Reference
GHG emission reductions or removals	Net estimated emission removals in the project area, measured against the without-project scenario	1,477,455	3.2.4
	Net estimated emission reductions in the project area, measured against the without-project scenario	N/A	3.2.4
Forest[1] cover	For REDD[2] projects: Estimated number of hectares of reduced forest loss in the project area measured against the without-project scenario	Not applicable	Not applicable
	For ARR[3] projects: Estimated number of hectares of forest cover increased in the project area measured against the without-project scenario	7,019.79	2.1.7
	Number of hectares of existing production forest land in which IFM[4] practices are expected to occur as a result	Not applicable	Not applicable

[1] Land with woody vegetation that meets an internationally accepted definition (e.g. UNFCCC, FAO, or IPCC) of what constitutes a forest, which includes threshold parameters, such as minimum forest area, tree height, and level of crown cover, and may include mature, secondary, degraded, and wetland forests (*VCS Program Definitions*)

[2] Reduced emissions from deforestation and forest degradation (REDD) – Activities that reduce GHG emissions by slowing or stopping conversion of forests to non-forest land and / or reduce the degradation of forest land where forest biomass is lost (*VCS Program Definitions*)

[3] Afforestation, reforestation, and revegetation (ARR) – Activities that increase carbon stocks in woody biomass (and in some cases soils) by establishing, increasing and / or restoring vegetative cover through the planting, sowing and / or human-assisted natural regeneration of woody vegetation (*VCS Program Definitions*)

[4] Improved forest management (IFM) – Activities that change forest management practices and increase carbon stock on forest lands managed for wood products such as saw timber, pulpwood, and fuelwood *(VCS Program Definitions)*

Category	Metric	Estimated by the End of Project Lifetime	Section Reference
Improved land management	of project activities, measured against the without-project scenario		
	Number of hectares of non-forest land in which improved land management practices are expected to occur as a result of project activities, measured against the without-project scenario	Not applicable	Not applicable
Training	Total number of community members who are expected to have improved skills and / or knowledge resulting from training provided as part of project activities	10,900	2.3
	Number of female community members who are expected to have improved skills and / or knowledge resulting from training as part of project activities	1,770[5]	2.3
Employment	Total number of people expected to be employed in project activities,[6] expressed as number of full-time employees[7]	5,900[8]	2.3

[5] 30% of the community trained in the framework of the project will be women as we will recruit 30% of women

[6] Employed in project activities means people directly working on project activities in return for compensation (financial or otherwise), including employees, contracted workers, subcontracted workers, and community members that are paid to carry out project-related work

[7] Full-time equivalency is calculated as the total number of hours worked (by full-time, part-time, temporary and / or seasonal staff) divided by the average number of hours worked in full-time jobs within the country, region, or economic territory (adapted from the UN System of National Accounts (1993) paragraphs 17.14[15.102];[17.28])

[8] For the 2021 Rhizophora plantation campaign, 2,892 community members were engaged and planted 1,845 ha. To reach the 7,020 ha, the project will engage and train 5,900 community members and teach them how to plant. See the number of people hired for the 2020 plantation campaign in the Juin-Septembre 2020 narrative report as supporting documentation

Category	Metric	Estimated by the End of Project Lifetime	Section Reference
	Number of women expected to be employed as a result of project activities, expressed as number of full-time employees	1,770[9]	2.3
Livelihoods	Total number of people expected to have improved livelihoods[10] or income generated as a result of project activities	5 000[11]	2.3
	Number of women expected to have improved livelihoods or income generated as a result of project activities	3 000[12]	2.3
Health	Total number of people for whom health services are expected to improve as a result of project activities, measured against the without-project scenario	Not applicable	Not applicable
	Number of women for whom health services are expected to improve as a result of project activities, measured against the without-project scenario	Not applicable	Not applicable
Education	Total number of people for whom access to, or quality of, education is expected to improve as result of project activities, measured against the without-project scenario	Not applicable	2.1.6

[9] At least 30% of the people recruited for the project will be women. See MANCO recruitment policy as supporting documentation

[10] A livelihood is the capabilities, assets (including material and social resources), and activities required for a means of living (Krantz & Lasse, 2001. *The Sustainable Livelihood Approach to Poverty Reduction*. SIDA). Livelihood benefits may include benefits reported in the employment metrics of this table

[11] The project aimed to support at least 5,000 producers involved in those value chains. See the Proposition Technique Eclosio Livelihoods Final WF-VF as supporting documentation

[12] The target beneficiaries are women and young people. Thus, we plan to support at least 60% of women in the IGAs

Category	Metric	Estimated by the End of Project Lifetime	Section Reference
	Number of women and girls for whom access to, or quality of, education is expected to improve as result of project activities, measured against the without-project scenario	Not applicable	2.1.6
Water	Total number of people who are expected to experience increased water quality and / or improved access to drinking water as a result of project activities, measured against the without-project scenario	Not applicable	Not applicable
	Number of women who are expected to experience increased water quality and / or improved access to drinking water as a result of project activities, measured against the without-project scenario	Not applicable	Not applicable
Well-being	Total number of community members whose well-being[13] is expected to improve as a result of project activities	297,794	2.3
	Number of women whose well-being is expected to improve as a result of project activities	19,000	2.3
Biodiversity conservation	Expected change in the number of hectares managed significantly better by the project for biodiversity conservation,[14] measured against the without-project scenario	7,019.8	5.2

[13] Well-being is people's experience of the quality of their lives. Well-being benefits may include benefits reported in other metrics of this table (e.g. Training, Employment, Livelihoods, Health, Education and Water), and may also include other benefits such as strengthened legal rights to resources, increased food security, conservation of access to areas of cultural significance, etc.

[14] Managing biodiversity conservation in this context means areas where specific management measures are being implemented as a part of project activities with an objective of enhancing biodiversity conservation, e.g. enhancing the status of endangered species

Category	Metric	Estimated by the End of Project Lifetime	Section Reference
	Expected number of globally Critically Endangered or Endangered species[15] benefiting from reduced threats as a result of project activities,[16] measured against the without-project scenario	2	5.2

[15] Per IUCN's Red List of Threatened Species

[16] In the absence of direct population or occupancy measures, measurement of reduced threats may be used as evidence of benefit

2 GENERAL

2.1 Project Goals, Design and Long-Term Viability

2.1.1 Summary Description of the Project (G1.2)

The proposed mangrove restoration grouped project intends to generate GHG emission removals by restoring the ecosystems in a first project instance of 7,019.8, by planting around 32 million new mangrove trees. This is a grouped project, with scoping for new planting sites within the 17 communes where agreements have been made with local Mayors. Future project activity instances will include a 300 m buffer zone around the initial project activity instances will be added to the project, to ensure areas of mangrove growth due to modeled sea level rise, as well as the associated CO_2 removals, are included in the project's boundaries. The project area is located in Sine-Saloum Delta and Casamance Estuary in Senegal, mostly within the boundaries of protected areas. The plantation will take place in selected locations according to ecological conditions, together with the local communities, through a design that implies the active participation of communities involved in the project.

The first project activity instance is planned to be planted between 2020 and 2022. An estimated 3,238.33 ha in Casamance and 3,781.46 ha in Sine-Saloum will be planted, with an estimated 32,000,000 trees. Most of the plants will be *Rhizophora mangle* (75%), 15% will be *Rhizophora racemosa,* and 10% will be *Avicenna germinans*. See Figures 1 to 4 for maps of the project area.

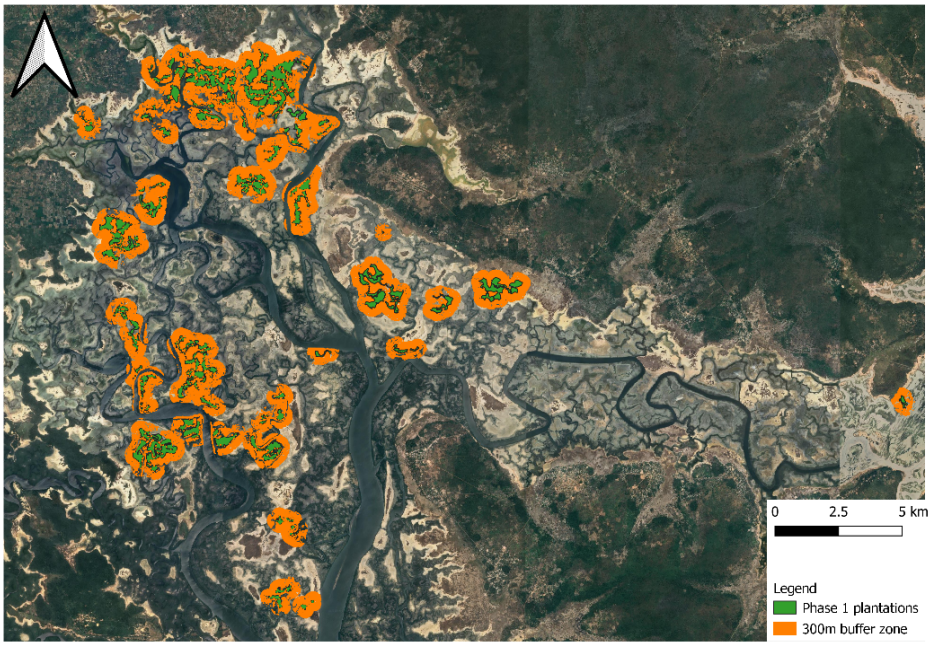

Figure 1: Casamance - Kafountine area Phase 1 and Buffer

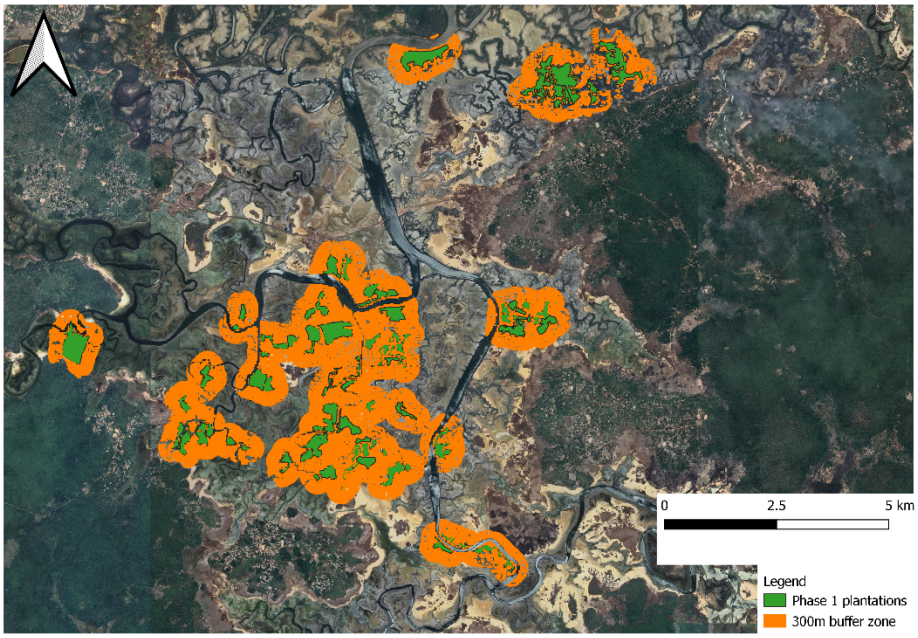

Figure 2: Casamance - Oussouye area Phase 1 and Buffer

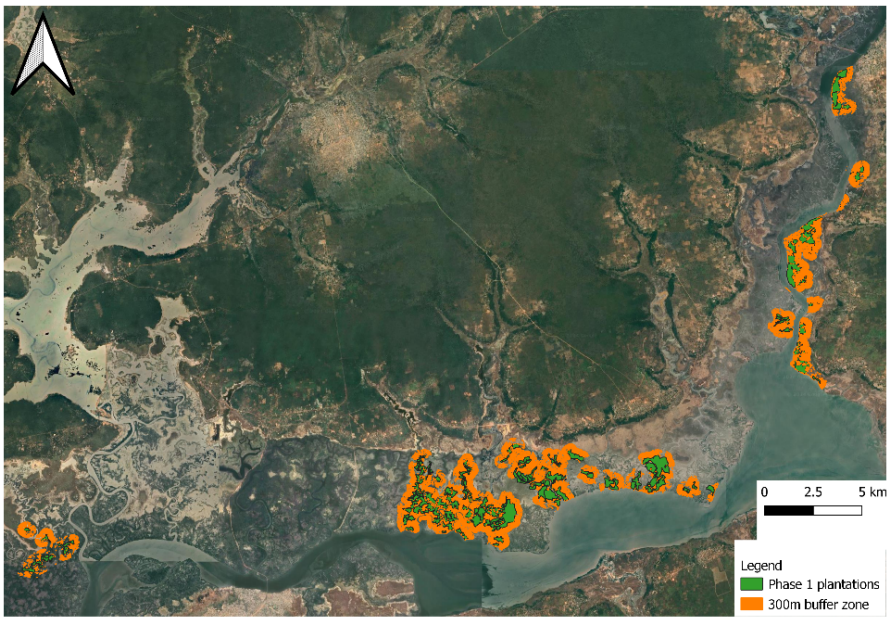

Figure 3: Casamance- Coubalan & Bement Bidjini area Phase 1 and Buffer

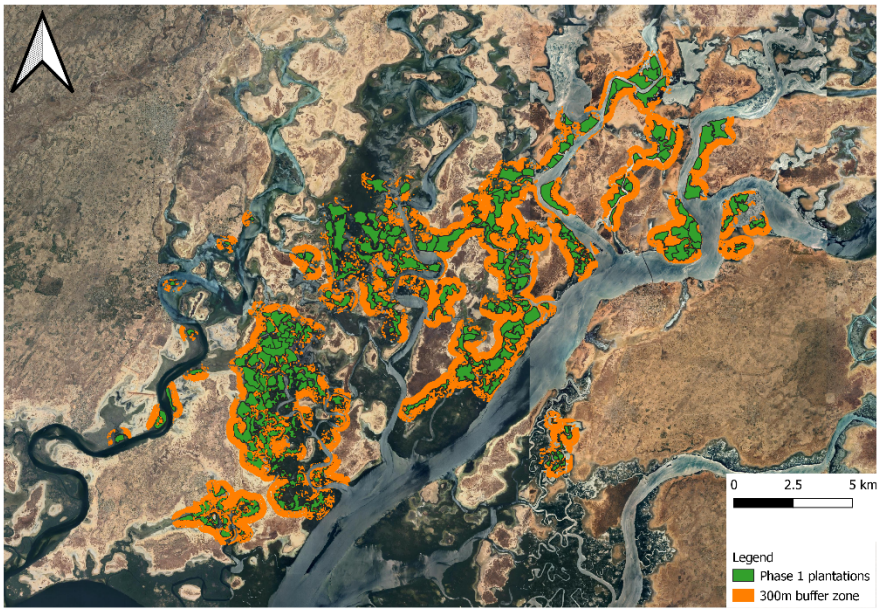

Figure 4: Sine-Saloum Phase 1 and Buffer

Prior to the implementation of the project, the habitat is degraded mangrove, where the mangrove degradation factors are multiple.[17]

The annual average GHG removals through sinks is estimated ex–ante as 49,248 tCO_2-e, with a total value of 1,477,455 tCO_2-e over a 30-year crediting period.

The goal of the project is to increase the mangrove area by planting a variety of species of native mangrove, which will increase the positive functions (ecosystem services) that mangroves provide to communities and biodiversity.

The overall project's climate, community, and biodiversity objectives are:

1. to mitigate climate change through the removal of GHG within biomass growth
2. to improve the well-being of local communities by creating job opportunities, increasing available natural resources, improving livelihoods, and enhancing the capacities of residents
3. to restore degraded wetlands and to improve environmental conditions, restoring ecological services, and enhancing the biodiversity index.

[17] The drought of the 1970s and 1980s, the construction of infrastructure (roads or hydro-agricultural), and deforestation caused by extraction of trees for firewood and construction. Human activities such as mangrove cutting for fish smoking, oyster picking and some fishing practices, as well as climate change, have led to mangrove degradation, reducing their area.

The mangrove plantation is aligned with the management objectives of the protected areas (Saloum Delta Biosphere Reserve and Marine Protected Area of Niamone in Casamance), which seek the conservation of biological resources and habitats.[18]

2.1.2 Project Scale

Project Scale	
Project	X
Large project	

2.1.3 Project Proponent (G1.1)

The project proponent (PP) for the validation of the grouped project under VCS and CCB standards is WeForest. WeForest is an international non-profit organization based in Belgium.

Organization name	WeForest
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2.1.4 Other Entities Involved in the Project

Oceanium, created in 1984, is a public utility organization under Senegalese law which campaigns for environmental protection.

Organization name	Oceanium

[18] Plan D'amenagement et de Gestion Du Parc National Du Delta Du Saloum (PNDS) 2021-2025

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Agresta S. Coop was responsible for the preparation of the initial draft of the project description document and advising during the project validation.

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Silvestrum Climate Associates supported the revision of Chapter 3 of this PD as a consultant.

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2.1.5 Physical Parameters (G1.3)

The project is located in Senegal. The geographical coordinates of the project area are described below:

- Saloum Delta, Fatick region, between geographic coordinates 14º15'N, 16º37'W and 14º04'N, 16º21'W coordinates
- Casamance Estuary, Ziguinchor and Sedhiou regions, between 13º01'N, 16º41'W and 12º21'N and 15º59W coordinates.

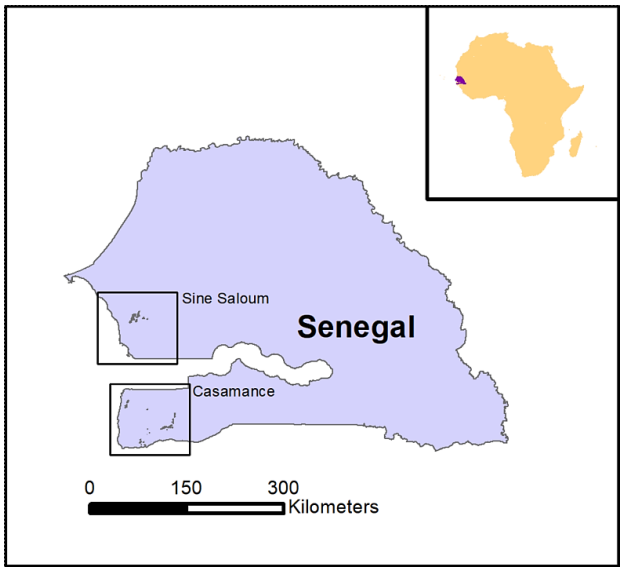


*Figure 5: Location of Sine-Saloum and Casamance Project Area (*Source: Prepared by the authors)

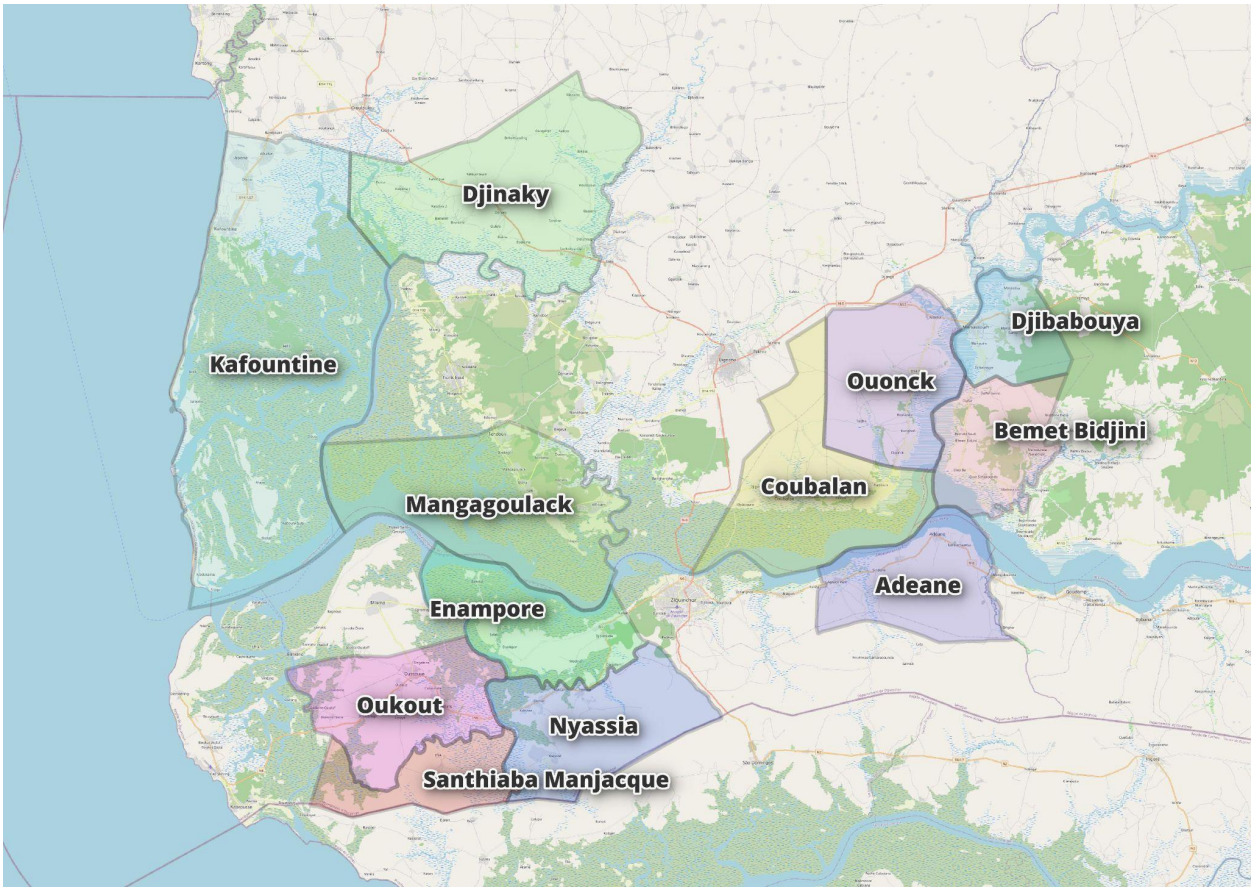


Figure 6: The twelve municipalities in which MANCO is active in the Basse-Casamance region.

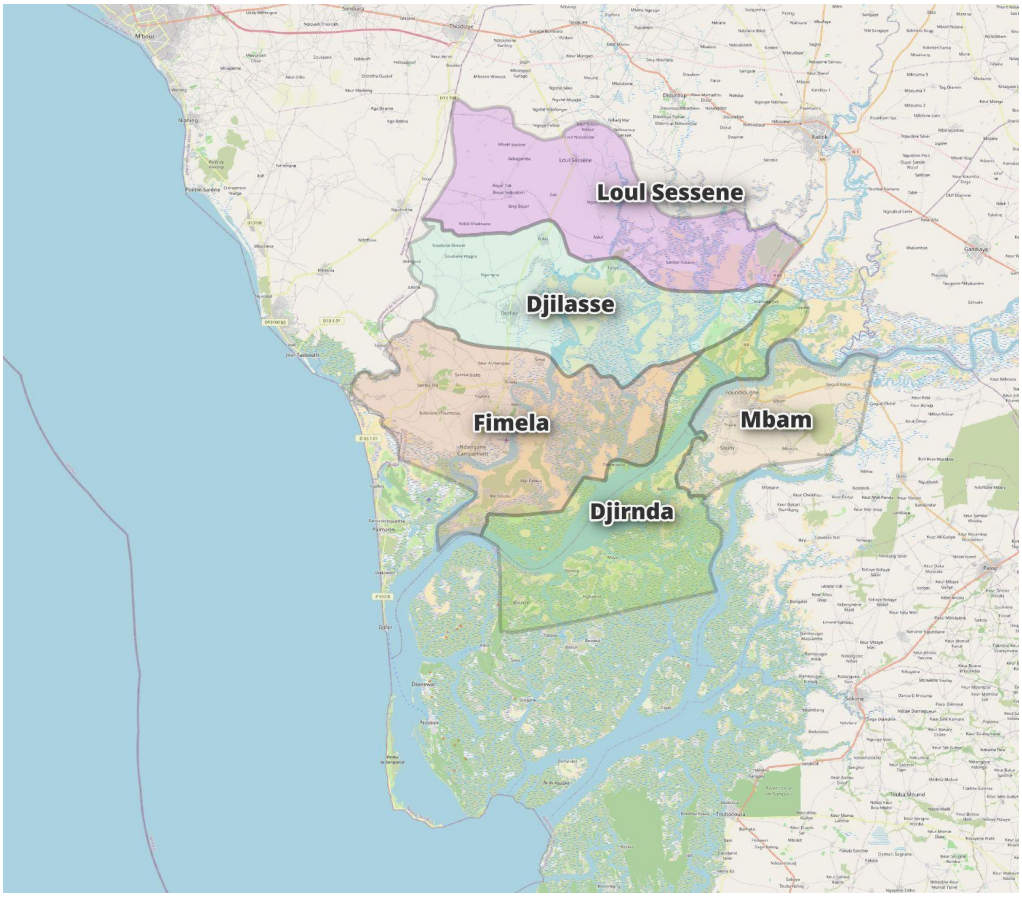


Figure 7: The five municipalities in which MANCO is active in the Sine-Saloum region.

Topography

The geology of Senegal's formation began more than two billion years ago. From a geological point of view, Casamance has two central units:

- The continental basin of the Middle and Upper Casamance, formed by the sandstone plateau of the Continental Terminal (CT). This surface is generally relatively flat, with an altitude not exceeding 50m.
- The maritime basin includes the Lower Casamance and where there is a permanent maritime influence due to the altitude not exceeding 30m.

The CT covers most of the Senegal basin and appeared in the Miocene (Sall et al., 2000, cited by Bassene, 2016[19]). Pagès et al. (1987, cited by Bassene, 2016), specifies, based on various works, that the Gulf of

[19] Olivier Aghandoul Bassene. L'évolution des mangroves de la Basse Casamance au Sud du Sénégal au cours des 60 dernières années : surexploitation des ressources, pression urbaine, et tentatives de mise en place d'une gestionº

Casamance, indented but shallow, has been gradually backfilled since the Ugolian (-20,000 years). Coastlines and mudflats were set up during the accompanying wet period of the Flandrian transgression. Mangroves have colonized these marshy areas which are crossed by many channels strongly anastomosed and drained by the tide, the bolongs.

Quaternary deposits, on the other hand, are observed over the whole of Senegal and present distinct hydrological conditions. In his thesis defended in 2001 on "The recent Quaternary of western Senegal (lakes Retba and Tanma; estuary of Casamance) Eustatic and paleoclimatic implications of diatoms", El hadji SOW, who studied the lithology and the diatom microflora of the carrot de Ziguinchor, drew the following conclusions:

- Ziguinchor has always been an area under the marine influence in the recent Quaternary. The behavior of the environment is that of a maritime gulf gradually passing to a lagoon which shows a slight opening during the last centuries.
- Mangrove colonization occurred after the closure of the old gulf by the shorelines.

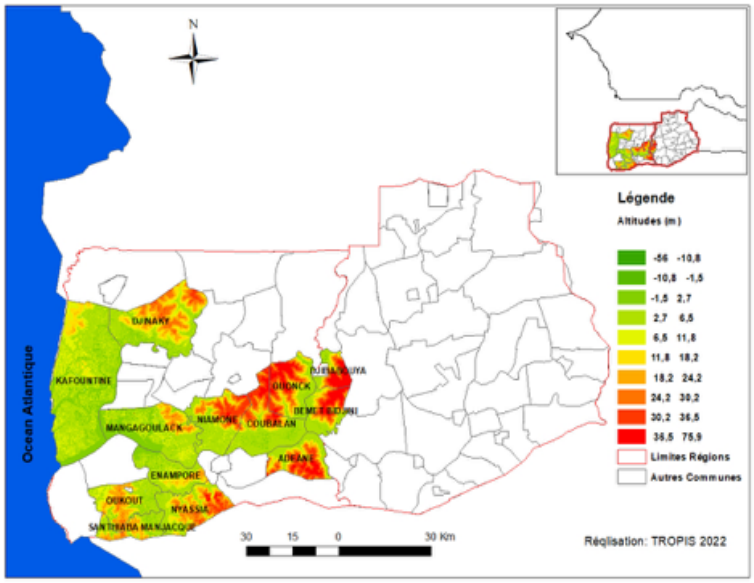


Figure 8: Topography of 12 communes included in the project in Casamance Region[20]

In the case of Sine-Saloum, it is characterized by low relief, with an altitude of no more than one meter everywhere, which makes its topography a relatively important asset for the development of natural heritage, particularly rich biodiversity (marine and terrestrial flora and fauna). Indeed, the flatness, combined

durable. Géographie. Université de Lyon; Université de Saint-Louis (Sénégal), 2016. Français. ffNNT : 2016LYSES040ff. fftel-01559306

[20] Tropis (2022) *Evaluation Environnementale Stratégique (EES) du Projet de restauration des mangroves au profit des communautés du Sine-Saloum et de la Casamance (Project MANCO).*

with the humidity of the deltaic environment, is considered the primary physical characteristic of the local ecological and biogeographic setting.

We can distinguish topographic units such as:

- the slightly raised terraces
- sandy cords
- isolated mounds
- areas prone to flooding by tides.

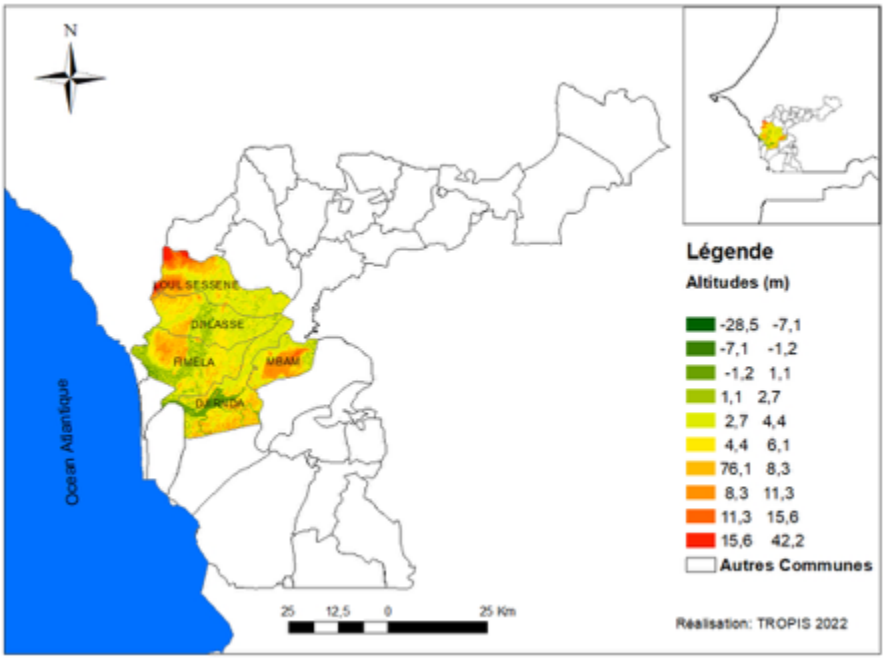


Figure 9: Topography of 5 communes included in the project in Sine-Saloum Region. .[21]

Soils

The soils are mainly sandy and sandy clay made up of dior soils (little leached tropical ferruginous soils), dekk soils (finer-textured soils with a high proportion of fine sand and silt), hydromorphic with temporary waterlogging, so-called soils dekk-dior and dior-dekk, halomorphic soils (saline soils, 'tanne' in Wolof), and mangrove soils observed in islands and estuaries.

[21] Tropis (2022) *Evaluation Environnementale Stratégique (EES) du Projet de restauration des mangroves au profit des communautés du Sine-Saloum et de la Casamance (Project MANCO).*

The mangrove mudflats are characterized by three main types of soil[22]:

- Acid sulfate soil: which has already undergone acidification by oxidation due to an annual alternation of submersion and drying. This is the mangrove zone.
- Potentially acid sulfate soil: subject to the influence of twice-daily tides, characterized mainly by their high sulfide content, which remains reduced as long as the submergence is maintained, and by a neutral pH. These soils are rich in organic matter.
- Tannic soil: an extension of the terrace zone which is only reached by spring tides and occupied, depending on the degree of salinity, by herbaceous plants in the edge zone or by a soil with a powdery structure or a saline crust.

Sine-Saloum is characterized by[23]:

- leached tropical ferruginous soils, developed respectively in the sandstone cover of the continental terminal and in the continental dunes
- tan-colored acid sulfate floors which serve as a resting place for birds, as well as for certain mammals, such as the green monkey, which likes the crabs that inhabit this type of soil
- low-evolved organic hydromorphic soils of current marshes which constitute feeding areas for certain migratory birds such as the curlew (Numenius phaeopus) and the ash curlew
- mineral soils and little evolved soils on recent sandy lines or accumulation of aeolian silts which constitute the preferred resting places for steroids
- rendzine-type calcimorphic soils rich in organic matter from artificial clusters of shells.

Climate

The climate in Senegal is tropical, with differences associated with the locations of the project area. While the Saloum Delta belongs to the Sudanese climate domain, the Casamance Estuary is located in the Sudanese-Guinean and Sub-Guinean climate domains, and it is influenced by the Sub-Guinean intertropical climate of alternate seasons: dry season and rainy season.

[22] UICN; Rapport final: Les mangroves du Sénégal:Situation actuelle des ressources, leur exploitation et leur conservation: Document_politique-Senegal (ntiposoft.com)

[23] Development and Management Plan of the Park National Delta Du Saloum (PNDS) 2021 – 2025

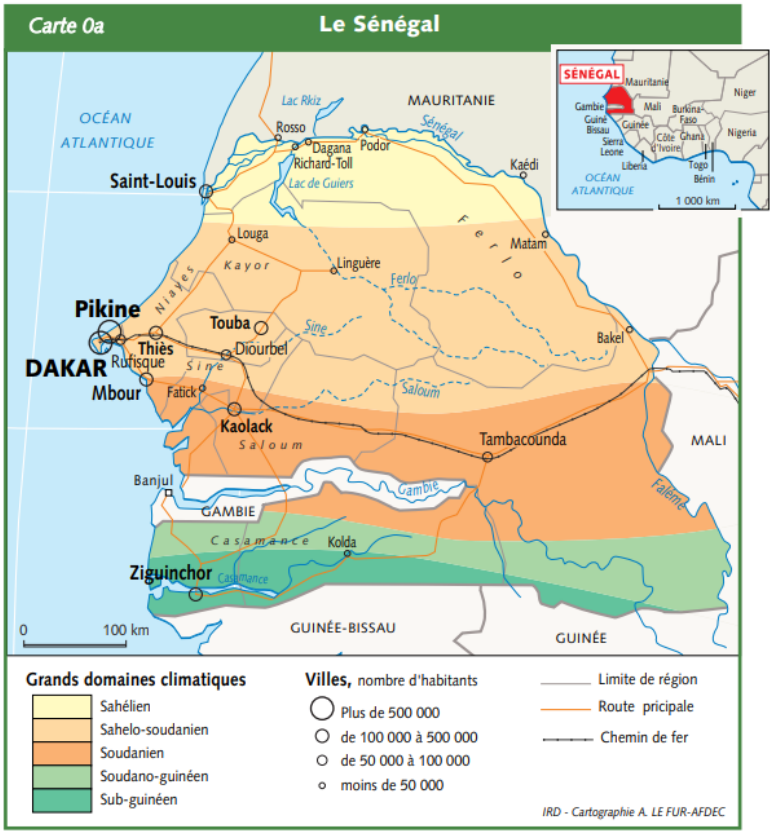


Figure 10: Location of Sine-Saloum and Casamance project area. Source:

The dry season typically lasts from six months in the south (November–April) to 8–10 months in the north. Even though the period from November to April is referred to as the dry season, precipitation occurrence is not unusual, especially from December to April. Southwest–northeast-oriented cloud bands coming from the Atlantic Intertropical Convergence Zone (ITCZ) cause these off-season rains, which represent about 1% of the annual rainfall[24].

The monsoon lasts between May and October in Casamance, and rainfall exceeds 1,000mm in a normal year in the whole area. The average temperature in Casamance is 27.7˚C at the Ziguinchor station, but there is a hidden value disparity. It varies first with the seasons: minimum temperatures are reached in January with 14.9°C, while the maximums are recorded at the end of the dry season with 37.1°C in March, 37.4°C in April, and 35.7°C in May. The sea also acts as a thermal regulator. The maritime area benefits from milder temperatures and does not register strong seasonal fluctuations as does the country's interior.

[24] De Felice and Viltard 1976; Thepenier 1981; De Brum Ferreira 1983

Sine-Saloum is surrounded by an environment characterized by a Sudanese tropical climate which includes the Sahelo Sudanese variant and a Sudano Sahelian variant. It is also influenced by the maritime climate on the coastline of Foundiougne and Fatick departments. It has the particularity of having a rainy season ranging from June–July to October and a dry season of 8–9 months. Average annual precipitation values vary between 880mm in the south and 354mm in the north.

Concerning temperatures, minimum annual averages between 21°C and 24°C occur from December to the end of February. Maximum annual averages between 35°C and 42°C occur between March and June.

Hydrology

Senegal's hydrographic network results, on the one hand, from the geological and geomorphological configuration of the country, and, on the other hand, from the regime and distribution of rainfall in the sub-region (DGPRE)[25]. Essentially, this network is dependent on the basins of the Senegal and Gambia rivers, the waters of which come from the Fouta Djallon massif located in the Republic of Guinea.

Besides these two large rivers, there are some small rivers, such as Casamance, Kayanga, Anambé, Sine, Saloum, and coastal basins whose flows are intermittent. A certain number of lakes and ponds complete this hydrographic network (Lac de Guiers, bolongs in estuaries and ponds in the Niayes region). In addition, the country has wetlands that are most often associated with a functional or degraded hydrographic network.

In Sine-Saloum, the water resources consist of surface water and water underground. Surface water consists of perennial rivers Sine, Saloum and Gambia, and tributaries located in the department of Foundiougne. There are also temporary watercourses made up of backwaters and ponds. Groundwater consists of Maastrichtian aquifers, Paleocene, Eocene, and late continental.

In Casamance, the hydrology is characterized by the presence of a mainstream, the Casamance River. The dynamics of its flow are dominated by two factors: the movement of regional tides and rainfall.

The Casamance River is the only river in Senegal that flows entirely within Senegal. It originates within the Senegalese borders and covers a watershed of 20,150km².

[25] La Direction de la Gestion et de la Planification des Ressources en Eau (DGPRE). Link: http://www.dgpre.gouv.sn/index.php/les-eaux-de-surface/

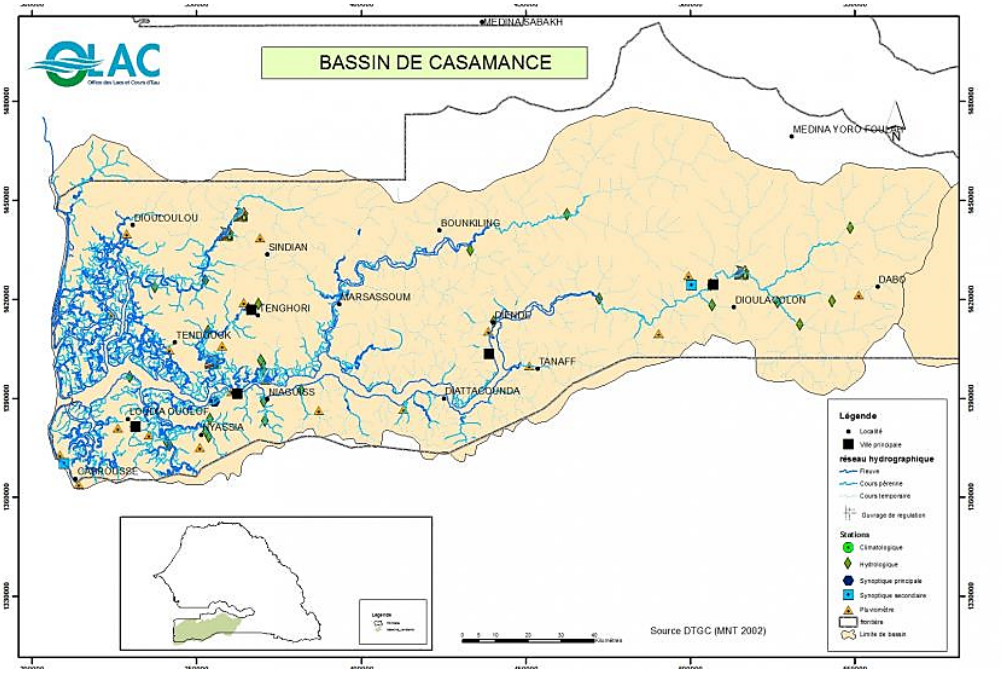


Figure 11: Basins of Casamance[26]

Types of vegetation

The mangrove vegetation in the reference area depends on the physical and ecological conditions (such as altitude, slope, salinity, tides and soils, among others), as well as the degree of degradation of the ecosystems.

Mangrove areas in Senegal have suffered a major decline due to a process of degradation, mainly due to repeated droughts from the 1970s to the 1980s, and overexploitation (see Section 5.1 Existing Conditions). These areas affected by degradation have gone from hosting mangroves in good condition (with densities of more than 2,500 trees/ha and average height of more than 6m) to degraded mangroves (with low densities and low tree height), to finally becoming 'tannes' areas. The restoration activities will be carried out in places of degraded mangroves or tannes, according to the previous classification.

The zonation of the vegetation observed close to the bolongs[27] is as follows[28]:

[26] Source: Office des Lacs et Cours d'Eau (OLAC). Link: *https://www.olac.sn/reseau-hydrographique/bassin-du-fleuve-casamance*

[27] River branches

[28] Sow M., Diallo A., Diallo N., Dixon C.A., Guisse A. (1994). Formations végétales et sols dans les mangroves des rivières du Sud. In : Cormier Salem Marie-Christine (ed.). Dynamique et usages de la mangrove dans les pays des

- A very small *Rhizophora racemosa* zone.
- A wide zone with *Rhizophora mangle* accompanied by *Avicennia africana*.[29]
- A bare zone, the tanne.
- An herbaceous zone composed essentially of grasses.
- A transition zone forming the coastal bush including cultivated species (Naeis, Cocos) and spontaneous species.

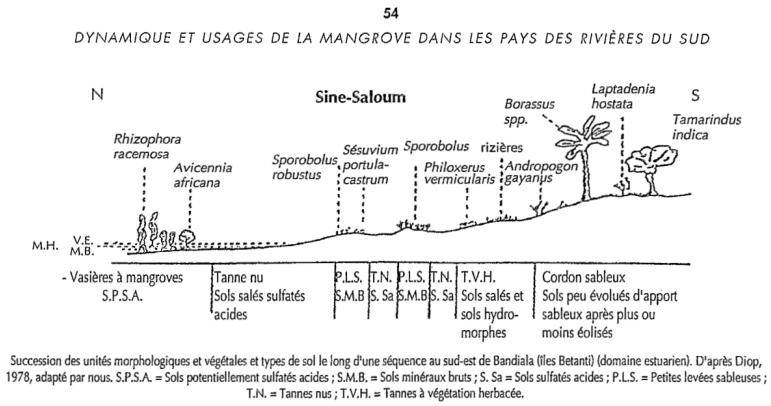


Figure 12: Successions of vegetation

The areas to be restored are the areas that actually are bare, but ecologically correspond to the domain of *Rhizophora* and *Avicennia*.

rivières du Sud (du Sénégal à la Sierra Leone). Paris : ORSTOM, p. 51-57. (Colloques et Séminaires). Dynamique et Usages de la Mangrove dans les Pays des Rivières du Sud (du Sénégal à la Sierra Leone) : Atelier de Travail, Dakar (SEN), 1994/05/08-15. ISBN 2-7099-1236-8. ISSN 0767-2896

[29] *Avicennia africana* is a heterotypic synonym regularly used in Senegal for *Avicennia germinans*; see https://powo.science.kew.org/taxon/urn:lsid:ipni.org:names:861125-1#)

2.1.6 Social Parameters (G1.3)

Senegal's social indicators show an improvement in recent years. However, Senegal continues to be one of the countries with the lowest Human Development Index[30] according to the UNDP[31] (HDI value 0.512 in 2019), being number 168 in the ranking of 189 countries.

The project takes place in two major locations: Sine-Saloum and Casamance. There are 17 communities included in the project zone, 12 from Casamance and five from Sine-Saloum. Within the communes, different villages are included. The total population of all the communities is 297,794 inhabitants based on projections from the last census conducted in Senegal in 2014.[32]

Casamance

- *Demographics*

Official demographic projections estimate the population of the 12 communes studied in the Casamance area at 192,568 in 2022. In line with the national trend, the population of the 12 communes where the project is being implemented is growing steadily. Between 2013 and 2022, the population of these 12 communes increased by 41%.

In all 12 communes covered by the project, density varies between 26 and 114 inhabitants per square kilometer. The highest densities are found in the communes of Adeane, Bemet Bidjini and Djibabouya, with values ranging from 59 to 114 inhabitants per square kilometer. They are followed by the communes of Djinaky and Ouonk, with densities ranging from 52 to 58 inhabitants per square kilometer.

Settlement of Lower Casamance has been in phases over time. This explains the considerable diversity in the ethnic composition of Lower Casamance. The Diolas are unquestionably the majority ethnic group. In the Oussouye area, they are called "diolas kassa", unlike the "diolas Fogny" in Bignona. They represent around 64% of the total population of the Ziguinchor region. In some villages, their representation can approach 100%. Other ethnic groups found in the region include the Mandingue (4%), Fulani (9%), Serer (2%), Wolof (5%), Balante (3%), Manjacque (4%) and Mancagnes (3%).

[30] The Human Development Index (HDI) is a statistic composite index of life expectancy, education (mean years of schooling completed and expected years of schooling upon entering the education system), and per capita income indicators, which are used to rank countries into four tiers of human development

[31] https://unstats.un.org/sdgs/UNSDG/IndDatabasePage

[32] Projection de la population du Sénégal/ANSD/MEFP- Juillet 2015

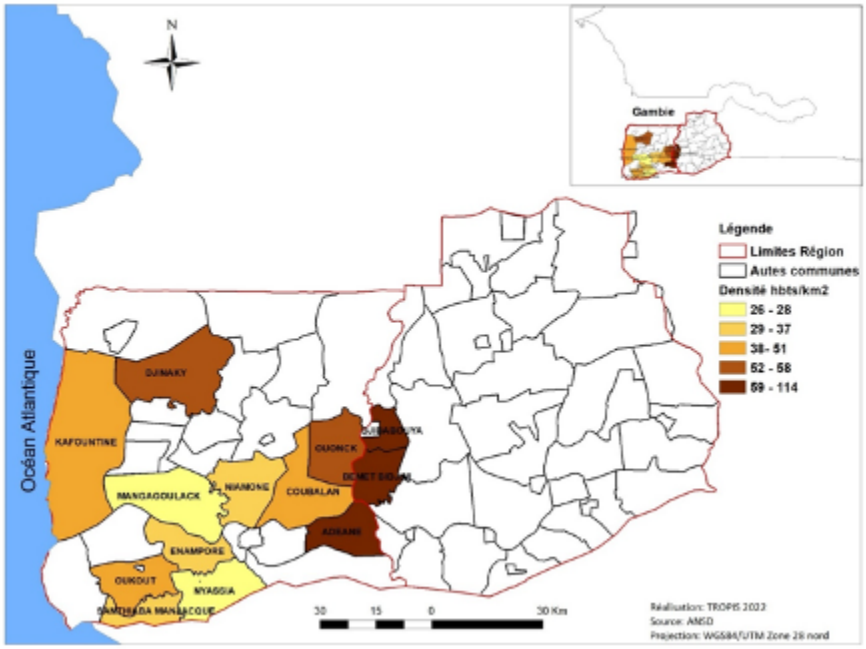


Figure 13: Population density of the 12 communes included in the project in the Casamance area.

The Casamance has been affected by a low-intensity political conflict for 40 years. Since 1982, the Movement of Democratic Forces of Casamance (MFDC) has claimed the region's independence, and the Senegalese Government has been fighting against that. People have migrated to Guinea Bissau, Gambia, or Europe[33] (mainly Spain, France, and Italy). While unresolved, there is little record of this having a direct impact on the project area. However, it has in the past caused some population movements, either voluntary or forced.

Casamance

- *Socio-economic activities*

Agriculture is the dominant activity in Casamance, as it is in all the project's 12 communes. Agriculture is the main source of income for rural populations. There are two types of cultivation: in flood valleys and on forest plateaus. Rice-growing in the lowlands and on the alluvial plains is the dominant agricultural activity. In terms of cultivated area, yield and production, rice is the most important crop. In this region, rice is grown using unmechanized techniques that are adapted to the environment. Rice cultivation takes place during the rainy season (June to December).

[33] https://mafeproject.site.ined.fr/en /

Millet is the second most important crop grown in the area. Other crops, such as groundnuts, maize, sorghum, and cowpeas, are increasingly grown in the area linked to the decline in rainfall. These crops, which are less demanding than rice in terms of water supply, are taking on significant proportions in the lowlands and are helping to compensate for the shortfall in rice yields for some farmers.

The Ziguinchor region boasts an 85-km coastline and a major hydrographic network, including a 300-km-long axial river and numerous bolongs, giving it a wealth of fishery resources and enormous potential for marine, lagoon and river fishing.

With a landed catch of 69,372.722 tonnes in 2016, the Ziguinchor region ranks fourth in Senegal in terms of fish production. The region's "exploitable fishery resources are estimated at 130,000 tonnes per year". These resources, which are poorly exploited, consist mainly of coastal pelagic species, coastal and deep-water demersal species, and lagoon species in abundance in the bolongs and estuaries of the Casamance River. Mangrove oysters can also be found.

- *Economic analysis of the mangrove ecosystem in the 12 intervention communes in Casamance*

In order to gain a better understanding of the issues surrounding mangroves, a survey was carried out in the 12 communes involved in the project in the Casamance area. The results showed that fishing, with a rate of 57%, is by far the most common activity in Casamance; mangrove wood, in second place, is often used to build traditional ceilings, or as energy wood, and sometimes even for fencing concessions. Then there's oyster farming, an activity particularly practiced by women whose income is not to be overlooked; it enables them to be financially independent from their husbands and, better still, to contribute to the economic management of the household. Other lesser-known activities are also highlighted by the interviewers were bee-keeping and traditional medicine.

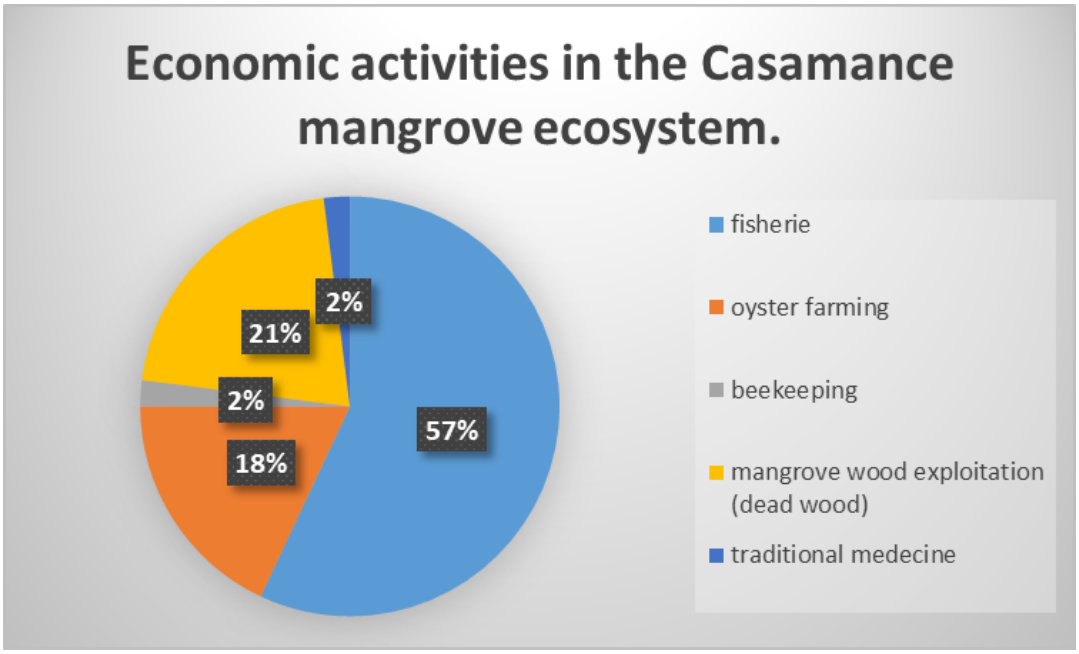


Figure 14: Economic activities in the Casamance mangrove ecosystem

Sine-Saloum

- *Demographics*

Several ethnic groups live in the Saloum delta. The main ethnic group is the Serer, divided into two sub-groups: the Serer living on the mainland and the Niominka living on the islands. Alongside this ethnic majority, there are also Peulhs, Wolofs, Bambaras, Mandingues and others.

The population of the 5 communes in the MANCO project is growing, as is that of the country as a whole. All 5 local authorities are experiencing rapid population growth. Between 2013 and 2022, the population of the 5 communes rose from 73,881 to 99,892, an increase of 35% in a decade. This rapid population growth is the result of natural increase, reinforced by migration.

Sine-Saloum is a region of great historical and cultural wealth. The Sine-Saloum takes its name from the Saloum River and its main tributary, the Sine. It constitutes more than 70% of the groundnut basin.

The population of Sine-Saloum is essentially composed of the Serere (81.88%) and the Mandingues (7.98%), but there are also Wolof (4.94%), Hal Pulaar (1.52%), Toucouleurs (1.39%), and others (Diolas, Sarakolés, Lébous, Bassaris, Balantes, etc. – 2.29%).

Population density in the project's 5 communes more or less matches the national average of 88 inhabitants/Km². Indeed, in these communes, population density varies between 42 and 108 inhabitants per square kilometer. The Fimela commune remains the most densely populated in the project area, with

a density of 108 inhabitants per square kilometer. It is followed by the communes of Mbam and Loul Sessene.

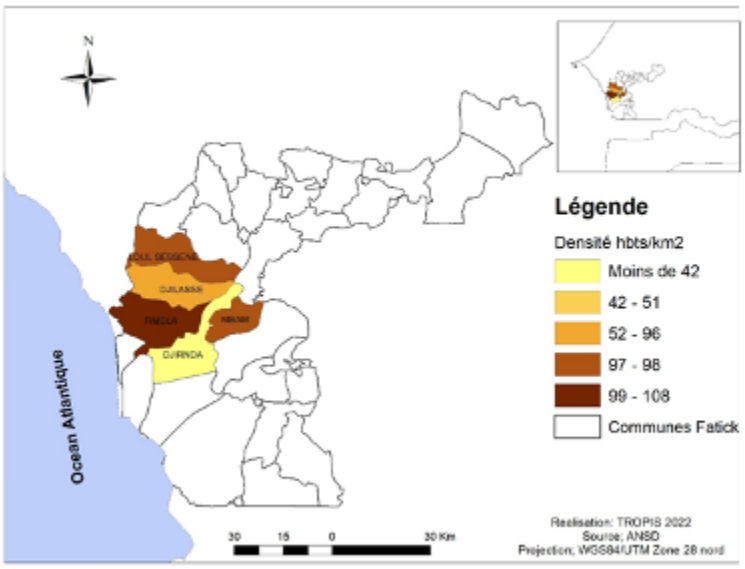


Figure 15: Population density of the 5 communes included in the project area in Sine-Saloum

- *Socio-economic activities carried out by the target population in the 5 project communes in Sine-Saloum*

Several activities are carried out in the Saloum Delta. These are mainly fishing, agriculture and tourism.

Fishing is an essential activity in the development dynamic of the Saloum Delta populations. Not only does it meet food needs, but it is also a means of generating income for fishermen.

Agriculture employs a very large proportion of the total population, close to 75% of the working population, (PDC, 2016). The production system is based on annual rotation between cash crops and cereals in the uplands, rice cultivation in the lowlands, and the development of market gardening in the valleys during the dry season. Millet occupies first place in terms of cultivated area.

Tourism has developed over the years in this area, a development justified by the great potential offered by the climate, the diversity of animal species and landscapes, and the cultural resources. The national policy of diversifying tourist zones as much as possible has made the Saloum one of the preferred destinations for international tourism.

- *Economic analysis of the mangrove ecosystem in the 5 intervention communes in Sine-Saloum*

Mangroves play a very important role in the local economic dynamics of the Saloum Delta. The results of surveys carried out among the populations of the communes concerned revealed that fishing and oyster farming are the activities most present in the mangrove ecosystem. Fish and oysters benefit from the improved environmental conditions created by the combination of freshwater, saltwater and mangrove vegetation.

Analysis of the distribution of mangrove-related activities by commune shows that fishing is present in all 5 communes in the project area, and is especially important in the communes of Djilasse and Loul Séssène. It also remains the predominant sector in the commune of Mbam. In Fimela, on the other hand, oyster farming dominates the fishing sector. Almost 70% of the commune's fishermen work in this sector. In the commune of Djirnda, all activities (fishing, oyster farming, beekeeping, mangrove timber harvesting, traditional medicine) related to the mangrove ecosystem are practiced, with fishing and timber harvesting predominating.

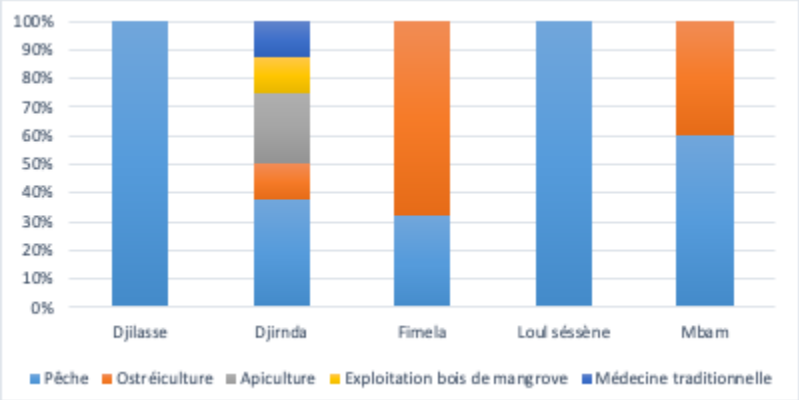


Figure 16: Distribution of mangrove-related activities by commune in the Saloum Delta.

Table 1: Relevant socio-economic indicators

Socio-cultural aspect	Sine-Saloum (Fatick region)	Casamance (Ziguinchor and Sedhiou regions)
Population	900,791 inhabitants (male-female ratio is 50%)	Ziguinchor region: 706 544 inhabitants (male-female ratio is 51.1%) Sédhiou region: 572 099 inhabitants (male-female ratio is 51.149%)
Ethnicity	Serer (81.88%) Manding (7.98%) Wolof (4.94%) Hal Pulaar (1.52%) Toucouleurs (1.39%)	Diola (64%), Manding (4%) Hal Pulaarl (6.3%), Wolof (5%), Fulani (9%), , Serer (2%), Balante (3%), Manjacque (4%) , Mancagnes (3%).
Age (2021 data)	Children (0 to less than 15 years): 17.9% Adults (15 to 64 years): 78.4´% Adults over the age of 65: 3.6%	Children (0 to less than 15 years): 18% Adults (15 to 64 years): 78.4´% Adults over the age of 65: 3.6%
Household income**	Poverty index of 67.8% (Fatick)	68.3% (Sedhiou) and 66.8% (Ziguinchor)
Education	The literacy rate in Fatick is 45.8%, close to the Senegal average (45.7%). Fatick has a schooling rate of 61.1%, above the Senegal average (51.1%)	In Ziguinchor it is 65.0%, being the second region with the highest literacy rate, after Dakar (68.7%) Ziguinchor presents the highest schooling rate in the country (87.3%). Sédhiou The literacy rate in Sedhiou is 47.8% (close to the Senegal average). Sedhiou has a schooling rate of 62.7%, above the Senegal average.
Health statistics*	Maternal mortality ratio (2017): 315	

Socio-cultural aspect	Sine-Saloum (Fatick region)	Casamance (Ziguinchor and Sedhiou regions)
	Infant mortality rate (deaths per 1,000 live births) (2019): 32.7 Adolescent birth rate (per 1,000 women aged 15-19 years) (2017): 68	
Employment* (unemployment rate, 2011)	Male 25 years or more: 8.3% Female 25 years or more: 9.6%	
Employment* (proportion % of informal employment, by sector, 2020 OIT)	90% of the workers in Senegal are working in the informal sector	
Access to basic services (energy sources for cooking, %)	Butane gas (47%), mangrove wood (38%), and non-mangrove wood (15%)	Among households in the Sédhiou region, the main sources of energy for cooking are butane gas (1.4%), firewood (91.3%), and non-mangrove wood (6.8%) No data for Ziguinchor region
Land ownership	Public domain	Public domain

Note 1: the indicators marked with (*) refer to the entire country. The data has been obtained from the United Nations SDG Indicators System (UNstats, 2021)

Note 2 (**): the three regions of the project are those with the highest poverty rate in Senegal, whose average is 54.7%

Governance Structures

After independence, the State of Senegal, judging the indigenous and colonial land tenure regimes to be inadequate with the new economic and social development requirements, promulgated a law on the national domain in 1964 (Law 64-46 of 17 June 1964). The law, which is still in force, has created a national domain whose regulations result in the State taking responsibility and an exclusive right of registration by the State and local authorities on rural land (Guide Foncier DGL FELO, August 2004). The classified domain belongs to the State, which may concede its exploitation to third parties based on a memorandum of understanding. This category of the estate includes plantations under management. Thus, the State of Senegal owns 97% of the land (including forests).

Forests in the public domain are divided into two categories:

- Classified **Forests** are the State's responsibility represented by the Directorate of Water and Forests, Hunting and Soil Conservation, and the Department of National Parks. These forests cover about 7,143,579ha (FRA, 2005) and include classified forests, integral nature reserves, national parks, and sylvo-pastoral reserves.
- Protected Area **Forests** are the responsibility of the local authorities. These cover an area of approximately 6,525,324ha (FRA, 2005).

There are very few privately owned forests in Senegal. In 2005, they covered an area of 5,099ha. There is no private domain in the project zone.

The land planted or to be planted for this project belongs to the government. The communities have the right to use public lands for different purposes: fishing (fish and oyster collection), rice, agriculture, and livestock rearing.

2.1.7 Project Zone Map (G1.4-7, G1.13, CM1.2, B1.2)

The first project activity instance consists of 7,019.8ha divided in the areas that are shown below. This area corresponds to the project area, where project activities aim to generate net climate benefits.

Table 2: Hectares and associated percentages in each location

Location	Ha	%
Sine Saloum	3,781.47	54
Casamance	3,238.33	46
TOTAL	7,019.79	100.0

There have been signed agreements with the mayors of 17 communities, with the document including the number of hectares to be restored. An addendum will be signed with communities at the end of the reforestation activities to include exact amount of area restored and a detailed maps of the areas reforested under the framework of this project. The Communes of Senegal are the fourth-level administrative divisions in Senegal (below country, region, and department).

As can be observed in the table below, the surfaces included in each community have a wide range of sizes, varying from the smallest at 0ha to the biggest at 1,713 ha.

The communities (or communes) and areas included in every agreement are listed below.

Table 3: Communities with signed agreement, and hectares to be reforested

Location	Region	Departments	Districts[34]	Communes	Ha
Sine Saloum	Fatick	Fatick	Fimela	Djilass	1,009.90
Sine Saloum	Fatick	Foundiougne	Niodior	Djirnda	886.61
Sine Saloum	Fatick	Fatick	Fimela	Fimela	1,713.07
Sine Saloum	Fatick	Foundiougne	Djilor	Mbam	134.53
Sine Saloum	Fatick	Fatick	Fimela	Loul Séssene	37.36
Casamance	Ziguinchor	Ziguinchor	Niaguis	Adeane	0[35]
Casamance	Sédhiou	Sédhiou	Djibabouya	Bemet Bidjini	218.27
Casamance	Ziguinchor	Bignona	Tenghory	Coubalan	952.43
Casamance	Sédhiou	Sédhiou	Djibabouya	Djibabouya	77.55
Casamance	Ziguinchor	Bignona	Kataba I	Djignaky	449.43
Casamance	Ziguinchor	Ziguinchor	Nyassia	Enampore	23.69
Casamance	Ziguinchor	Bignona	Kataba I	Kafountine	924.45
Casamance	Ziguinchor	Bignona	Tendouck	Mangagoulack	57.82
Casamance	Ziguinchor	Ziguinchor	Nyassia	Nyassia	168.45
Casamance	Ziguinchor	Oussouye	Loudia Ouolof	Oukout	68.52
Casamance	Ziguinchor	Bignona	Tenghory	Ouonck	22.45

[34] Arrondisement in French

[35] The agreement signed with the municipality provided for the reforestation of 7 hectares during the first phase of the MANCO programme (2020 - 2022). However, as the reforestation target was reached without the Adéane reforestation, it was decided with the commune to postpone reforestation operations in the commune during phase 2 (2023 - 2027).

Location	Region	Departments	Districts[34]	Communes	Ha
Casamance	Ziguinchor	Oussouye	Cabrousse	Santhiaba Manjaque	275.26

As can be observed in Figures 5 and 6, every community has a wide administrative area and includes a number of villages. Some of them have participated in the restoration activities because they are linked to the mangrove or because they are close to the restoration areas. The socio-economic activities that will be included in this project will also be developed in all the project communities.

The project zone is made up of the project area and the 17 communities with signed agreements.[36] Future activity instances are expected to be within these communities.

The High Conservation Values (HCV) identified in the scope of the project are as follows:

- HCV1: Project area inside the Sine-Saloum Biosphere Reserve. Communities of Djilass, Fimela, and Loul Séssene

The Sine-Saloum Biosphere Reserve is a remarkable testimony to the synergy between a natural environment with extensive biodiversity and a style of human development that is still present. The Biosphere reserve is characterized by a great diversity of habitats, including savannah, mangrove, sandy islets, lagoons and shorelines. For instance, the region is home to a quarter of the world's population of King Terns (Sterna maxima albidorsalis). Bird Island is also the world's first hibernation and breeding site for this endangered species.

- HCV1: Project area inside the Niamone Kalounaye Marine Protected Area (MPA). Communities of Coubalan and Ouonck

The Niamone Kalounayes Community Marine Protected Area covers the communes of Ouonck and Coubalan. This protected area is home to a diversity of reptiles (Nile crocodiles, Nile monitors, land tortoises), marine mammals (dolphins and manatees), birdlife (pink flamingos, grey pelicans, egrets, Gambian geese, grayling) and flora (mangroves, forests, grassy savannahs).

- HCV6: Gandoul Community Marine Protected Area (Fatick region)

The Gandoul Community Marine Protected Area covers the communes of Djirnda and Mbam. This protected area is home to a diversity of marine and coastal resources (arches, prawns, murex, fish, cymbium, oysters, dolphins, manatees, etc.), forests (*Rhizophora spp*. and *Avicennia spp*.), prosopis

[36] CCB Standard version 3.1. The project zone is defined as the area encompassing the project area in which project activities that directly affect land and associated resources, including activities such as those related to provision of alternative livelihoods and community development, are implemented. For grouped projects, the project zone also includes all potential project areas (i.e. all potential new land areas in which project activities that aim to generate net climate benefits may be implemented in the future after the initial validation).

(Prosopis juliflora), baobab (Adansonia digitata), tamarind (Tamarindus indica) and acacia (Acacia nilotica). Lastly, this protected area is home to other animal resources, including jackal, monkey, hyena and serval.

- HCV6: Mangagoulack community heritage area (Ziguinchor region)

The Mangagoulack community heritage area covers 9665 hectares, or 30% of the Mangagoulack commune. This protected area is the fruit of the efforts of a number of local fishermen, who came together to form an association to combat the degradation of the mangrove forests, and in particular to work together to rebuild the area in which they live.

The Kawanana APAC is made up of estuarine mangrove dotted with canals (Bolong) and the main ecological functions maintained by the APAC are those of ecosystem protection and regeneration.

For further information regarding the identification of HCVs see the report of HCV – available as supporting documentation.

Geodetic coordinates are provided in Section 2.1.5. A kml file has been included as supporting documentation.

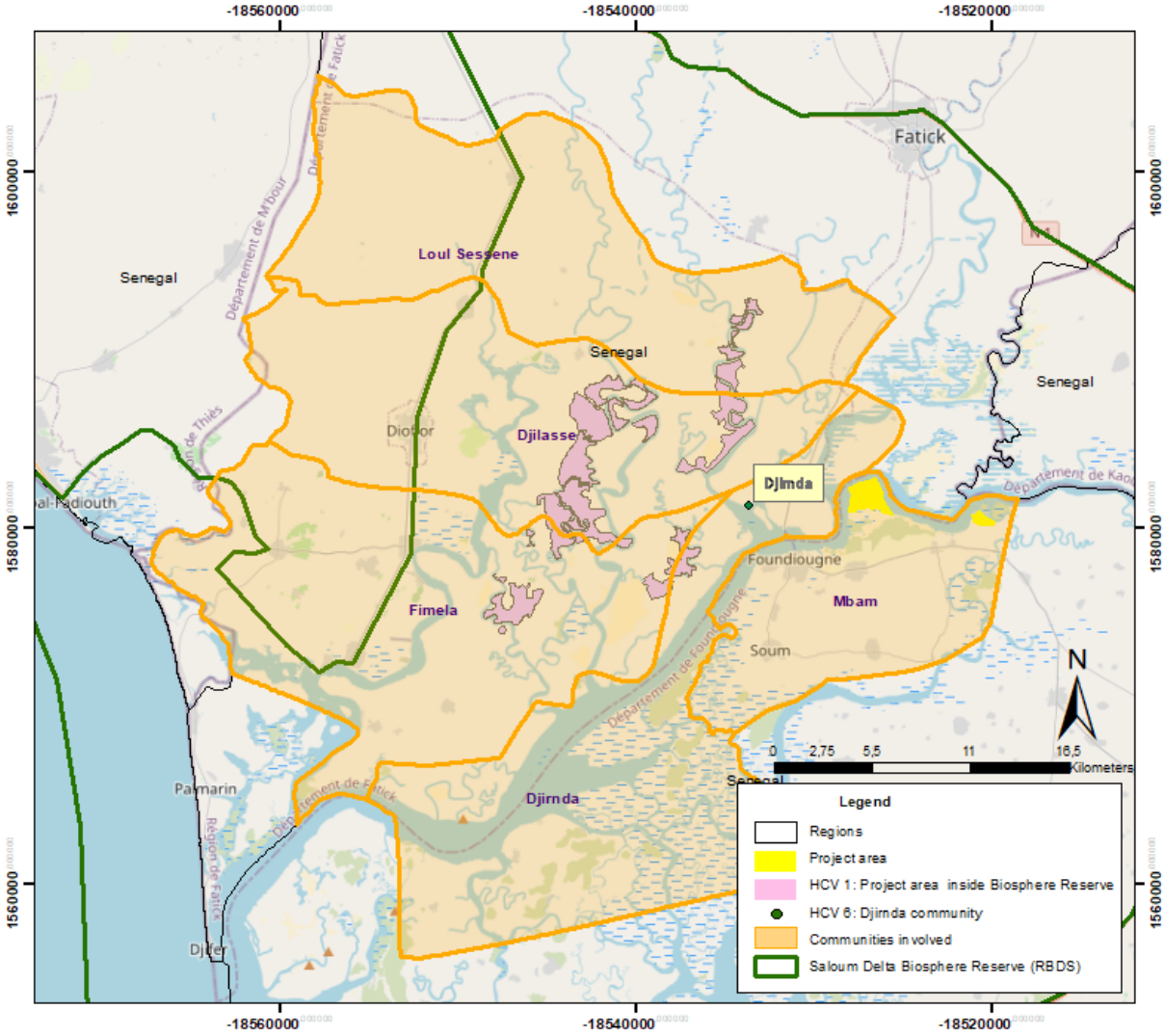


Figure 17: Project area, communities, and HCV in Sine-Saloum location. Fatick region. The Casamance map below shows the project area, municipalities, and identified HCVs

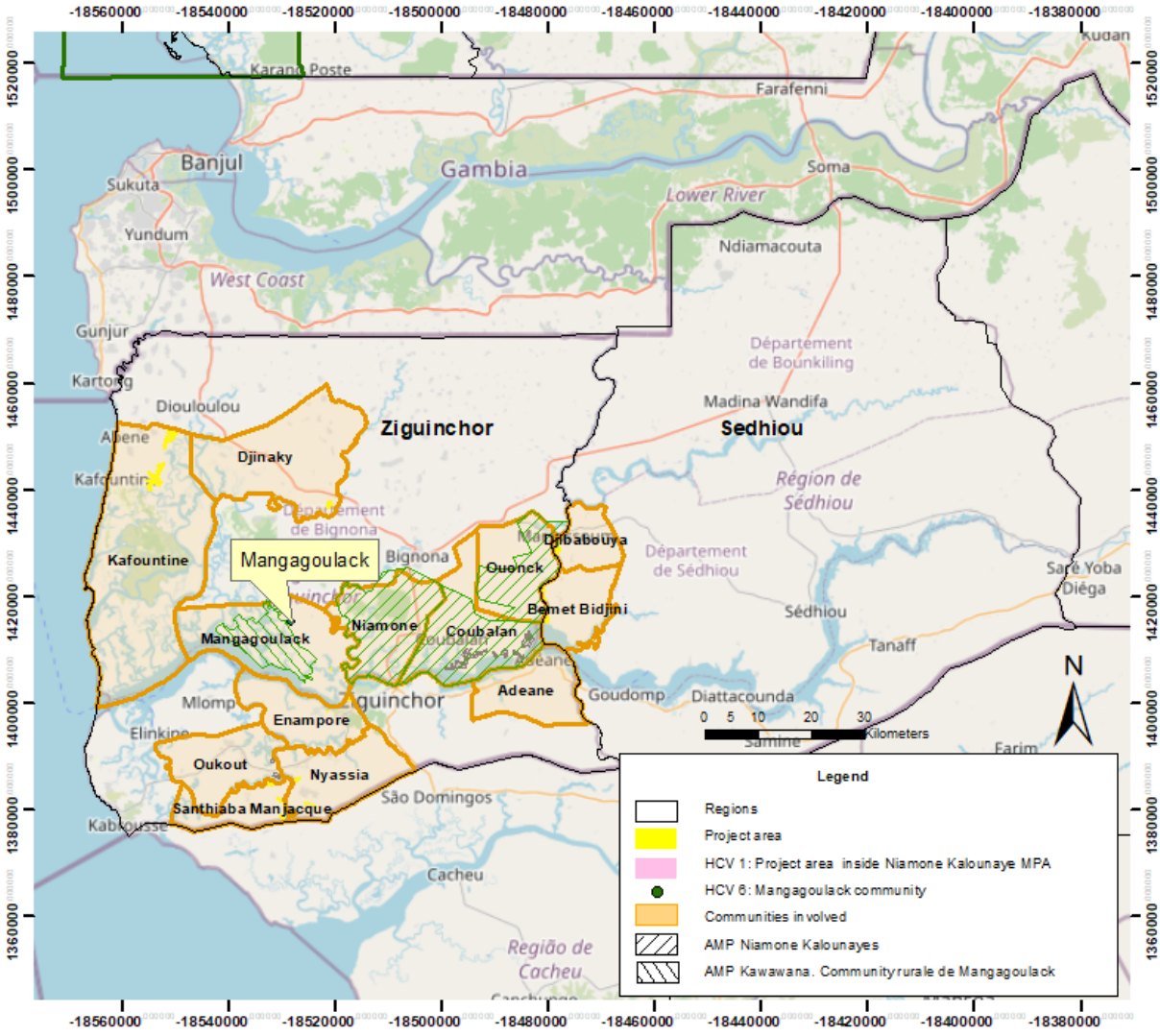


Figure 18: Project area, communities, and HCV in Casamance location. Ziguinchor and Sedhiou region

There are no predicted areas with off-site climate impacts.

The areas where other stakeholders will be impacted are described in Section 4.3. During the lifetime of the project, awareness will be created through involved stakeholders. This project could have a positive impact on the use of natural resources in Casamance made by Malians, Burkinabes, and Guinean fishermen since it is also expected to include them as stakeholders. Other impacted stakeholders could be the tourists in Sine-Saloum and Casamance areas.

Since the project proponent and implementer are in contact with researchers and scientific committees, it is expected that an additional benefit of the project will be to provide new knowledge regarding the restoration and conservation of mangroves.

The areas where off-site biodiversity impacts are predicted are described in Section 5.3.

2.1.8 Stakeholder Identification (G1.5)

A stepwise approach was taken to stakeholder identification that involved:

1) Identification of potential key stakeholders
2) Characterisation of potential key stakeholders
3) Selection of key stakeholders to be engaged
4) Continual reassessment of key stakeholders throughout project development

Stakeholders were identified under three categories: participant communities, regulatory gateways, and other interest groups and technical partners.

Community stakeholders:

A major focus of stakeholder identification has been the identification, characterisation, and selection of participant communities. The project area was selected by (i) a field study to identify the degraded areas to be reforested and (ii) the subsequent agreement with the mayor to be involved in the project[37]. At the local level, discussions were held with the mayors of the communities concerned in the identification of sites to be reforested. The mayors were also involved in reforestation and mobilization of the communities. An agreement with each mayor was signed from May to June 2020 to identify plantation areas in each community and define the carbon credit retrocession. As mentioned in Section 2.1.7, 17 agreements have been signed with the mayors[38].

Between January and April 2020, Oceanium conducted a survey among the communities to understand the role played by mangroves in the project area and to better understand community expectations.

[37] See « methodologie de selection de sites du projet » as supporting documentation

[38] See agreements with mayors as supporting documentation

Oceanium field staff, together with village chiefs, identified the local organizations and individuals to be involved in the project. In each of the communities, a questionnaire was submitted to three people[39]: an elected municipal official, a youth representative, and a women's representative. The mayors and elected officials directed the Oceanium teams to the most appropriate people to survey because of their responsibilities (president of an association, president of an economic grouping, etc.).

The objectives of this survey were to collect the following information[40]: (i) the perception of the communities of the project area on the ecosystem functions of the mangrove, its degradation factors, the mechanisms of its own development; (ii) the level of adhesion of the communities to a mangrove restoration; and (iii) the activities to be developed to contribute to the development of their territory.

The key stakeholders identified at community / department level were:

- Stakeholders at community or village level: mayors of the communities (17), village chiefs, and environmental committees in the communities, the governor at the regional level, and steering committees. This group includes different social groups linked to mangroves, such as women who collect oysters, beekeepers, fishermen, young people, etc.
- Associations linked to different activities such as fishing, oystering, beekeeping, etc.: local committee of artisanal fisheries, shrimp collectors, the AMPs Gestion Committee, and other producers' organizations.
- Sportive and cultural associations
- Religious leaders
- Opinion leaders

Regulatory Gateways:

As land is a public domain, exchanges took place with the government of Senegal, particularly, the Ministry of Environment and Sustainable Development. These exchanges concerned the tripartite agreement and the modalities of institutional support that the project could contribute to.

The stakeholders identified were:

- Public authorities: marine community-based protected area departments, the Water and Forest, Hunting and Soil Conservation Department, Directorate for the Environment and Classified Establishments, Regional Governor, National Committee on Climate Change.

[39] See Local Stakeholders Consultation document as supporting documentation

[40] See Local Stakeholders Consultation as supporting documentation

Other interest groups and technical partners:

In addition to the local communities, other selected stakeholders were consulted as part of the project design for the restoration activities.

The identification of actors from academic research was carried out on the recommendations of the Directorate of Environment and Classified Institutions (which depends on the Ministry of Environment and Sustainable Development – abbreviated in French as MEDD)[41].

The stakeholders identified were:

- Other NGOs or associations: Headteachers' Collective (CODEC in French), CAREM, other NGOs working in national and international projects in the area, such as Project AMP-Mangrove (French development agency, IUCN – projet régional pour le renforcement de la protection des écosystèmes de mangroves en Afrique de l'Ouest, Provale (African development bank) – implemented in four Senegalese regions, including Fatick; association of young people, associations of women linked to fishing activities, etc.
- Education and research organizations: Assane Seck of Ziguinchor (agroforestry department), ISRA, Dakar Soil Institute, and Dakar UCAD.
- Tourist operators (including hotels, guides / canoeists, artists / creators).

Further information on the stakeholders consulted and the discussions are available as supporting documentation[42].

Livelihoods support stakeholders:

Three field visits were performed to identify and contact various associations and local groups related with livelihood activities[43]. The livelihood activities will focus on local organizations that are already involved in the honey and oyster sectors.

Stakeholder identification for SBIA participation:

Based on this previous work, selected stakeholders were invited to participate in the Social and Biodiversity Impact Assessment (SBIA) workshop[44], to which all the representatives of the project stakeholders group were invited. The selection of the representatives was based on their role (mayor, president of an

[41] See CR réunion Oceanium-DEEC available as supporting documentation

[42] See Oceanium juin-juillet 2020 narrative report (from page 26) as supporting documentation

[43] See project Manco analysys sectorial as supporting documentation

[44] See liste de participants as supporting documentation

organization, village chief, focal point, State staff, etc.) and the abovementioned criteria according to CCB standard

The following tables describe the rights, interests, and relevance of key stakeholders: :

Table 4: Identified stakeholders

Local community groups		
Rights / Roles	Interests / Involvement	Relevance
Primary beneficiaries of the project. They have the right to use the resources from the public land[45]. Participate in capacity-building training related to project activities.	Protect the community goals in the project's development. Involvement in different processes of project conception phase, implementation, and monitoring. Received goods from mangrove-ecosystem	Direct participation and involvement in the project activities of restoration and management. Direct and indirect receivers of climate, biodiversity, and community impacts of project activities. Long-term maintenance of mangrove conservation.

Mayors		
Rights / Roles	Interests / Involvement	Relevance
Assure compliance of project objectives at the village level. Law representative for people living in the villages.	Involvement in all processes of field project conception phase, implementation, and monitoring. Field project supporter at the village level.	Legal institution for project consultation and execution on long-term mangrove carbon conservation.

[45] Loi n° 2018-25 du 12 novembre 2018 portant Code forestier. Code forestier | Gouvernement du Sénégal (sec.gouv.sn)

Mayors		
Rights / Roles	Interests / Involvement	Relevance
	Signature of agreements.	Support the monitoring of field missions.

Government institutions at department level		
Rights / Roles	Interests / Involvement	Implications and evidence
To regulate land use and ensure compliance with the regulations at department level. Law enforcement on all aspects for communities.	Stakeholders in field conception phase and approbation. Project endorsement at department level. The projects allow these institutions to interact with other agencies with a stake in mangroves for the exchange of information and experience.	Signed agreement with the national level that also engages the department level[46].

Government institutions at national level		
Rights / Roles	Interests / Involvement	Relevance
To ensure the project is in compliance with laws and regulations of government of Senegal.	They lead the forest national monitoring and the implementation of a national strategy to raise public awareness on mangrove preservation. To ensure the sustainable development of lands.	Signed agreement with the Ministry of Environment and Sustainable Development, October, 2021. Validation of the project by the National Committee on Climate Change in August, 2020.

[46] See Senegal_Tripartite agreement signed FINAL as supporting documentation

Other stakeholders

Economic interest group (abbreviated in French as GIE)		
Rights / Roles	Interests / Involvement	Relevance
Collection and selling of mangrove resources	The expected positive impact on mangrove resources.	Direct participation and involvement in the project activities. Direct and indirect receivers of climate, biodiversity, and community impacts of project activities. Long-term maintenance of mangrove conservation. Supporting local business development.

Sports and Cultural Association		
Rights / Roles	Interests / Involvement	Relevance
The use of mangrove areas	Being employed during the restoration activities.	Support young people in the practice of sports activities. Impact on village cohesion.

2.1.9 Stakeholder Descriptions (G1.6, G1.13)

From the stakeholder identification process outlined in Section 2.1.8, a set of key stakeholders with interest in, influence over, or affected by the project activities. Oceanium has been working with different local stakeholders for years, which implies a good knowledge about different stakeholder groups. The mangrove is a public asset owned by the Senegalese Government, and the communities have the right to access and

use its resources. The only condition to access the mangrove is to have the means for access; for example, women need the money to rent a boat to enter into the mangrove. Mayors grant the villagers the right to use village land for cultivation, and if families are not cultivating the land, they have to give it back to the city hall. Apart from commercial activities, people also access the mangrove to collect dead wood, honey, oysters, and fishing for household consumption.

The different identified stakeholders are mentioned below:

1. Mayors of communities

Reforestation will take place in 17 communities. These communities are administered by an elected mayor and assisted by an elected city council. The election of the mayor and deputies takes place by secret ballot and absolute majority. There are five communities involved in the Sine-Saloum project zone (Djilass, Djirnda, Fimela, Mbam, Loul and Sessene) and 12 in Casamance (Adéane, Bemet, Coubalan, Djibabouya, Djinaki, Enampore, Kafountine, Mangangoulack, Nyassia, Oukout, Ouonk, and Santhiaba Manjack). The agreements with each mayor specify the number of hectares that will be reforested in this first project activity instance and the percentage of carbon credits that will be returned. Mayors play a relevant role in involving the communities in reforestation operations.

For the implementation of reforestation projects within the communes, it is necessary to have the validation and commitment of the mayors of the communes who are representing their inhabitants (community). This is why agreements between Oceanium and the mayors of the communes have been signed.

Mayors play an important role in reforestation activities. Being signatories of the agreements, they get the information about the actions planned in their local authorities. One month before the start of the reforestation campaign[47], the project organizes an information, awareness, and preparation tour for reforestation activities. During this tour they will also take the opportunity to request the opinion and recommendations of the administrative authorities (sub-prefect, prefect, and governor) and also of other stakeholders (water and forest directorate, community marine-protected areas, associations, etc.). An update on planning and achievements, and implementation difficulties, as well as the first results on the survival rate, will be presented and shared.

2. Government institution at department level

The public institution personnel involved in the project at the governmental level are the regional governors and the prefects of the departments.

[47] See Plan de communication du projet MANCO as supporting documentation

For Sine-Saloum, the administrative authority for the region is the governor of the Fatick region. The two departmental prefects involved in the project are in charge of the administrative management of the Fatick and Foundiougne departments[48].

For the Casamance zone, the governors of Ziguinchor and Sedhiou represent the State at the regional level. The prefects of Bignona, Oussouye, and Ziguinchor are involved as representatives of the State in these departments.

3. Government institutions at national level

COMNACC

The National Committee on Climate Change (COMNACC) is a body for coordination, consultation, training, sensitization, management, and monitoring of the various activities identified in the framework of the implementation of the United Nations Framework Convention on Climate Change and its additional legal instruments.

The COMNACC will play an information, sensitization, training, and facilitation role in designing, financing, implementing, validating, and monitoring, sub-regional and regional programs, and projects relating to the priority areas referred to in Article 4 of DECREE n° 2011-1689 of October 3, 2011 for establishing the National Committee on Climate Change.[49]

It will ensure the consistency of programs and projects with national objectives relating to climate change at the level of mitigation. In this regard, the Directorate of Environment, Designated National Climate Authority (DNA) shall be kept informed and involved in all projects submitted in the carbon markets [50].

The Ministry of Environment and Sustainable Development prepares and implements the policy defined by the Head of State in terms of environmental monitoring, pollution control and protecting nature, fauna and flora. This Ministry is responsible for the protection and, as such, it takes measures to prevent and combat pollution of all kinds. It ensures that potentially polluting activities do not jeopardize the living environment of the community and the quality of the environment. To achieve this goal, the Ministry is composed of several thematic directorates in charge of various portfolios.

The Ministry areas covered by our project are: (i) the Water and Forests, Hunting and Soil Conservation Directorate (WFHSCD); (ii) the Environment and Classified Establishments Directorate; and (iii) the Community Marine Protected Areas Directorate.

[48] http://www.servicepublic.gouv.sn/assets/textes/chef_de_village.pdf

[49] http://www.jo.gouv.sn/spip.php?article9403

[50] See the tripartite agreement as supporting documentation

Water and Forests, Hunting and Soil Conservation Directorate

The WFHSCD is responsible for the development and implementation of national forestry policy. It exercises the prerogatives of the State in the areas of soil conservation, wildlife management, and forest ecosystems. The main objectives of the forestry policy are to ensure, on the one hand, the sustainable management of forest potential and its biodiversity and, on the other, the satisfaction of the needs of the communities for forest goods and services, and the maintenance of socio-economic and ecological balances.

The WFHSCD will support the project through technical support and that of its decentralized structures, within the limits of the resources made available, in the following areas: sensitization of actors, facilitation of the acquisition and transport of planting materials. This support will focus on constructing an intervention framework for the implementation of activities on environmental education and sustainable development focused on the preservation of mangrove areas. In addition, the Directorate of Water, Forestry, Hunting and Soil Conservation (DEFCCS) will participate in plantation monitoring missions in areas outside MPAs.

Community Marine Protected Areas Directorate

The objective of the Community Marine Protected Areas Directorate (CMPAD) is to contribute to national poverty reduction strategies through sustainable marine spatial management.

The CMPAD will provide technical support and that of its decentralized structures in and around MPAs, within the limits of the resources made available. This support will focus on constructing an intervention framework for the implementation of activities on environmental education and sustainable development focused on the preservation of mangrove areas. It will facilitate the mobilization of the populations in planting activities, monitoring, and follow-up. In addition, the Directorate of Community Marine Protected Areas (DAMCP) will participate in missions to monitor in situ plantations and the preservation of restored mangrove areas. Thus, the project will contribute to the technical capacity building of its agents involved in the process.

Environment and Classified Establishments Directorate

The Environment and Classified Establishments Directorate acts as the focal point for the United Nations Framework Convention On Climate Change (UNFCCC) and also as the DNA for the implementation of the Kyoto Protocol and Article 6.4 of the Paris Agreement, carbon market mechanisms in the fight against climate change, and is responsible for ensuring compliance and transparency in the implementation of national commitments, including the Determined Contribution at the National level (CDN).

Within the framework of this project, the Direction de l'Environnement et des Etablissements Classés DEEC will ensure compliance with the implementation of the tripartite agreement on behalf of the government of Senegal and will oversee the completion of the environmental assessment of the project and the implementation of the related environmental management framework. It will also support, in collaboration with the National Committee on Climate Change, all verification and certification operations, and the avoidance of double counting of emission credits, within the limits of available means.

4. Sports and cultural associations (SCAs)

SCAs are present in all the villages surveyed and are very often linked to the village soccer teams. A national soccer tournament, called Nawetan, takes place every year during the winter period. Villages from all over the country are represented, and winning this tournament is a source of pride for the inhabitants. For example, the Marssassoum team won the tournament in 2013, and this victory is a source of pride for the inhabitants. SCA members are mainly young people between the ages of 25 and 39.

The practice of soccer and participation in Nawetans seems to be the main objective of the SCAs in the villages we visited. To be able to register and participate in the various matches across the country, Civil Society Organization (CSO) members: (i) do agricultural work in the villagers' fields; or (ii) participate in reforestation operations.

5. Economic interest groups (EIG)

An EIG is established by a written contract between two or more natural or legal persons for a specified period, establishing a legal framework to develop the economic activity.

The EIGs carry out various activities: soap production, oyster collection, collection and processing of non-timber forest products, salt collection, and selling and market gardening seem to be the main activity carried out by the EIGs.

2.1.10 Sectoral Scope and Project Type

This project is a grouped project for the ARR (with WRC) of degraded wetlands in Senegal. For the first project activity instance, the project will restore 7,019.8ha.

Sectoral scope: Agriculture, Forestry, and Other Land Use

Project Category: Afforestation, Reforestation, and/or Revegetation (ARR) with Wetlands Restoration and Conservation (WRC)

Activity type: Restoring wetland ecosystems and enrichment and regeneration of native forest (ARR+RWE)

Project type: Grouped project

2.1.11 Project Activities and Theory of Change (G1.8)

The project's overall objective is to reverse the trends in degradation and restore degraded mangroves to bring back valuable ecosystems and productivity, improve soil quality, contribute to the fight against climate change, and rehabilitate ecosystem services. With the restoration of 7,019.8ha in degraded mangrove areas, about 1.4 million tons of CO_2-e would be mitigated in the 30 years of project implementation. In

addition to this climate objective, the project also focuses on improving local communities and biodiversity (see project objectives in Section 2.1.1 Summary Description of the project).

The achievement of these objectives follows the principles of sustainable development, agreed in the 2030 Agenda, and the Paris Agreement, defined at the COP21 Climate Summit, where it was agreed not to exceed 2ºC of the temperature recorded in the pre-industrial era. In this sense, this project will be able to contribute to these global goals, which would not happen in a scenario without a project. In this way, if the project is not executed, the land will continue in a state of degradation. Thus, GHG emissions would not be mitigated, community benefits would not be generated, and biodiversity would remain in poor condition.

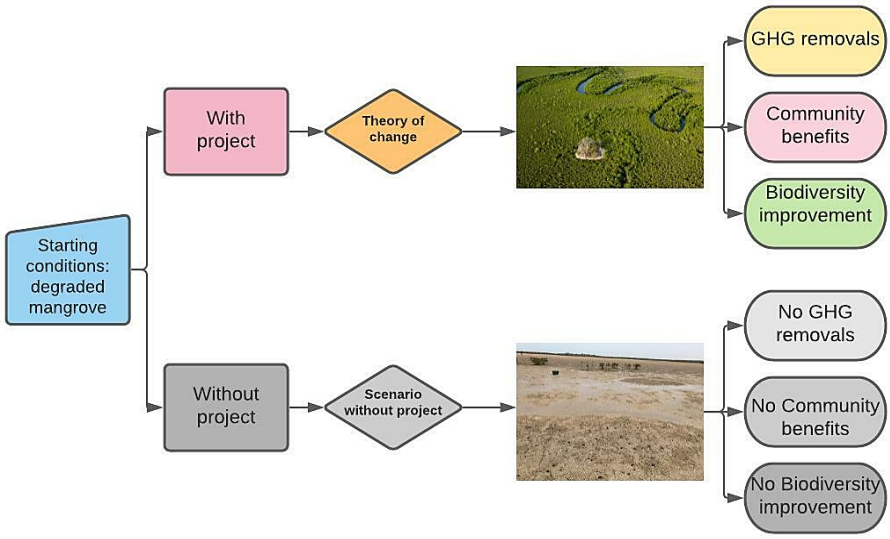


Figure 19: Theory of Change within the framework of the entire project

Annex 1 provides a summary description of each project activity and the expected output, outcomes, and impacts using a Theory of Change to explain how the activities will achieve the project's predicted climate, community, and biodiversity benefits.

The activities included in the project are described below:

A. Mangrove restoration activities
B. Identification and protection of non-reforested areas inside the project area to conserve habitat for waders
C. Awareness campaign
D. Supporting resources on sustainable use (oysters, beekeeping, fishery)
E. Scientific research activities

The sub-activities included in the mentioned activities are described below:

A. Mangrove restoration activities

Oceanium has a long tradition of planting mangroves with local communities and has forged a relationship of trust and partnership with various grassroots community organizations at the village, municipal, departmental, and regional levels. In addition, the project collaborates with youth associations and SCAs. The strategy put in place is that each structure reforests its own locality with the support of the technicians of the PP and implementation partners.

A.1. Identification of mangrove planting sites

The site identification process goes through several stages. These different phases allow all the possibilities of successful reforestation.

- After the agreement is signed with the communities, reconnaissance of potential areas is carried out with the local technical services and findings are presented to the government team of the communities.
- A team made up of municipal councilors, members of an environment commission, and officials from the interested towns, will be in charge of visiting the site to give their opinion on the selected area.

A.2. Collection of propagules and nursery

Mangrove reforestation with *Rhizophora* is done with propagules and *Avicennia spp.* reforestation is done with seedlings produced in the nursery. For the collection of *Rhizophora* propagules, on-site training collection techniques will be organized so that local residents can collect the most suitable propagules which should be mature and in good condition.

A.3. Design of plantations according to local ecological conditions and selected species

The most suitable species, as well as the planting conditions and the places of origin, will be decided locally and for each plantation area. In this way, the adaptation of the planted species and their durability over time is ensured.

A.4. Mangrove plantation process

This activity includes: a) the relationship with the mayors and local authorities one month before the planting activity, for the preparation and awareness of the tasks to be carried out; b) hiring local people for the

planting campaign[51]; c) training of the local people hired in (C.1.) Forest planting and management, and (C.2.) HSSE.

A.5. Follow-up and replacement of dead trees in the first five years

The project's reforestation will be regularly monitored. Plots with high mortality rates or low densities will be replaced, remediated or replanted with *Avicennia and Rhizophora spp*. in order to make the reforestation more resilient to drought.

B. **Identification and protection of not reforested areas inside the project area to conserve habitat for waders**

Within the plantation areas there are areas to be potentially conserved due to the possible importance in the feeding of the waders. In this way, a currently existing habitat is conserved and a greater diversity of habitats and species is promoted.

C. **Awareness campaign**

C.1. Local stakeholders' identification likely impacted by the project

The project team will take into account the stakeholders likely to be impacted by the project, integrating them into the awareness-raising objectives, as well as in the participation and training tasks, if applicable. Sections 2.1.8 and 2.1./9 detail this stakeholder identification process in more detail.

C.2. The signing of agreements

Taking into account the communities that have plantation areas within their territories, collaboration agreements have been signed between them and WeForest. An agreement has also been signed with the government of Senegal (who owns the land), to carry out the project without legal impediments. This project aims to return 10% of the benefits generated by the sale of carbon credits to the communities so that they can also enjoy the benefits of managing their resources. This fact is reflected in each of the signed agreements. Further information on the 10% is found in D.4 of this section.

CCB projects have a strong commitment to the participation and involvement of stakeholders affected by the project. In this sense, the project follows the principles of access to information, consultation, and advice, participation in decision-making, non-discrimination, feedback and grievance redress procedure, and respect for workers' rights, with equal opportunities and correct training.

[51] There is an Oceanium recruitment policy to ensure transparent hiring with equal opportunities for local residents, as well as to seek to integrate gender equality in hiring and to follow the Safety, Health and Environmental care standards during tasks. plantation. See recruitment policy in supporting documentation.

The project will create and manage one national and two regional project steering committees. The steering committees will be tasked with organizing and structuring all communities to participate in information and decision-making.

C.3. Elaboration and implementation of communication and consultation plan

Complementing the previous activity, and as an instrument for the transfer of information between all the stakeholders, a Communication and Consultation Plan will be implemented, which consists of the following elements:

a) Radio broadcasts to disseminate information about the project

b) Cinema debate to inform about the project

c) Disseminate communication materials

d) The SBIA workshop

e) The Oceanium representatives in each community act as a focal point and can receive and disseminate the information in the villages they work in.

Cinema debates and radio podcasts are the main channels of information to the residents of the villages in the communities selected for the project. This way of reaching the population is the most accepted and ensures the vast majority of people in participatory communities are sensitized to project objectives. It is planned to carry out around 15 of these activities per year (cinema debate and radio podcast).

C.4. Development of workshop before the validation event

WeForest has organized two participative workshops, one in Sine-Saloum and the other in Casamance[52]. These workshops have been organized to present the project and to discuss with the stakeholders (mayor, government representatives, representatives of various types of organizations, etc.) the focal points of the project: social and biodiversity projections under a without-project land-use scenario, the activities, impacts, indicators, and risks of the project.

These workshops have promoted a dynamic exchange and dialogue between all stakeholders to ensure their effective participation in the harmonization, planning, implementation of activities, and evaluation of local initiatives around the mangrove.

C.5. Establishment of a grievance procedure before the validation event

[52] See workshop report available as supporting documentation

A communication and grievance mechanism has been developed and will be implemented during the project period. Further information on the communication and grievance mechanism can be found in Section 2.3.12.

D. **Supporting resources on sustainable use (oysters, beekeeping, fishery, non-timber products, etc.)**

The project has among its objectives to improve the well-being of local communities by creating job opportunities, increasing available natural resources, improving livelihoods, and enhancing the capacities of resident women and men. In seeking sustainable development, social peace, a correct distribution of benefits and future well-being that ensure the permanence and success of the project, the following activities will be carried out to promote the local economy and livelihoods:

D.1. Study and define income-generating activities

To improve the supply chains of products from natural resources available in the territory, the project will study available markets and subsequently design income-generating project activities.

This activity aims to:

- know the market, actors, and the opportunities for the communities
- increase the knowledge on method of production
- improve the relationship between producers and buyers
- create alternative livelihood opportunities, including within the mangrove planting sites

D.2. Support sustainable use of resources

Build capacity for communities to implement sustainable harvesting and production of fish, beekeeping, oysters, salt, non-timber products, etc.

This activity aims to provide:

- fair and equitable distribution to local residents of mangrove products and benefits
- reduction of salinity rates
- reduction of the risk of erosion
- an increase in the value of the land (due to use), greater presence of local residents for exploitation, greater vigilance to train the foreigners on local rules for resources management

D.3. Investment in the oyster supply chain

The project will be involved in improving the capacity and quality of the supply chain supported by the project, through the improvement of community structures and organizations, gender equality, and correct distribution of benefits.

This investment in the oyster value chain aims to:

- generate income
- increase, improve and equilibrate the yearly household incomes
- increase the value and quantity of oysters

D.4. 10% revenue sharing generated by the sale of carbon credits

Ten percent of the carbon credits generated, in relation to the hectares of each community, will be returned to them. The modality for sale and revenue sharing will be defined by the National Steering Committee to be established by the Senegalese Government. The steering committees will ensure a correct distribution of these funds in beneficial development projects for the community. This activity is directly related to an equitable distribution of the benefits of the project.

E. Scientific research activities

Because there is a lack of existing knowledge about good sustainable use of mangroves and associated resources, as well as ecosystem services and well-being for local communities, and the immediate threat of climate change, the project will use the best knowledge and the best techniques available. Therefore, the following actions will be executed:

- eDNA study: to characterise the diversity of species present in the ecosystem in which we operate
- Soil carbon study
- Flux towers: To measure greenhouse gas exchange in the project area by installing three flux towers. The use of Eddy covariance allows direct measurement, at ecosystem or site level, of land-atmosphere exchanges of carbon dioxide and methane.
- High Resolution Drones images: To monitor the plantation and to use it as decision making tool for remediation activities
- Mini buoys: The Mini-Buoy is a tool to assess hydrological site suitability (inundation and tidal currents) for mangrove restoration. The mini-bouys will help for site identification and survival rate causes analysis.

F. Surveillance monitoring

During the lifetime of the project, a surveillance monitoring activity will be implemented that will monitor the presence of anthropogenic impacts and illegal activities that are directly harmful to biodiversity in the project area.

2.1.12 Sustainable Development

The project contributes to sustainable development and is aligned with the main strategic documents at the national and international levels:

1. In the document Assessment of the Vulnerability of the Biodiversity Sector to Climate and Adaptation to Climate Change as part of the Determined Contribution at the National level (CDN), the strategic lines proposed by the government, to which this project contributes, are as follows[53]:
    a. Integrate the adaptation of biodiversity to climate change in public and sector policies, and legal texts
    b. Strengthen the resilience of ecosystems
    c. Strengthen knowledge bases on biological diversity
    d. Strengthen the resilience of local communities
    e. Strengthen communication, awareness, and education on climate-related risks
    f. Strengthen the capacity of stakeholders to effectively address biodiversity adaptation to climate change
2. The project converges with the 2030 agenda in the following Sustainable Development Goals (SDG).
    a. Directly:
        - SDG 13 Climate action
            - Target 13.1: Strengthen resilience and adaptive capacity to climate-related disasters
            - Target 13.2: Build knowledge and capacity to meet climate change
        - SDG 14 Life below water
            - Target 14.2: Protect and restore ecosystems
            - Target 14.4: Sustainable fishing
            - Target 14.5: Conserve coastal and marine areas
            - Target 14.7: Increase the economic benefits from sustainable use of marine resources
            - Target 14.B: Support small-scale fishermen
        - SDG 5 Gender equality
            - Target 5.1.: End all forms of discrimination against all women and girls everywhere

[53]https://chm.cbd.int/api/v2013/documents/C7FD0693-E2CA-D872-98EB-B0F43CC15C54/attachments/207088/CDN_Biodiversite_CC%20VF%20juillet%202017.pdf

- Target 5.5.: Ensure women's full and effective participation, and equal opportunities for leadership at all levels of decision-making in political, economic, and public life
- Target 5.A: Undertake reforms to give women equal rights to economic resources, as well as access to ownership and control over land and other forms of property, financial services, inheritance, and natural resources, in accordance with national laws
- Target 5.B: Enhance the use of enabling technology, in particular information and communications technology, to promote the empowerment of women

3. The project, having as one of its central objectives the removal of GHG emissions, contributes directly to the Paris Agreement and its main objectives.

- The Paris Agreement's central aim is to strengthen the global response to the threat of climate change by keeping a global temperature rise this century well below 2ºC above pre-industrial levels and to pursue efforts to limit the temperature increase even further to 1.5ºC.
- Additionally, the agreement aims to increase the ability of countries to deal with the impacts of climate change, and make finance flows consistent with low GHG emissions and climate-resilient pathways.

4. The project is also aligned with the Convention on Biological Diversity and its priority objectives:

a. Conservation of biological diversity
b. The sustainable use of biodiversity resources
c. The fair and equitable sharing of the benefits derived from the use of genetic resources

2.1.13 Implementation Schedule (G1.9)

Table 5: Milestones in the project development

Date	Milestone(s) in the project's development and implementation (details with date and stakeholders in Annex 2)
10/07/2020	Starting date
July-September 2020	Plantations campaign in year 1. First activity instance
June 2020	Agreements with mayors were signed
March-April 2020	Radio broadcasts
March-May 2021	Cinema debate events
April-May 2021	SBIA workshops

Date	Milestone(s) in the project's development and implementation (details with date and stakeholders in Annex 2)
October 2021	Agreement with the Senegalese Government signed[54].
July-September 2021	Plantations campaign in year 2. First activity instance
December 2021	Project registration in VCS database. ID number: 2834
April 2022	First site visit for VCS and CCB validation
July-September 2022	Plantation campaign in year 3
July-September 2024	Plantation campaign

Annex 2 includes a detailed agenda of all the activities already performed at the stage of the Validation.

2.1.14 Project Start Date

According to VCS standard, the project start date is the date on which activities that lead to the generation of GHG emission reductions or removals are implemented. For this project, the start date is 10/07/2020, when the plantation campaign began.

2.1.15 Benefits Assessment and Crediting Period (G1.9)

The project crediting period is from 10/07/2020 to 09/07/2050 with a lifetime of 30 years, which is the same as the CCB benefits assessment period.

2.1.16 Differences in Assessment / Project Crediting Periods (G1.9)

This is the first validation of the project under CCB and VCS. There are no differences between the GHG emissions accounting, climate adaptive and resilience, community, and / or biodiversity assessment period.

2.1.17 Estimated GHG Emission Reductions or Removals

Table 6: Estimated annual net GHG emission reductions and removals

[54] See the tripartite agreement as supporting documentation

Year	Estimated baseline emissions or removals ($\Delta C_{BLS,t}$) (tCO_2e)	Actual net GHG removals by sinks ($\Delta C_{ACTUAL,t}$) (tCO2e)	Estimated leakage emissions ($LK_{,t}$) (tCO_2e)	Estimated net GHG emission reductions or removals ($\Delta C_{ARR-VCS,t}$) (tCO_2e)
2020	0	0	0	0
2021	0	0	0	0
2022	0	3	0	3
2023	0	28	0	28
2024	0	1,646	0	1,646
2025	0	5,700	0	5,700
2026	0	12,290	0	12,290
2027	0	20,004	0	20,004
2028	0	29,251	0	29,251
2029	0	-6,581	0	-6,581
2030	0	16,389	0	16,389
2031	0	21,266	0	21,266
2032	0	24,829	0	24,829
2033	0	32,153	0	32,153
2034	0	39,872	0	39,872
2035	0	48,057	0	48,057
2036	0	56,741	0	56,741
2037	0	65,931	0	65,931
2038	0	75,582	0	75,582
2039	0	51,740	0	51,740

Year	Estimated baseline emissions or removals ($\Delta C_{BLS,t}$) (tCO_2e)	Actual net GHG removals by sinks ($\Delta C_{ACTUAL,t}$) (tCO2e)	Estimated leakage emissions ($LK_{,t}$) (tCO_2e)	Estimated net GHG emission reductions or removals ($\Delta C_{ARR-VCS,t}$) (tCO_2e)
2040	0	84,295	0	84,295
2041	0	88,740	0	88,740
2042	0	96,292	0	96,292
2043	0	101,645	0	101,645
2044	0	107,320	0	107,320
2045	0	112,247	0	112,247
2046	0	116,926	0	116,926
2047	0	121,160	0	121,160
2048	0	123,112	0	123,112
2049	0	30,818	0	30,818
Total	0	**1,477,455**	0	**1,477,455**

Table 7: Estimated GHG emission reductions or removals

Year	Estimated GHG emission reductions or removals (tCO_2e)
Total estimated ERs	1,477,455
Total number of crediting years	30
Average annual ERs	49,248.5

2.1.18 Risks to the Project (G1.10)

Table 8: Project risk analysis

Identify Risk	Potential impact of risk on climate, community and / or biodiversity benefits	Actions needed and designed to mitigate the risk	State of the implementation (December 2023)
Weakness on stakeholder engagement during the project life cycle	Stakeholders are not strongly involved in project activities The non-involvement of the stakeholders in the project leads to not achieving the community objectives and jeopardizes the biodiversity and climate objectives of the project. Medium risk probability.	a. Stakeholder engagement design plan for implementation b. Stakeholder engagement implementation Monitoring Plan c. Awareness campaign	a. Implemented b. Implemented c. Implemented since the start date of the project
Possible overestimated income-related expectations by residents	By communicating that part of the project's profits will be returned to the communities, an expectation is created. The money that will be returned depends on the ha to plant in every community agreement with each community, and the quantities are quite different (see Section 2.1.7). It is possible that if the amount and destination of money received by communities is not known by communities, some residents may perceive that they are not benefiting from it. Medium risk probability.	a. Communicate to mayors on the revenue share they will receive. b. Publication of the investment plan by the steering committee. c. Participatory workshop	a. Continuous process as with local election some mayors have changed b. Waiting for the Minister of Environment to establish the steering committee (scheduled in 2024). First steering committee scheduled for quarter 4 2022. c. Implemented. Done in April-May 2021.

Identify Risk	Potential impact of risk on climate, community and / or biodiversity benefits	Actions needed and designed to mitigate the risk	State of the implementation (December 2023)
Ineffectiveness of the national and regional project steering committees	The steering committee does not properly perform the functions for which it was constituted. Low risk probability.	Define working protocol and distribution. Distribute revenue-sharing from the sale of carbon credits into the accounts of local councils.	Not implemented yet. Will be defined during the project steering committees. Deadline: before the first verification.
Conflict between natives and fishermen coming from other countries (Ghana, Mali, etc.)	Over-exploitation of the natural resources of the mangroves by foreigners. Plantation degradation. Medium risk probability.	Awareness campaigns. Elaborate communication materials regarding laws of allowed activities in the bolong (fishing or not of shrimps). Establishment of working protocol and channel of communication with MPA committees. Inclusion of surveillance activities in the Monitoring Plan. Reports of public incidents and information from the mayors' registry will be collected.	Awareness campaign at the village level has started.
Lack of motivation or capacity to plant or manage mangrove areas	Incorrect sustainable use of the mangrove. Low risk probability.	Training conducted for plantation (including handling the propagules).	Training is done each year during the plantation.

Identify Risk	Potential impact of risk on climate, community and / or biodiversity benefits	Actions needed and designed to mitigate the risk	State of the implementation (December 2023)
Lack of appropriation of the HSSE management plan	Damage to people. Damage to plantations. Low risk probability.	Identification of one Oceanium focal person in charge of compliance for the implementation of the project HSSE management plan[55]. Training to Oceanium staff on the implementation of the HSSE management plan before the start of the plantation campaign	From April 12th to 16th 2022 , first aid training of Oceanium staff[56]. second session scheduled for May 2024. plantation risk presentation to the plantors before each planting activity. From 16 to 20 June 2021, training on the HSSE management plan[57].
Planting in an unsuitable area, due to high salinity, erosion, or expected human pressures, which make reforestation efforts not successful documented in literature (Feller et al., 2017).	Failure in the regeneration of mangrove areas or achievement of densities lower than initially expected. High risk probability.	Preventive actions: 1) Selection of plantation sites with sustainability and resilience criteria. 2) Multi-criteria selection of species based on ecological conditions of planting sites. The planted species are adapted to high salinity conditions, especially *Avicennia* for more saline soils.	1, 2) and 3) done each year based on the site identification methodology. 4) and 6) results of the plantation monitoring available in Oceanium narrative reports[58]. 5) Replacement activities scheduled from 2023 onwards.

[55] See the HSSE management plan as a supporting documentation

[56] See Oceanium training evidence as supporting documentation

[57] See the April-June 2021 narrative report as supporting documentation

[58] See the October-December and July-September 2021 narrative report as supporting documentation

Identify Risk	Potential impact of risk on climate, community and / or biodiversity benefits	Actions needed and designed to mitigate the risk	State of the implementation (December 2023)
		3) Plantation audit campaigns. 4) Implementation of remediation plans in planting sites with high mortality 5) Monitoring different parameters of soil index: salinity, ph, soil characteristics, etc.	
Decrease in mangrove ecosystem productivity: decrease in fisheries production due to unsustainable catches or increased pressure from local people.	Fish population in decline. Communities would not have enough fishing resources for their livelihoods. Medium risk probability.	Effective implementation of Monitoring Plan. Support for sustainable fisheries management activities (promotion of aquaculture, support for surveillance).	Fishermen support implemented
Drought events [59] during the lifetime project	Previous drought events have seriously impacted the mangrove areas[60]. Even though the severe drought events have decreased since	Multi-selection criteria for selecting plantation areas. Design of plantation campaign taking into account the ecological	Done before each plantation campaign. Diversification of species planted to increase plantation resilience

[59] Severe drought is understood as greater or equal than 15 days

[60] Balla Dieye, E. L. H., Tahirou Diaw, A., Sané, T., & Ndour, N. (2013). Dynamique de la mangrove de l'estuaire du Saloum (Sénégal) entre 1972 et 2010. Cybergeo. https://doi.org/10.4000/cybergeo.25671

Identify Risk	Potential impact of risk on climate, community and / or biodiversity benefits	Actions needed and designed to mitigate the risk	State of the implementation (December 2023)
	1970s-1980s[61]droughts is a phenomenon that can seriously affect the mangrove areas in the future. The revised scientific papers indicate that the main characteristic of rainfall remains its high interannual variability with significant deficits during the 1970s and 1980s. If these episodes appear again, the mangroves can suffer an important regression as will the biodiversity and population that depend on the mangrove. Medium risk probability.	conditions of planting sites.	
Pest and disease outbreaks	Losses in the density of plantations. Decay and even death of mangroves. Low risk, since historical bibliographic information related to this has not been found (see Non-Permanent Risk Report). Low risk probability.	1) Raising awareness of the possible pests and diseases that may appear. 2) Monitoring the plantations regularly as set out in the Monitoring Plan. 3) Organization of corrective actions together with the local community, if necessary. 4) Do not use pesticides	1) Done during the plantation monitoring campaigns. 2) Plantation monitoring campaign has started in 2021. Each year 1% of the planting area is carried out

[61] Andrieu, J., Lombard, F., Fall, A., Thior, M., Ba, B. D., & Dieme, B. E. A. (2020). Botanical field-study and remote sensing to describe mangrove resilience in the Saloum Delta (Senegal) after 30 years of degradation narrative. Forest Ecology and Management, 461(117963), 117963.

Identify Risk	Potential impact of risk on climate, community and / or biodiversity benefits	Actions needed and designed to mitigate the risk	State of the implementation (December 2023)
		or chemicals. Only biological methods will be used.	3) Not implemented yet. 4) During the project life cycle.
Medium- to long-term degradation of the mangroves in the project areas, once implemented, due to the environmental threats and human pressures previously described.	The recovery of mangrove has different rates of success as described in Sections 4.1 and 5.1. Human and natural threats such as climate change can impact the project in different degrees of severity. The impact of sea level rise over time in particular is a risk to the long term mangrove survival. Medium risk probability.	The project will follow sustainable forest management criteria (Kusmana, 2015), through continuous communication with stakeholders, continuous monitoring of the impacts on climate, community and biodiversity factors, and the fast and flexible action response to mitigate emerging threats. The impacts of sea level rise have been modelled over 100 years to enable analysis of impacts and selectin of planting sites that may be less affected.	Implementation of communication activities (radio podcast transmission, cinema-debate, etc.) Impacts of sea level rise mapped and mitigating actions taken in project design.

2.1.19 Benefit Permanence (G1.11)

The project activities reflect the communities' priorities and identification of activities has been carried out with a commitment to free, prior, and informed consent. The communities are the main beneficiaries of the ecosystem services (increased vegetation that attracts fish, oysters, and other animals, and reduces

salinity) provided in the project areas that will be reforested in the first phase. The direct benefits provided by the ecosystem services are a long-term incentive for maintaining the mangrove and its climate, community, and biodiversity benefits.

Therefore, at the end of the project, the communities' own interests and investment, along with the governance structure (the steering committee) created for the purpose of this project, will continue the management for the benefit of all people.

The correct implementation of the project, taking into account all potential risks and adaptation to climate change, through a careful selection of species and plantation sites, contribute to the resilience of the plantations beyond the project lifetime.

The MANCO project is designed to play an important role in socio-economic development and the preservation and enhancement of the mangrove ecosystem in Casamance and Sine-Saloum. On the environmental front, the project will promote better preservation of natural areas and wetlands that are currently under serious threat. The planting of mangroves in the Sine-Saloum and Casamance estuaries will protect the land against marine and coastal erosion by forming a natural barrier against marine currents.

The resilience of the restored mangroves to future threats will be increased through including Avicennia species, especially through remediation planting. Avicennia species tend to be more resilient to environmental pressures that have affected the region in the past.

2.1.20 Financial Sustainability (G1.12)

The costs of project activities will be fully financed by the sale of the carbon credits. This is based on thorough financial analysis. WeForest is engaging with market buyers to identify suitable financiers for the project and Phase 1 planting is being funded by an organisation intending to purchase the credits who would otherwise not invest in a project of this type.

In addition, further actions have been taken to ensure the financial sustainability of the project:

a) The communities by means of the steering committee will receive 10% of the revenue of the carbon credits sold. These funds will be used to improve the wellbeing of the communities implementing projects related to education, health, infrastructure, etc.

b) The project will support communities in economic development through the sustainable use of natural resources, improving production chains, and their access to markets (see activities C1, C2, and C3 in Section 2.1.11: Project Activities and Theory of Change).

2.1.21 Grouped Projects

1) Eligibility Criteria for Grouped Projects (G1.14)

The project proposes a first instance of 7,019.8 hectares to be reforested. However, the final scaling limits are expected to be about 17,000 hectares. For the expansion, the activities, technologies, and measures will be adopted in the same way as for the project description.

The eligibility criteria for expansion are as follows:

- New project instances should be designed in accordance with applicable VCS requirements and methodologies as per the first instance.
- New project instances should be located within the Sine-Saloum and Casamance estuaries in Senegal, as per the first instance.
- The crediting period for new project instances will be the same as for the first instance.
- The baseline scenario for new project instances will be the same as, or more conservative than, the baseline scenario for the first project instance and in accordance with the regulations set out for the applicable methodology.
- The social parameters at the project activity instance start date will be similar to those described for the first project activity instance.
- The same project proponent and project partners will be involved in implementing new project instances as for the first project instance, and should have appropriate capacity to do so effectively.
- New project instances will fall under the same MRV system for coherent reporting.
- New project instances must be aligned with the proposed governance structure for the project.
- The planting area historically used to be mangrove (see section 2.1.5). Degraded areas will be considered for future plantations if they have maintained their degraded condition for more than 20 years and are more than 8m away from other plantations. The technologies and identification methods will be the same as for the present project.
- In the case of incorporating new communities into the project, the same process will be followed as for those currently involved: 1) previous meetings, 2) joint selection of stakeholders, 3) joint selection of plots to be reforested, 4) signature of the agreements.
- Project Activities and Theory of Change are maintained during the expansion. In this way, the agreements signed with the government and the communities, the implementation of the steering committees and communication activities, among others, are maintained.
- In the case of new villages to be incorporated, they will be involved in the same way as the first instance, incorporating them into the cinema debate, radio podcast, steering committees, and monitoring plan, among others.
- New instances should be subject to consultation processes similar to those carried out for the first instance in terms of respect for land tenure and rights of use, such as compliance with the free and informed prior consultation process.

2) Scalability Limits for the Grouped Projects (G1.15)

The limitations for expansion are as follows:

a) New plantation areas will be placed in the 17 communities in the Sine-Saloum and Casamance estuaries with which there are signed agreements.

b) The choice will be limited to the expansion of the mangrove swamp from other projects, keeping a distance with these and always taking into account the technical criteria on the success of the plantations.

c) The initial forecast is that around 17,000 total hectares is available for scoping, including consideration of the sea level rise assessment.

3) **Risk Mitigation Approach for Grouped Projects (G1.15)**

The risks identified must be reassessed and updated when new project instances are incorporated. Thus, the risk matrix will incorporate the risks associated with the expansion.

To further reduce risks of adding project instances, and ensure continuing effectiveness and robustness of the project, the following aspects will be taken into account:

- Prior to expansion of the project to new instances, a full financial analysis and capacity assessment will be undertaken to ensure that the project proponent and implementing partners are able to implement new project instances to the same quality as the first project instance.
- Project expansion plans will be presented to the WeForest Board to provide an additional layer of independent oversight.
- WeForest will work with local partners on the ground to build their capacity to expand the project.
- The project will implement a robust data monitoring and data storage system that can cope with additional demands of new project instances.
- Effective stakeholder communication will be conducted to ensure that new and existing project stakeholders understand the process, rationale, and implications of incorporating new project instances.
- The national and international regulatory environment will be regularly assessed to ensure project compliance.

2.2 Without-project Land-Use Scenario and Additionality

2.2.1 Land-use Scenarios without the Project (G2.1)

The sites to be reforested are degraded mangrove areas with some pre-existing mangrove species (see figure below). The conditions existing prior to project initiation were identified as the most likely scenario. For more details, see Section 3.1.4 Baseline Scenario, where it is explained that the continuation of the pre-project land use, land remaining as a degraded wetland, is established as the baseline scenario.

Figure 20: Scenario without project

In the Sine-Saloum Biosphere Reserve (SSBR) and the Casamance estuary, the sites chosen to be reforested are practically bare (tannes) with limited mangrove plants signaling that the landscape is suitable for mangrove restoration (Photo below). These sites are suitable areas for the development of certain mangrove species including *Rhizophora spp*. and *Avicennia spp*. as seen in the surrounding areas where there are large expanses of relatively dense mangroves consisting mainly of *Rhizophora spp.* and *Avicennia spp*.

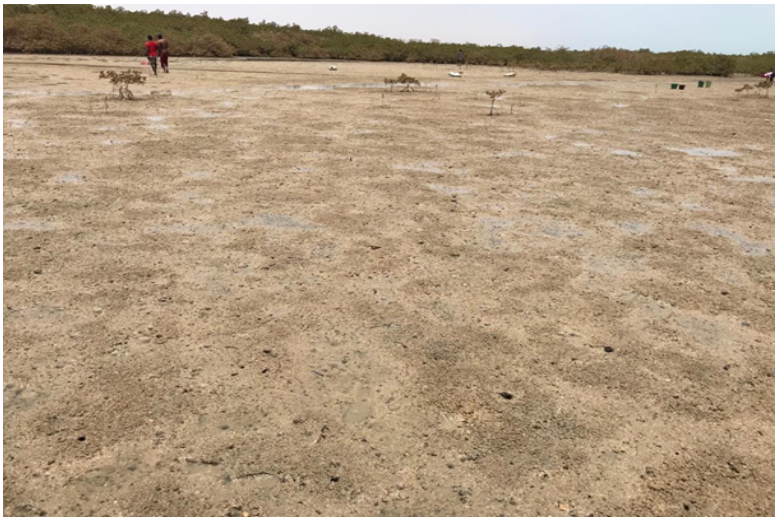


Figure 21: Mangrove ecosystems surrounding reforestation sites in the RBDS.

Analysis of the basic environmental and social conditions in the project area shows that the project's area of influence is still strongly marked by a continuing process of environmental and natural resource degradation, primarily as a result of drought in the 1980s, and in some cases the use of unsustainable production systems e.g. unsustainable oyster harvesting techniques. The project area is marked by mangrove degradation, with major consequences for the reduction of biodiversity, despite the significant interventions and efforts of the State and various development partners and NGOs to regenerate and enhance the mangroves.

The option of not carrying out the project would mean maintaining this status quo. The project's failure to intervene in the sub-sectors of aquaculture, fishing, the collection of non-timber forest products and beekeeping would mean not resolving the precariousness and vulnerability affecting the populations of the area, and not acting on the ongoing process of degradation of natural resources.

"Doing nothing" would also mean failing to respond to the erosion of biological diversity caused by the degradation of natural resources and the mangrove ecosystem. This alternative would therefore not be in line with the environmental protection and sustainable development objectives advocated by Senegal and its development partners.

The "no project" alternative itself has a number of negative impacts and effects (lower incomes; increased emigration, more conflicts; further degradation of natural resources, etc.).

In addition, the scenario without a project was intensively discussed in the SBIA workshops with the communities, where the following conclusions were obtained:

- Traditional exploitation of mangrove products would continue. The deforestation around the plantation sites would continue, and some mangrove species would disappear. Mangrove decline would cause a decrease in the amount of fishing available so that the benefits to the communities would decrease. Also, in the absence of the mangrove, salinization would increase, and rice paddies and wildlife habitat would disappear.
- The communities do not have the financial and technical means to reforest in a large-scale project such as this one.
- In the absence of the project, in the medium term (3-5 years), shellfish and fisheries would continue, but without mangroves as nurseries for fish, population numbers are likely to decline.

2.2.2 Most-likely Scenario Justification (G2.1)

The most-likely scenario is explored in more detail in Section 3.2.1. The most likely scenario is the continued existence of degraded mangroves without significant restoration. The main evidence for the continuity of degradation lies in the fact that, after their degradation (mostly in the 1980s when the area experienced severe droughts) these areas have not recovered.

To make a correct selection of areas in which to plant the plantations, the project prepared the ‘Study of eligibility of land inside the project boundary of the project: Mangrove Restoration Program with Sine-Saloum and Casamance communities, Senegal Grouped Project’ using remote sensing analysis tools. In

it, it was evidenced that the areas selected for reforestation are degraded and have been for at least the last 20 years. In that sense, they will most likely continue to be degraded areas in the future, in the case of the without-project scenario.

2.2.3 Community and Biodiversity Additionality (G2.2)

As mentioned in Section 3.1.5 this project would not occur in the absence of a VCS project activity. In the absence of the project, the most likely scenario would be continuation of pre-project existing conditions.

The detailed additionality assessment was demonstrated by using the 'Combined tool to identify the baseline scenario and demonstrate additionality in A/R CDM project activities, v1.0' – please refer to Section 3.1.5 for details. Project activities would not have been implemented under the without-project scenario due to technological, investment, local ecological conditions, as well as social barriers. Therefore, the community and biodiversity benefits would not have the opportunity to occur either. Despite the existence of national laws and regulations to protect the environment (see Section 2.5.7), deforestation and illegal activities such as poaching or logging are expected to occur.

According to the Ministry of the Environment, in its national strategy for biodiversity,[62] the operationalization of this strategy emphasizes that the preservation of biodiversity and the improvement of the living conditions of the population cannot be achieved without the active involvement of all stakeholders. These stakeholders must work closely with a National Biodiversity Committee with real powers and adequate resources, and participate fully in the effective implementation of the strategy's action plan. The State of Senegal is struggling to mobilize the necessary resources for the implementation of its action plan. In the without-project scenario, the implementation of the national biodiversity strategy will be limited due to lack of resources and support from projects and programs.

In Section 3.1.4 it is demonstrated that the project activities would not have been implemented under the without-project scenario due to significant financial, technological, institutional, or capacity barriers.

2.2.4 Benefits to be used as Offsets (G2.2)

Not applicable

[62] See stratégie nationale & plan national d'action pour la biodiversité, Août 2015, Ministère de l'environnement et du développement durable

2.3 Stakeholder Engagement

2.3.1 Stakeholder Access to Project Documents (G3.1)

The project's communication strategy will proceed through an integrated approach using various channels in synergy in order to multiply the points of contact with the intended target(s) and to ensure that the messages conveyed are consistent in content and form.

For stakeholders who can read, the project document as narrative reports, monitoring reports, and other project documents will be distributed to project relevant stakeholders. The documents will be sent by email (for those who have an email address) or given as a paper version via Oceanium officers. For those who cannot read, a summary of the documents has been shared through radio broadcast and cinema debates. Local languages will be used where appropriate.

The main forms of media to communicate project information to stakeholders include:

- Radio podcasts. Community radios are one of the most suitable means of communication to inform the population, as they are often listened to even in the most remote places and have the advantage of being broadcast in local languages. Interactive radio broadcasts also allow for calls from listeners to share their opinions on the subject matter. In the first series of radio broadcasting (from February 2021), communities were informed about the project's key issues and had the opportunity to raise their questions. In the next sessions and podcast, the communities will continue to be informed of the most notable progress and events, as well as, where appropriate, the opportunities for involvement.
- Cinema debates. This consists of a film screening followed by a debate about the film[63]. Within the framework of the project, the film will deal with the topics that the project wishes to discuss with the participants. The video must capture attention and convey simple, relevant messages in an accessible vocabulary and with images that the general public can understand. The cinema debate is an opportunity for assembly meetings in each community. During the debates, the progress of the project is presented, as well as complaints, claims, and recommendations, and other needs from the community will be heard. In the cinema debates, carried out since March 2021, a general presentation of the project has been provided; the implementation team and their roles.
- Participatory workshops. The CCB standards require that project proponents describe the socio-economic and biodiversity conditions at the project site and explain what these conditions would be in the presence and absence of the project. The SBIA workshop has been organized with project stakeholders to collect their inputs for the project description and potential impacts. A summary of the project was prepared and shared with the invitation letter that was sent to all the stakeholders invited to the workshops (there were about 25 people in each workshop: one in Casamance and

[63] See the communication tool made by Oceanium and its partners on cinema-debate communication channels in this link http://www.rampao.org/IMG/pdf/outils_cinedebat.pdf

one in Sine-Saloum). The SBIA workshop report was shared with workshop participants on November 10, 2021[64] and their feedback collected.

- Oceanium focal points. The Oceanium representatives in each community act as focal points and can receive and disseminate the information through villagers.
- Routine villager assembly. The project owner will notify local stakeholders through the routine villager assembly regarding every milestone of the project development, including listing, registration, issuance, etc.

In addition, all VCS and CCB project documents will be made publicly available on the Verra registry.

2.3.2 Dissemination of Summary Project Documents (G3.1)

Project documentation will be published on the VCS and CCB websites for all stakeholders to obtain the detailed project information and development progress. Summary information on monitoring results will be actively disseminated to project stakeholders through channels as described below. Also, the summary of the project description in the local language (Wolof, French, Serere, or Diola) has been shared among local communities during the cinema debates[65], the radio podcast transmissions[66], and also in the participatory workshop held in 2021. The discussions held during cinema debates were held in French, Wolof and Diola, the radio podcast transmissions are always done in Wolof, Serere, or Diola depending on the radio localization (Serere for radio stations based in Sine-Saloum and Diola for radio stations based in Casamance).

The key activities to disseminate information to communities and receive feedback are as follows:

- Interviews with mayors. In these interviews, the Oceanium team gave the key information about the project to offer participation in the projects[67].
- Radio podcasts (RP), which were retransmitted in the radio stations of the project area[68]. These broadcasts included general information of the project and were planned to reach all local communities.

[64] See the November 10, 2021 Marie-Louise Thoye email sent to SBIA workshop participant as supporting documentation named “mail d’envoi du rapport d’atelier du SBIA workshop”

[65] See the rapport cinéma-débat as supporting documentation

[66] See the report with the initial support of the mayors to the project in supporting documentation.

[67] See the report with the initial support of the mayors to the project in supporting documentation.

[68] See the document with radio broadcast planning and radio station coverage in the supporting documentation

- Cinema debate (CD)[69]. Each community was invited to participate in the cinema debate to be informed about the project and listen to their concerns and ideas. To notify the population, Oceanium listed their assistance in all the villages of the project. They spread the information by word of mouth to the village leaders, children, and people they met. This is a typical method of communication. Regarding the inhabitants of the surrounding villages, they traveled by their own means. Nonetheless, to compensate for their travel, Oceanium provided snacks and drinks to participants. The cinema debates were carried out by Oceanium facilitators and were structured in three blocks:
    - A video of about 30 minutes which explains the situation of the mangroves in Casamance and Sine-Saloum. The film on the return of mangroves, directed by Nicolas Van Ingen, on the state of mangrove degradation in the Sine-Saloum and Casamance, and the urgency of restoring it for local people and the ecosystem.
    - A PowerPoint presentation that describes the key points of the project, including required information for G1.1-9 in CCB standards (Project overview and *Project Design and Boundaries)*[70]. This is a free space to listen to actors about key issues they want to discuss, their concerns, expectations, etc.

Oceanium included the contact details of its local representative in the presentation so that any participant could make contact.

In total, 25 cinema debates were conducted. Due to the security measures regarding the COVID pandemic, the sharing sessions brought together on average between 40 and 50 people for about two hours. However, some flagship localities like Niambalan and Coubalan attracted about a hundred people each. These projections have raised awareness among 1,200 to 1,500 people regarding the importance of reforestation and of preserving natural resources. This allowed each of the project actors to share their opinions and ideas for better sustainability of the project. The communities highlighted that a sustained effort to combat salinization and its related problems needs to be made in the areas affected by mangrove restoration.

- As a result of the SBIA workshop, the project's final report with the activities to be implemented and outputs, outcomes, and impacts expected was shared with the communities. The results of the workshops were shared by email with the communities in French[71], since this is a language understood and used by all ethnic groups. Each SBIA workshop participant was asked to spread the content of the workshop result to the people they were representing for them to have a chance to get the information required to understand the project activity. In addition, during field visits and activities, Oceanium will ensure that the people they meet have knowledge of the project and will report back to the project management on the level of knowledge of the project activities. Depending on the level of

[69] See the methodology for the implementation of Cinema Debate in the supporting documentation.

[70] See the presentation (already translated to French in supporting documentation)

[71] See Rapport - workshop EISB projet MANCO as supporting documentation

knowledge, specific capacity-building activities for the relays or communication activities may be organized in villages where knowledge of the project is low.

A communication plan[72] of the project will be set during the life of the project. The channels used to communicate to project stakeholders are presented below:

Table 9: Communication plan

Targets		Communication tools	Frequency
Community	Inhabitants (local community groups, fishermen, beekeepers)	⇒ Radio programmes (RP)	RP and CD: before and during the reforestation campaign
		⇒ Cinema-debate (CD)	
		⇒ Door-to-door outreach by Oceanium's field-based facilitators	
	Planters	⇒ Posters distributed in the main places where people pass through	Door to door before the reforestation campaign and according to the information to be distributed
Local authorities and elected representatives		⇒ Official correspondence	At least once a year
		⇒ Annual activity report sent before each Steering Committee	
Students		⇒ Consider potential for animations in classrooms with pupils (educational projects based on tree planting)	School year
		⇒ Consider distribution of notebooks to pupils enrolled in schools in the project areas	Distribution of notebooks at the beginning of the school year
Teachers		⇒ Consider transmission of the project presentation note	Contact at the beginning of each school year

[72] See plan de communication du projet MANCO as supporting documentation

Targets	Communication tools	Frequency
	⇒ Consider project presentation meeting and follow-up meeting	Quarterly meeting
Oceanium staff	⇒ Staff meetings	Weekly meeting with Oceanium employees
Technical and financial partners	⇒ Quarterly and annual activity reports	Quarterly and annual
	Weekly and bi-monthly meetings between Oceanium, WeForest, and Eclosio	
	⇒ Participation in meetings of the Sine-Saloum and Casamance mangrove platforms	
Opinion leaders	⇒ Depending on needs and themes, specific meetings with decision-makers to raise their awareness on a subject where their support is expected	Depending on the needs and themes
Media	⇒ Ongoing dialogue with the media to disseminate information about the project to the general public	During the project lifetime
The general public	⇒ Facebook page, Instagram, and websites of Oceanium and WeForest	Quarterly
Policymakers	⇒ Specific interviews with decision-makers to raise awareness on an issue where their support is expected	Depending on the needs and themes (at least once a year)

2.3.3 Informational Meetings with Stakeholders (G3.1)

The informational meetings include the ones described in the section above and also particular meetings with different local associations. The meetings with the mayors were scheduled with the Oceanium team. The cinema debates were publicized in the radio podcasts.

Each year there is a meeting with the Ministry of Environment to present them the project achievements in order to collect their recommendations on the project implementation.

Beyond these bilateral meetings, a SBIA workshop was organized in Sine-Saloum (April 27-29 2021) and Casamance (May 4-6 2021) where representative stakeholders (including community mayors, governors, representatives of the Senegalese Government, local associations, NGOs, educational and research institutions, and representatives of other projects) were invited. An invitation letter and a summary of the project were sent to the stakeholders in order to inform and invite them to participate in the workshop. The workshop organization team called all the invited stakeholders to confirm their participation in the workshop.

2.3.4 Community Costs, Risks, and Benefits (G3.2)

During the SBIA workshop, project WeForest and Oceanium staff explained the potential costs, risks, and benefits to relevant communities and stakeholders by using the Theory of Change, and invited them to give their feedback. These were identified using a participatory and transparent process.[73]

According to the workshop, the community benefits of the project include incomes from selling carbon credits, environmental (improve the biodiversity, salinity control, aesthetics, etc.), and social (jobs opportunities during the plantations, economic opportunities, and capacity building from improved activities in selected value chains such as oyster- and beekeeping). Stakeholders are aware of the design concept of the project and have shown their willingness to participate in the project.

The map of selected stakeholders is available as supporting documentation[74].

2.3.5 Information to Stakeholders on Validation and Verification Process (G3.3)

The project stakeholder representatives have been (and will continue to be) informed on the validation and verification process through the cinema debate, the SBIA workshop, Oceanium staff field mission visits, the project regionals and national committee, and by formal letter, a call, and email.

Oceanium's zone coordinators will inform people and collect the evidence available as supporting documentation (this will consist of a table with the list of people that have been contacted, their number, and the way they have been contacted to be informed about the auditor field visit).

[73] See rapport - workshop EISB project MANCO

[74] Workshop – Casamance region stakeholders; workshop – Sine-Saloum region stakeholders

A communication and grievance mechanism[75] has been developed and will be implemented during the project life cycle. The goals of this mechanism are as follows:

- Provide effective means to convey information about the project to the relevant stakeholders.
- Provide clear means for the community to express their concerns to the project proponent.
- Provide clear and definite procedures for handling complaints.
- Provide effective procedures to resolve disputes between the community and project proponent if any problems occur in the preparation and implementation of the project.

The summary of the project will be translated into French and distributed to the primary stakeholders, primarily those participating in the SBIA workshop.

To ensure that key actors have a good understanding of the grievance mechanism Oceanium´s staff have organized several meetings at the community level to spread the information to elected officials from the project's intervention villages.

One month after these meetings, Oceanium's project management team will visit 10% of the intervention villages to interview people and measure their level of awareness of people regarding the project and the grievance mechanism. In the event that a lack of awareness of the project persists, communication activities such as cinema debates can be planned in villages with low awareness. In addition, Oceanium's relays can also organize specific meetings with the population to reinforce their knowledge.

During all the project communication events in the villages (cinema debates, radio broadcasts), the presence of a complaints management mechanism specific to the project will be presented.

2.3.6 Site Visit Information and Opportunities to Communicate with Auditor (G3.3)

The local stakeholders have been kept informed regarding the project process, especially when the auditor would be making the site visit. A week prior to the visit, the project staff informed relevant stakeholders in advance about the details of the audit process and arranged a half day for the auditor's interview with stakeholders so that the stakeholders had sufficient time to communicate with the auditor[76].

Oceanium and the project proponent will be in charge of the auditor's logistics (transportation, hotel, restaurant, meeting localization) to guarantee a good framework of exchange. Several representatives of the stakeholders from communities are invited to have a conversation with the project proponent and the auditor regarding the issues of the relevant project. Some of the meetings between the stakeholders and the auditor are performed in the absence of the project proponent and implementer.

[75] Named 'mecanisme simple de gestion de plaintes' in supporting documentation

[76] See the Manco -LETTRE D'INFORMATION Maire Djirnda as supporting documentation

2.3.7 Stakeholder Consultations (G3.4)

Stakeholders, mainly communities, have played a vital role in the design of the project, mainly in the following:

- Cinema debates: after the video and presentation, there was an open discussion to listen to and clarify the participants' concerns.
- SBIA workshops: in this three-day workshop, there was a profound discussion with selected stakeholders, and their inputs were considered in the final project. Around 25 people assisted with every workshop, with women representing 30%. Results are detailed in Table 10.
- National Committee on Climate Change (COMNACC): the project idea was presented to the project stakeholders (project mayors included) during the technical review and approval workshop of the mangrove restoration project with the communities of Sine-Saloum and Casamance that was organized in August 2021. After the project presentation by Oceanium and WeForest, COMNACC validated the project.
- National and regional steering committees (see Section 2.4).
- The environmental and social assessment that will identify the project risks and ways to mitigate them. For this assessment, consultation with project stakeholders will take place to present the project to them and to capture their concerns and recommendations about it[77].
- Agreements with mayors and governmental authorities.

Table 10: The SBIA workshop survey results

Thematic	Questions to participants	Answers
Carbon accounting and certification	How is carbon sequestered?	Like human beings, trees also breathe. However, instead of taking oxygen to release CO_2, they take CO_2 to release the oxygen we breathe. Since CO_2 contributes to global warming, the fact that trees can store it has an effect on climate change. The VCS + CCB certification ensures (for the climate) that there is a proper accounting of the volume of carbon sequestered by reforestation. In addition, the quantification of carbon stored by the project will be based on complex allometric equations that are outsourced. It is
	How is carbon sold?	
	How will you quantify the carbon sequestered?	
	Is it the above-ground or root carbon that will be accounted for?	
	Explain clearly and easily what carbon storage is.	

[77] See Terms of Reference for the consultancy activities for the Environmental Impact Assessment

Thematic	Questions to participants	Answers
	For VCS + CCB certification, can you go over the explanation?	a research firm (Agresta) that will support us in this process. Carbon can be accounted for from the first leaves. The carbon accounting within the framework of the project will be done only on the surfaces reforested by the project.
	How soon can carbon accounting begin in your project?	
	Is it only the reforestation activities that you account for?	
Stakeholder involvement	How to involve the GHG in reforestation.	The project aims to work with all stakeholders to ensure that the project's actions meet the objectives. The first step in this process is that the workshop allows us to build the project document together and to identify the issues that you consider most important to include in the project. In addition, the workshop will allow us to better define how the stakeholders will be involved and to better define their roles. The local stakeholders are expected to be involved in two ways: the first through their mobilizations for reforestation activities and the second in the accompaniment of socio-economic activities (for beekeeping and oysters). The fishermen are obviously stakeholders in the project. We will work in synergy with the other programs that intervene in the area: we will be members of the mangrove platform and we will report all our activities to the governor of the region so that he has a global vision of the actions that take place in the region.
	With a reforestation of more than 7,000ha in three years, what will the involvement of the communities in the project be?	
	Is it planned to support the communes in reforestation activities other than mangroves?	
	Can the communes involved expect to recruit their sons (young people from the community) to the Oceanium?	
	Who are the targets of the project?	
	What strategy will you put in place to better involve stakeholders in your activities?	
	What will be the role of poachers towards the communities today?	
	Are the fishermen in the area involved?	
	Is it possible for the project to work in synergy with other programs operating in the area?	

Thematic	Questions to participants	Answers
Project description	Can you go back over the three components with their characteristics or definition?	Clarification of the villages involved and the three key components of the project.
	Which villages are concerned in the Sine-Saloum?	
Follow-up and sustainability	What can be done to preserve the project's achievements in the environment for the next 15 to 20 years?	The achievements of the project will be preserved through the protection of reforested mangroves. The means of perpetuation will be the sensitization of the stakeholders. The monitoring of the project will be respected because it is an activity foreseen in the framework of the project. The necessary means for monitoring operations will be made available. The agreement that will be signed between the Senegalese Government, Oceanium, and WeForest provides for the involvement of conservationists, water, and forestry agents and Oceanium for the monitoring of reforestation.
	What are the means to sustain the activities in the environment?	
	Can the project be monitored?	
	Will the logistical means be available at all times?	
Others	How to identify reforestation sites?	Reforestation sites are identified using satellite data, measuring salinity, presence of water in the plot and soil texture.
	What is the right climate for mangrove restoration?	The Senegalese climate in mangrove ecosystems is suitable for mangrove reforestation projects. The identification of areas to be reforested is essential.

Based on these contributions, the main aspects that had to be revised include[78]:

- Take into account the project stakeholders in the plantation sites' identification and in the plantation monitoring.
- The plantation monitoring will be done with the Directorates of Marine Protected Areas, and Water and Forests, Hunting, and Soil Conservation.
- The project stakeholders (socio-economics actors, mayors, village chief representatives, state agencies, scientists) will be members of regional and national management committees. They will give advice and identify the project priorities with the project proponent. The National Committee will also be responsible for the allocation of funds from carbon credits to municipalities.
- Maintain communication with all the project stakeholders by updating them on the project implementation (plantations and livelihoods) by using radio podcast broadcasts and cinema debates.

2.3.8 Continued Consultation and Adaptive Management (G3.4)

Oceanium will be responsible for maintaining communication with the stakeholders. Oceanium has signed agreements with local radio stations and will continue to use this channel to inform local stakeholders on the project implementation. In addition, before each plantation campaign, Oceanium will organize cinema debates in the project communities and will hold meetings with communities' representatives (mayors).

Stakeholders will also be able to give their opinions and recommendations on the implementation of the project to the project proponent.

This will be possible through the channels listed below:

- Cinema debate: After the presentation of the project and the associated film, there is systematically a time for exchange between Oceanium and the communities. It is during these debates that the communities can transmit their opinions, recommendations, and grievances.

- Steering committee: During the national and regional steering committees, stakeholders, including mayors, village chiefs, and the administration give their opinions and recommendations on the implementation of the project. These opinions are recorded in minutes and the project has a maximum of one year to take the recommendations and opinions into account.

- Radio broadcast: These will be retransmitted via the radio stations of the project area. These broadcasts included the critical facts of the project and are planned to reach all local communities. After broadcasts, public feedback will be received and responded to directly by the Oceanium staff in charge of the transmission.

[78] See SBIA workshop rapport available as supporting documentation

- Village relays: Oceanium has a vast network of village focal points in the project area. These relays are known to all and their mission is to open up a dialog with the stakeholders and bring up the needs, recommendations, and opinions of the communities.

- Grievance mechanisms: The complaint management mechanism that will be put in place will be based on the involvement of the mayors, prefects, and Oceanium. The mayors and Oceanium staff will have at their disposal a complaints management book where they will record all complaints and grievances received on the project. Depending on the level of the complaint, several channels of discussion are planned (see Sections 2.3.12 and 2.3.13).

2.3.9 Stakeholder Consultation Channels (G3.5)

As mentioned, given that Oceanium is a well-known and well-established NGO in the communities, there are adequate communication channels with all the communities participating in the project and with other stakeholders (government, local associations, NGOs, research centers, etc.). The radio broadcasts, the cinema debates, the COMNACC, and the SBIA workshops were the primary channels for local communities to participate. During these activities, critical issues of interest for the communities were shared, including the areas to be planted, the jobs generated, the income from carbon credits etc. These issues were discussed and clarified. The participants were very active and formulated many questions for the facilitators during the entire process. To implement project activities (site identification, planting, support for socio-economic activities, awareness-raising, etc.), Oceanium and Eclosio staff are in constant contact with communities, elected municipal representatives and administrative authorities (reforestation and site identification).

Several channels of exchange with stakeholders have been set up so that they reach out to the project proponent (see Section 2.3.8).

2.3.10 Stakeholder Participation in Decision-Making and Implementation (G3.6)

Mechanisms for participation and decision-making for all identified stakeholders have been created since the beginning of the project. At the start of the project, a local stakeholder consultation[79] was made to identify communities' needs and expectations regarding the project livelihood component. In addition, local communities have been consulted directly (cinema debates[80]) and through the representation of the mayors, women, and the youth in the SBIA workshops[81]. The project proponent will also pay attention to include women and the youth in the project governance organizations.

[79] See the « 2. Local stakeholders consultation » as supporting documentation

[80] See the « rapport cine debat et radio communautaire » as supporting documentation

[81] See the Rapport - workshop EISB projet MANCO as supporting documentation

For the 2021 cinema debate that took place, 39% of the participants were women. See the following table:

Table 11: The cinema debate participants

Number of participants	Gender
272	Women
408	Men
11	No information
691	Total

During the organization of the cinema debates, Oceanium encouraged village chiefs and mayors to have women and young people participate. Many young people (in the age group 15-35) were present at these events. Their good understanding of the project will facilitate their participation in reforestation activities. Moreover, the young people will be ambassadors of the project to their communities for the preservation of the plantations carried out within the framework of the project in particular, and of the mangroves in general.

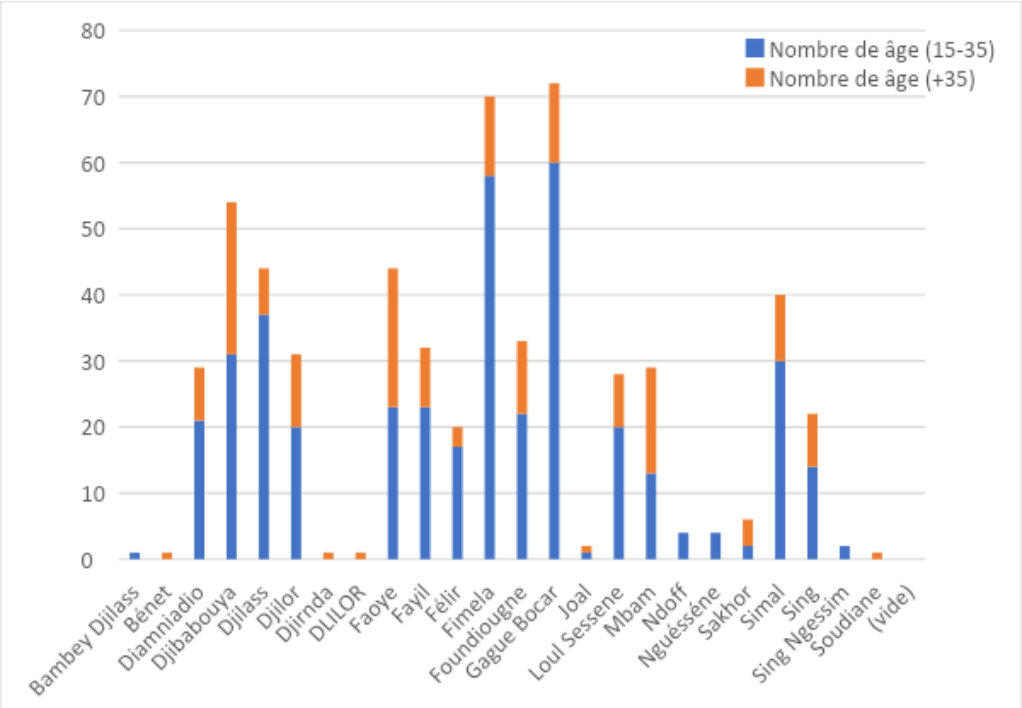


Figure 22: Attendance, according to age, at the cinema debates

2.3.11 Anti-Discrimination Assurance (G3.7)

Senegalese law prohibits discrimination on the grounds of race, nation, sex, or religion. The project proponent and all project participants have established the anti-discrimination rules in the implementation of the project, including providing equal job opportunities for any qualified workers regardless of their gender, race, nationality, or religion, no additional requirements for women or minorities, and equal pay for equal work, etc. Positive discrimination was considered to select the participants for the SBIA workshop for women to be properly represented. Also, it was a priority that women participated in the plantations to have a salary.

These considerations will also be included in the training sessions and during the crediting period so that women and minority groups are represented in the steering committee and other local communities. Following the existing grievance and redress procedure, anyone could report any prejudice to the project proponent.

Oceanium and WeForest are mutually committed to the seven social principles which refer to the international labor standards defined by the International Labour Organization (ILO): (1) prohibition of child

labor, (2) forced labor, non-discrimination, (3) freedom of association and right to collective bargaining, (4) occupational health and safety, (5) legal working hours, (6) remuneration at or above the minimum wage.

The selection of the people involved in the reforestation activities is entrusted to the authorities of the different villages involved in the project. The selection criteria are listed below:

- Area to be reforested. Depending on the area, the number of planters required varies.
- Availability of propagules. If propagules are in short supply during reforestation, the area manager will mobilize a small group.
- Difficulty of reforestation. The nature of the soil on site is variable. The age and physical ability of those involved in reforestation activities will be taken into account according to the land difficulty.
- Age. In order to combat child labor, only people over 15 years of age will be able to participate in the activities as planters, nursery workers, or agents in charge of cleaning the plantations.
- The origin of the operators. In order to enable communities to generate income through reforestation, priority will be given to communities living in the project area (reforestation, transplanting, cleaning).

Once the number of people needed has been identified by the local authorities, they share the list with the zone chief who ensures that the number of participants identified corresponds to expectations and that at least 30% of the proposed groups are women's groups.

Women and men participated in the cinema debates, and focus was made to include women in the SBIA workshop. In Casamance, out of 25 participants, six were women, and in Sine-Saloum out of the 23 participants, six were women. The project will continue to involve women in the project decision and would like to reach 30% minimum participation of women in its activities.

2.3.12 Feedback and Grievance Redress Procedure (G3.8)

COMPLAINT MANAGEMENT PROCESS FOR THE MANCO PROJECT.

Definition of common concepts

- Complaint Management Mechanism (CMM):

The Complaint Management Mechanism is the practice of receiving, addressing and responding to concerns about mangrove plantations in a systematized manner.

- Complaint

A complaint is an expression of dissatisfaction with the implementation of project activities (planting, communication, stakeholder inclusion, other). These complaints may refer to actions or inactions by staff, volunteers or direct beneficiaries of the project that directly or indirectly cause anxiety or negative effects to anyone.

Complaints about the implementation of the Project may involve sensitive issues that should be handled confidentially, respecting the wishes of the potential complainants.

- Stakeholders

A Stakeholder is an individual or group that has an interest and/or impact in the project's decisions or activities; that is, whose interests may be positively or negatively affected as a result of the execution (or non-execution) of the project's decisions or activities.

- Complainant

Any individual, group of individuals, or structure affected directly or indirectly by the project activities as well as those who may have an interest in the project or the ability to influence its outcomes.

Objectives

- Establish a system for receiving, recording, and addressing complaints and concerns in a timely manner with special attention to vulnerable groups;
- To provide an efficient, transparent, timely, fair, and non-discriminatory system that would allow aggrieved persons to complain and avoid litigation;
- Promote the social and amicable resolution of complaints;
- Ensure the sustainability of the project's interventions and its ownership by the stakeholders;
- Provide clarification in response to requests for information.

Complaint Management Procedure

1. Access to information

During the course of project activities, stakeholders will be periodically informed of the ongoing complaint management mechanism. For example, stakeholders will be informed of the existence of a complaint management mechanism at the following events:

- reforestation operations
- plantation cleaning
- cinema-debate
- community radio programs
- project meetings (national and regional steering committees, project presentation to mayors and authorities)

During these events, stakeholders will be informed of the opportunity to communicate their complaints and grievances to the project manager.

2. Receipt and registration of the complaint

Informal handling of a complaint:

When an individual or group of individuals wish to refer a complaint, they should first approach the Oceanium relays or Oceanium staff who live in or near the village. The initial objective is to seek a resolution informally.

Formal complaint:

If it is not possible to resolve a complaint informally, or if the stakeholder does not feel it is appropriate to do so, they should raise the issue formally in writing to Oceanium through (1) the mayors, (2) local authority (like prefet) f, or (3) Oceanium project manager. The written complaint can be submitted anonymously, or by a third party on behalf of the grievant. The written complaint should contain details of the nature of the complaint and how they feel it could be resolved. The written complaint will be sent to Oceanium's institutional officer who sends the complaint to the zone chief who must write a report with his analysis of the situation. Then this report is sent to the project manager who proposes a solution. The booklet will contain a table according to the model below:

Table 12: Formal complaint table

Date of complaint	Name of complainant	Complainant's phone number	Grounds for complaint	Complainant's expectations of the complaint	Signature of complainant	date of return of the complaint	signature (when the complaint is returned)

The Zone Manager will call the complainant to a meeting to discuss the complaint with him/her. This will normally take place within 10 working days of receiving the complaint in writing. Complainants should be allowed to explain their complaint and how they think it might be resolved. The complainant may be accompanied by a third party if requested. After the meeting, the Area Manager (within 5 business days) will inform the complainant in writing of what action, if any, he/she has decided to take, along with a full explanation of how the decision was made. The complainant shall be informed that he/she may appeal (and to whom the appeal should be made) if he/she feels that the complaint has not been satisfactorily resolved.

Appeal

If the complainant wishes to appeal, he or she must notify the reasons for this appeal. This should be done within 5 business days of the written communication of the complaint hearing decision. Within 10 business days of receiving the appeal, an appeal meeting will be held. The appeal will be handled by Oceanium head office staff. If requested by the complainant, a third party mediator can be engaged to hear the appeal.

After the meeting, Oceanium (or the third party mediator) will notify the complainant in writing of the outcome of the appeal, no later than 10 business days after the appeal hearing. This decision is final.

3. Consideration of the complaint and return to the complainant

Whatever the method of handling the complaint (amicable, negotiation or justice), the person who received the complaint will have to give feedback to the complainant on the handling of his complaint. This feedback will be made within 15 working days. The feedback may be given by telephone or verbally and the date of the feedback on the complaint will be mentioned in the notebooks provided for this purpose and the escalation mechanism in the absence of an amicable resolution will be systematically reminded to the complainant. The table for receiving feedback on complaints is presented below:

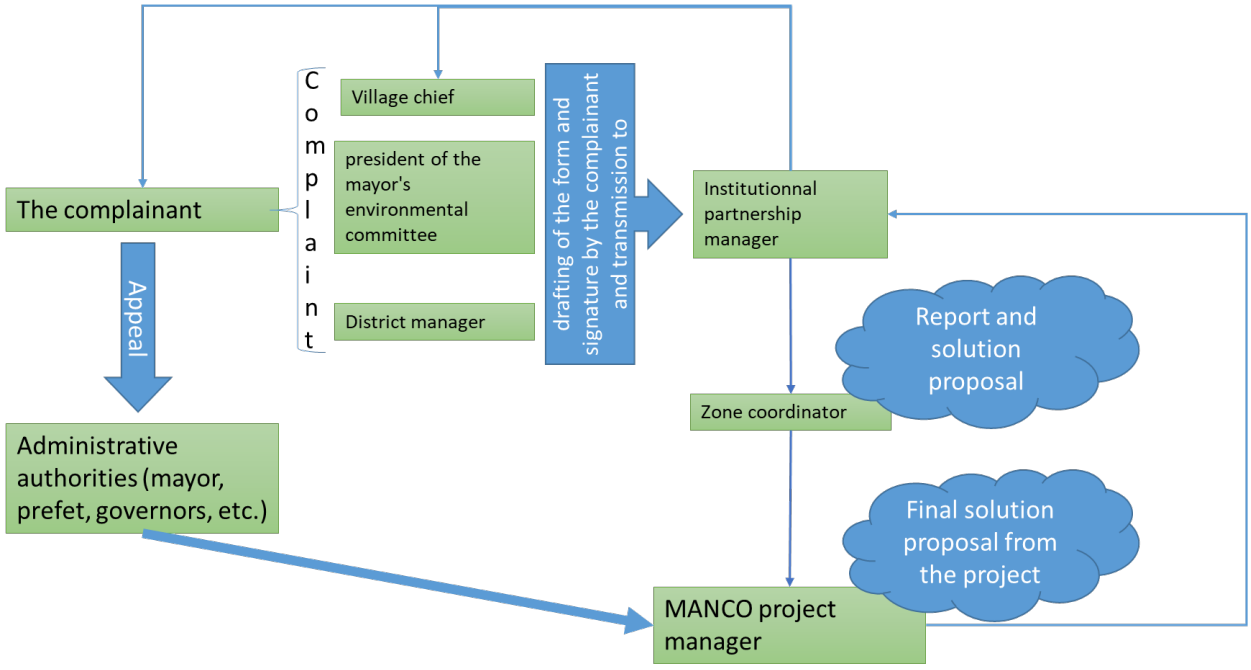


Figure 23: Complaint circuit

Table 13: List of project area managers to contact in the Sine Saloum

Name of Oceanium Zone Coordinator	Municipalities covered	Phone number	Place/ village of residence
ARAME SENGHOR	Mbam Djirnda Fimela Djilass Loul Sessene	774493132	Foundiougne

Table 14: List of project area managers to contact in Casamance

Name of the Oceanium Zone Manager	Covered municipalities	Phone number (+221)	Place/ village of residence
Youssouph Diedhiou, Oceanium Casamane coordinator	All the Casamance project area	77 970 22 76	Zlguinchor

The complaint form is available in Annex 3.

2.3.13 Accessibility of the Grievance Redress Procedure (G3.8)

The project will rely on elected municipal officials to inform communities about the grievance redress procedures. The elected municipal officials are drawn from all the villages in the project's communes and are responsible for sharing the information with their constituents. In order to ensure that the communities have a good knowledge of the project's grievance redress procedure, Oceanium and WeForest will organize meetings to present the project to all the municipal councils so that they can present the project and the grievance redress procedure to the populations. Graphical copies of the procedure will also be distributed in the communes.

Oceanium and WeForest will be responsible for ensuring that the elected representatives from the project villages share the information with the inhabitants. During Oceanium's field missions their teams will get closer to the elected officials in order to assess their level of knowledge and to provide them with additional information so that the populations can have the right information about the complaint management system.

During the project, grievances collected during the year will be presented to the members from the national and regional committees. The decision made for each grievance will also be shared during those committee meetings.

At the village level, records will be kept by the village chief on any complaint raised concerning the project. These records will be accessible to anyone who would like to see them. Residents will have the ability to reach out to the mayor, Oceanium staff, or the village chief if they have any complaint to address.

2.3.14 Worker Training (G3.9)

Different training events took place during the restoration campaign activities:

- Nursery training: All the 19 people recruited for the A*vicennia spp.* nurseries have been trained on seed collection, nursery management, pests, transportation, and replanting.
- Banana leaf sheaths: In 2021, 150 women were hired and trained to produce banana leaf sheaths for use in the *Avicennia* spp. nurseries.[82] This has the objective of making the nursery operations more environmentally sustainable. However, this activity was discontinued due to limited availability of banana leaves to meet the demands of the project.
- Storage training: One of the risks identified in the *Rhizophora* plantation is the quality of propagules. Oceanium staff are trained at the beginning of each plantation campaign to manage the storage of propagules. In addition, at the beginning of plantation, planters are trained on addressing the shortage of propagules and the identification of good propagules to be used for the plantation[83].

- Plantation training: Oceanium staff are training the planters for *Rhizophora spp.* and *Avicennia spp.* plantation (density, method of planting, etc.). A reforestation day can gather between 50 and 500 people (minimum 50 people per reforestation site)[84]. In the 2021 campaign for *Avicennia spp.*, the operations mobilized 2,189 men and women together.
- Monitoring training: The plantation monitoring methodology includes the density control, the mortality and survival calculations, environmental and physical characteristics, and the pests / disease identification attacks. Oceanium staff is trained to collect data and they are supervised by the Oceanium project manager. The Oceanium monitoring and evaluation officer is responsible for the data analysis and for the field training for Oceanium field staff. In addition, Oceanium field staff have been trained on KoBo Collect[85] to allow digitization of the plantation monitoring process. This training occurred in August 2021 and was

[82] The January-March Oceanium narrative report is available as supporting documentation, and includes the following: A two-day training was organized in the villages of Niambalang, Youtou, Kaguite, and Siganar to strengthen the capacities of 140 trainers, the majority of whom are women who will then be in charge of multiplying the training to 250 other people.

[83] See document named Avril-Juin 2020 narrative report part 2.1.1.4 as supporting documentation

[84] See Juin-sept 2020 narrative report available as supporting documentation

[85] See document named Rapport de formation sur KOBOTOOLBOX as supporting documentation

provided to the project manager, the project M&E officer, and the Casamance coordinator. In December 2021, the Oceanium project M&E officer trained the Sine-Saloum Oceanium staff on the use of KoBo Collect. For Casamance, the staff was trained by the Oceanium field coordinator on the use of KoBo Collect.

- First aid training: In April 2021, all the Oceanium permanent staff were trained in first aid by the Red Cross[86]. In May 2024, Oceanium will be trained again on first aid by the Red Cross.
- HSSE management plan training[87]: In July 2021, 23 Oceanium staff were trained[88] on the Oceanium heath, security, and environmental management plan. Each semester, Oceanium staff produces a document with all the incidents identified and the mitigation measures to avoid repeating those incidents. In May 2024, Oceanium staff will also be trained again to ensure that this HSSE management plan is well known by Oceanium staff.

2.3.15 Community Employment Opportunities (G3.10)

There are four main groups of employment opportunities generated by the project:

- Those related directly to reforestation activities, including propagules collection, nursery, and plantation activities.
- Direct activities derived from the improvements in fishing, oystering, non-timber product collection and selling, and beekeeping.
- Indirect activities due to the improvements in the mangrove ecosystem; local communities will have more fishing opportunities, oyster collection, beekeeping, and field cultivation thanks to the reduction in salinization.
- Opportunities derived from the project monitoring.

For the plantation activities, the project is mobilizing a large number of community members who are paid for those activities (e.g.: 2 189 people were engaged in the 2021 plantation campaign). A protocol that guarantees equal opportunities[89] was elaborated to avoid any discrimination and prevent any conflict among communities.

[86] See Oceanium first aid training evidence as supporting documentation

[87] See supporting documentation named HSSE training

[88] See Feuilles de présence formation HSSE CAS et SS as supporting documentation

[89] See politique de recrutement MANCO as supporting documentation

2.3.16 Relevant Laws and Regulations Related to Workers' Rights (G3.11)

The legal framework is the Senegalese Labour Code (Law No. 97-17 of December 1, 1997), in particular Title XI, which deals with health and safety at work, and the national interprofessional collective agreement of December 30, 2019.

Several texts on the subject have been adopted by the Senegalese State:

- Decree No. 2006-1249 of 15 November 2006 establishing minimum safety and health requirements for temporary or mobile construction sites.
- Decree No. 2006-1252 of 15 November 2006 laying down minimum requirements for the prevention of certain physical environmental factors.
- Decree no. 2006-1254 of 15 November 2006 on the manual handling of loads.
- Decree No. 2006-1256 of 15 November 2006 setting out the obligations of employers in terms of safety at work
- Decree No. 2006-1259 of 15 November 2006 relating to safety signaling measures at work.

Senegal's environmental code, law 2001-01 of 15 January 2001, title II, chapter III and IV on the protection and improvement of the environment.

Senegal is one of the 187 member states of the ILO, the only tripartite organization of the United Nations that designs international standards, policies, and programs to promote decent work.

2.3.17 Occupational Safety Assessment (G3.12)

Given the scale of the project, the number of people from the communities (5,900 planters), and the risks associated with plantation operations, Oceanium needed to strengthen its health, safety, and environmental management plan. A consultant was recruited[90] to help identify the risks linked to plantation operations and the Oceanium teams in charge of plantations were trained in this management plan. The HSSE plan aims to assist Oceanium's approach to improve the safety of staff and people involved in reforestation. The HSSE plan provides general guidance on precautions and procedures applicable to most situations encountered. All staff were also trained in first aid. In addition, all dugout canoes carrying staff have first aid kits and freshwater rations for the planters.

During tree planting, the workers face the risk of injuries from the heavy weights they have to carry and the exposure of planters to the sun. The risks posed by the plantation are assessed to be of a similar magnitude as those of their usual activities as fishermen, oyster collectors, or beekeepers.

A health and safety plan has been produced to identify, monitor, and manage the negative impact of these risks. The project HSSE management plan identifies the principal risks of the project for the workers and

[90] See contrat signée Oceanium et BIC as supporting documentation

proposes measures to mitigate them. Any new risks identified will be mitigated and the HSSE management plan will be improved over time. The Project HSSE management plan can be provided on request.

The community participation rate shows a genuine enthusiasm from the community to reforest the mangrove in their locality. A reforestation day can gather between 50 and 500 people (minimum 50 people per reforestation site). From July to September 2020, about 270 reforestation operations were carried out, involving approximately 15,000 people.

The risks and the mitigation measures to implement in the project can be reviewed in the supporting documentation.

To reduce risks associated with planting activities, Oceanium has put in place the measures listed below:

- Provision of first aid kits and life jackets in the canoes.
- Production and distribution of a sheet containing the contacts of the health centers and hospitals in the reforestation areas to the teams in charge of reforestation.
- Exchange with the assistance branch in Ziguinchor to organize first aid training in 2021.

The first version of the HSSE action plan was finalized in November 2020. In December 2020, the plan[91] was presented to the stakeholders (planters, boat drivers, others) to validate its content. The document[92] has been submitted for the approval of the Oceanium president.

For each campaign, the Oceanium teams fill in an incident log. The various incidents listed are analyzed[93] and the mitigating measures taken are evaluated. The incident logs are available at the various Oceanium field bases.

2.4 Management Capacity

2.4.1 Project Governance Structures (G4.1)

Proper governance of the project ensures the empowerment and involvement of all stakeholders in the project – this is key to the success of the project objectives.

The project proponent is WeForest, who has staff representation in Senegal. Their main objectives are to:

[91] See the PPT de la formation SSSE dispensée aux Staff d'Oceanium as supporting documentation

[92] See the système de management SSSE Oceanium as supporting documentation

[93] See Oct-Dec narrative report part 3.2 as supporting documentation

1) Ensure an up-to-date, fluid, and consistent connection between the field team (Senegal) and the main managers of the operation (Belgium).

2) Ensure correct implementation of all the proposed activities, together with the implementing partner (Oceanium).

3) Be directly aware of any incidents that may occur during the implementation of the project.

4) Have direct connection with different stakeholders, both with those who are in charge of the decision-making process (steering committees), and with those who are in charge of the implementation of the activities and the Monitoring Plan (the communities, mayors, and local structures and organizations).

5) Support in development and implementation of the monitoring plan, and reporting of the resulting information.

The project proponent will participate both in decision-making and in the implementation of activities and the Monitoring Plan, together with the actors and structures defined below:

Project implementation partner: The project implementation partner is Oceanium. Oceanium is a local organization with a very experienced team, which has participated in other environmental and social projects, including mangrove reforestation. Oceanium is responsible for engaging stakeholders and implementing the activities in the field.

Support and consultation partner: Agresta, a consultancy firm with expertise in forestry, is supporting Oceanium in the development of the project. Agresta, additionally, was responsible for the writing of the initial draft documents for auditing.

National Steering Committee: As indicated in the tripartite agreement between the Ministry of Environment and Sustainable Development of Senegal, Oceanium and WeForest, a National Project Steering Committee will be set up to cover all carbon projects in the country, made up of experts in the AFOLU sector. The Ministry of Environment and Sustainable Development will be responsible for the establishment of this committee, and will define its composition, functions, and operation. The National Steering Committee will ensure compliance with the contractual relationship between the participating municipalities and Oceanium, and revenue share of 10% of the certified carbon credits generated by the project, according to agreement with the different municipalities and communities, in collaboration with the regional steering committees. The first National Steering Committee meeting will take place before the first verification.

Among the main functions of the National Steering Committee are: 1) to be informed of the progress of the project; 2) to provide support to stakeholders in implementation of the project and ensuring adequate participation of all organizations involved; 3) align and coordinate the information received from the regional steering committees. The National Steering Committee will meet in person once a year.

Regional steering committees: Two regional steering committees will be set up, one for Sine-Saloum and the other for Casamance. These committees will have the function of improving the engagement of the actors at the regional level, trying a correct representation of all interests. They will also meet once a year.

These committees are expected to be the meeting place for all those interested in the project. In these committees all voices and opinions will be heard, which will be shared with WeForest and the National Steering Committee, to establish implementation priorities.

Communities: The project has signed agreements with 17 communities or municipalities. According to the tripartite agreement between the Ministry of Environment and Sustainable Development, all rights to use the carbon credits will be transferred to Oceanium and then to WeForest. The design of the benefit-sharing plan is dictated by the Tripartite Agreement signed with the Senegalese Government. Under this agreement, WeForest will retain 90% of these credits that will be mainly transferred to the investors who pre-funded the project activities, and the remaining 10% will be channeled to the communities for community development actions. The commercialization of 10% of the carbon credits will be managed based on direction of the National Steering Committee.

Mayors and local governments: The mayor is the representative of the State and the inhabitants living in the commune. In this capacity, he is responsible, under the authority of the Prefect, for:

- the publication and execution of laws, regulations, and decisions of the executive;
- the execution of general security measures;
- the special functions attributed to him by the laws and regulations.

The mayor is the representative of the commune. As such, he is responsible, under the control of the Municipal Council, for administering the commune, preparing, and executing the deliberations of the Municipal Council.

The Municipal Council, composed of councilors elected for five years by direct universal suffrage in accordance with the Electoral Code, is the deliberative body of the municipality. The election of the mayor and his deputies takes place by secret ballot and by an absolute majority. It is the inhabitants of the communes (composed by villagers) that elected their mayor. According to Article 29 of Law No. 96-07 of March 22, 1996 transferring powers to the regions, communes, and rural communities[94], the State of Senegal has transferred to the communes (i) the creation of woods and protected areas, (ii) reforestation operations, and the creation of communal woods.

Local structures and organizations: Oceanium has proven experience in planting mangroves with local communities and has created a relationship of trust and partnership with various grassroots community organizations in the village, at municipal, departmental, and regional levels. In addition, the project collaborates with youth, sports, and cultural associations. Each structure will reforest its own community,

[94]See Law No. 96-07 of 22 March 1996 transferring powers to the regions a supporting documentation in this link https://senegalservices.sn/storage/texte_references/loi-transfert-region.pdf

with the support of the project technicians. Payment is made per reforested area and the amounts are paid to the association or the village structure which will take care of the distribution according to the internal policy of its organization. To prevent elite capture, the amount of the payment is shared in front of all community members involved in planting and Oceanium relays express their availability in case of any payment distribution issue. Since 2020, only one case of inequitable distribution has been raised, and this was resolved by the project team.

Finally, these structures will also be involved in monitoring the results, also with technical support from the project.

2.4.2 Required Technical Skills (G4.2)

The essential technical skills to develop the project successfully include:

Table 15: Required technical skills

Strategic lines	Key skills required	Partner possessing Skills
A. Mangrove restoration and protection activities	Ability to organize plantations with a large number of people.	Oceanium
	Skills in reforestation to train the local community in the plantations.	Oceanium
	Knowledge of botany, biodiversity, and plant pathology.	Oceanium & Weforest
	Skills in GIS analysis and remote sensing.	Oceanium & Weforest
B. Local stakeholder identification and consultation activities	Ability to interact with a range of actors (governments, local communities, mayors, NGOs, etc.) to inform, engage, and resolve any dispute that might arise.	Oceanium & Weforest
	Communication tools skills.	Oceanium

Strategic lines	Key skills required	Partner possessing Skills
C. Social sphere and promotion of livelihoods and future well-being	Ability to develop projects with local populations. Knowledge of local markets and financial, social, and environmental sustainability. Health and safety training skills for wetland reforestation projects.Knowledge of business models and business plans.	Oceanium Eclosio Oceanium (Red Cross) Eclosio
D. Research, innovation, and development	Data analysis, research, and scientific training skills.	Weforest
E. Project implementation and monitoring.	Ability to coordinate and manage multiple tasks with tight deadlines, including organizing meetings with stakeholders. Technical skills in the development of carbon projects and environmental services to develop the documents needed for the validation (PDD, Monitoring Plan, GHG emissions, biodiversity, etc.). Skills on project monitoring, indicators, and evaluation.	Oceanium & Weforest Oceanium & Weforest Oceanium & Weforest
F. Support on sustainable resources use	Ability to coordinate and manage multiple tasks with tight deadlines, including organizing meetings with stakeholders. Technical skills in the honey, beekeeping, and oyster sector.	Oceanium & Weforest Eclosio

2.4.3 Management Team Experience (G4.2)

The management team has extensive experience in mangrove reforestation projects, including activities in Senegal.

WeForest[95] is implementing reforestation and afforestation projects in multiple countries around the world. Oceanium[96] was established in Senegal in 1984 and has participated in various mangrove reforestation projects in the same areas as this project. Agresta[97] has participated in mangrove reforestation, and CCB and VCS standards projects. Eclosio, which is implementing the socio-economic component of the project, has solid experience in supporting the integration of producers into the market system.

For more information about the project team, see Sections 2.1.3 and 2.1.4.

2.4.4 Project Management Partnerships/Team Development (G4.2)

All experience needs are covered by the main project partners (WeForest and Oceanium) or by external partners (Agresta S. Coop, Eclosio). In this way, the experience on plantations is widely covered by Oceanium, which has been managing large mangrove reforestation projects for around 15 years, and has dealt with local communities since its creation in 1984. Agresta S. Coop. has provided assistance to PD developers for more than 10 years. Eclosio, formerly Gembloux Development Aid, was set up in 1986 on the initiative of the Gembloux University Faculty of Agronomic Sciences. It has carried out numerous projects to promote food sovereignty for local populations.

The recommendations of the market study[98] led WeForest to recruit an operator to implement the project's livelihood activities. As recommended by the study, the choice of seeking collaboration with Eclosio[99] was justified by the need to have a partner with proven experience in supporting small producers and entrepreneurs in the project area. Eclosio supports, with the help of its local partners, vulnerable families and their organizations in order to:

- develop income-generating agro-ecological activities that are not dependent on external factors and that respect the environment;
- benefit from a decent income, particularly through the processing and marketing of their production;
- benefit from a healthy and balanced diet, with particular emphasis on the role of women as guarantors of the nutritional health of their families;
- support local dynamics and territorial development for and by the communities;
- professionalize themselves through quality training and support in finding sustainable employment;
- defend their interests by lobbying the public authorities.

[95] https://www.weforest.org/

[96] https://www.au-senegal.com/oceanium,1190.html?lang=fr

[97] https://agresta.org/

[98] See rapport final- étude marché as supporting documentation

[99] https://www.eclosio.ong

Following the terms of reference[100] proposed by WeForest, Eclosio has elaborated a detailed proposal for a project covering an initial two-year pilot phase. Its technical and financial offer is attached to this document.

Finally, the project has the support of the Ministry of the Environment and Sustainable Development, certified through the signed tripartite agreement. The Ministry has among its tasks, managing the protected areas (Sine-Saloum Biosphere Reserve and Marine Protected Area – MPA – Niamone Kalounayes). All plantation plots in Sine-Saloum belong to the Biosphere Reserve and 51.7% of the plantation plots in Casamance belong to the MPA. For this reason, the project will be assisted by the Ministry and the professionals in charge of the protected areas to provide the best technical support and management. Both parties seek to achieve a common objective: “restore degraded wetlands and to improve soil and environmental conditions, restoring ecological services and enhancing biodiversity.”

2.4.5 Financial Health of Implementing Organization(s) (G4.3)

This information is described in the risk report.

2.4.6 Avoidance of Corruption and Other Unethical Behavior (G4.3)

In the contract signed between Oceanium and WeForest, Annex 5 mentions that each Party agrees and warrants that it and its Affiliates, and their respective directors, officers, employees, and personnel, have not made, offered, or authorized, and will not make, offer, or authorize, in respect of the matters covered by this Agreement, any payment, gift, promise, or other advantage or thing of value, whether directly or through any other person or entity, to or for the use or benefit of any public official (such as any person exercising a legislative, administrative, or judicial function, including any person employed by or acting on behalf of a public body, public enterprise, or public international organization) or any official of a political party or candidate for public office, or any member of the official’s or candidate’s immediate family, including any payment, gift, promise, advantage, or thing of value intended to influence or reward any discretionary act or decision of that person or organization, or to obtain an improper or inappropriate advantage, in violation of that party’s internal policies.

In the tripartite agreement between Oceanium, WeForest, and the Ministry of Environment and Sustainable Development, article 12 deals with the anti-corruption policy. It is written that the parties undertake to comply with all laws and regulations in terms of ethics, transparency, the fight against corruption, fraud, and money laundering. The parties also undertake to implement the necessary measures adapted to avoid any violation of the aforementioned measures, in particular the anti-corruption legislation (Law No. 2015-16 of July 6, 2015).

WeForest has a Code of Conduct for professional ethics that all staff members and consultants are expected to sign and adhere to.

[100] See TDR mise en oeuvre de la composante livelihoods - projet MANCO as supporting documentation

2.4.7 Commercially Sensitive Information (Rules 3.5.13 – 3.5.14)

No sensitive information has been generated nor excluded from the public version of the project.

2.5 Legal Status and Property Rights

2.5.1 Statutory and Customary Property Rights (G5.1)

The ownership and access or use of resources belong to different entities. The project is implemented in areas of national public domain and the communities have GHG removal rights, which have been transferred to Oceanium by contractual agreement. Oceanium, in turn, transfers them to WeForest, also by contractual agreement. Rights to use 10% of the carbon credits will be dedicated to communities that will identify in which type of project they would like to invest the revenue from credit sale. This process will be guided by the National Steering Committee, and further information can be found in Section 2.4.1.

Although the project land belongs to the public domain, the communities have the rights of use and access to resources such as fishing, wood for firewood, or the collection of oysters and other mollusks. In this sense, the signing of a tripartite agreement between the Ministry of Environment and Sustainable Development, WeForest, and Oceanium, further ensures the complete availability of land and resources. Furthermore, 17 agreements have been signed with the municipalities and communities, in which they commit to the execution of the project in conjunction with Oceanium and WeForest. All these agreements ensure that:

1) Land and resources are fully available to implement project activities.

2) The areas in the plantation plots will be used for the purpose of the project (the regeneration of the mangrove), and not for other uses unrelated to the project activities.

2.5.2 Recognition of Property Rights (G5.1)

The lands chosen as the project area belong to the lands of public domain. Officially, according to Law No. 64-46 of 1964, the tripartite agreement signed between the government, WeForest, and Oceanium takes into account its execution in areas of public domain, with permission of exploitation and sustainable use by the communities, according to the agreement and in the forestry code of Senegal.

Property rights to land and resources are recognized and respected in this project. In this sense, and to ensure this, 17 agreements have been signed with each of the municipalities where the plantation plots are located, and one (1) tripartite agreement, between the Ministry of Environment and Sustainable Development, WeForest, and Oceanium, has been signed to ensure accessibility to both lands and the resources they host.

The carbon rights to the project proponent have been confirmed by the authorization agreement signed in the tripartite agreement on October 8, 2021.

2.5.3 Free, Prior and Informed Consent (G5.2)

The official start date of the project was July 2020. By that date, Oceanium and WeForest had already reached agreements with the 17 municipalities where the plantation plots are located. The agreements were signed between Oceanium and each of the communities involved. These agreements, added to the tripartite agreement between the national government, WeForest, and Oceanium, ensure the legality of all actions.

Apart from the meetings to present the project to the mayors and public institutions, cinema debates were organized in the 17 communes of the project. These cinema debates were an opportunity to present the project to each community and raise awareness about the degradation of mangroves. Following the screening of the film and the presentation of the project, the communities expressed their willingness to participate in the project and provided their consent for the project implementation.

The process of signing the agreements was informed and consented to with the communities. In this sense, several communication channels have been implemented with the residents of the towns that will participate in the project (see the communication plan, included in supporting documentation, for more information).

Finally, this project includes the provision of allocating 10% of the sales of the carbon credits generated to the communities, so that they can implement social and local development projects.

All this is included in the agreements, so that, as prioritized in the Convention on Biological Diversity (CBD), signed in 1992 by 196 countries, including Senegal, there is an adequate distribution of the benefits generated by the use of biodiversity.

2.5.4 Property Rights Protection (G5.3)

The project area belongs to the state[101]. Communities have the rights of use of natural resources [102], and agreements have been signed with all parties involved which give their consent and approval, and show their participation and convenience with the project. Therefore, the project ensures that project activities will not lead to involuntary removal or relocation of property rights holders from their lands or territories, and does not force rights holders to relocate activities important to their culture or livelihood.

[101] See Law 64-46 (June 17, 1964), page 3 as supporting documentation. In this law, it is written that 95% of the lands belong to the state. In addition, the plantation areas have been selected to belong to the Public Domain, in a joint consultation between the communities, Oceanium, and the Government of Senegal.

[102] See Loi n° 2018-25 du 12 novembre 2018 portant Code forestier (Senegal forestry code) as supporting documentation.

2.5.5 Illegal Activity Identification (G5.4)

The parties involved in the project do not carry out illegal activities in the project area or in nearby mangrove areas. However, possible incursions by foreign people who extract the resources (such as for hunting and fishing) have been reported, with the possibility of degrading the mangrove.

As currently 100% of the project area in Sine-Saloum and more than 50% of the project area in Casamance belong to protected areas, the project will work together with the government and the communities involved to obtain evidence and protect the areas against possible illegal activities or non-consensual use or exploitation.

2.5.6 Ongoing Disputes (G5.5)

Not applicable. There was no current dispute at the beginning of the project in the project area.

2.5.7 National and Local Laws (G5.6)

The major policy instruments that structure the management and conservation of natural resources in Senegal are the Plan Senegal Emergent (PSE Vert) and sectoral policies (environmental, forestry, sustainable development, decentralization, wetlands, and biodiversity). These policy instruments place particular emphasis on:

- deepening knowledge of natural resources;

- development of natural resources;

- the fight against the degradation of the environment and natural resources;

- meeting the needs of communities in terms of biological diversity resources;

- strengthening the institutional and technical capacities of actors in the implementation of actions for the conservation of the environment and natural resources;

- promotion of livelihoods;

- the resilience of vulnerable groups.

Several legal instruments govern the management of natural resources. The main instruments are:

- Law No. 2001-01 of January 15, 2001 on the Environment Code
- Law No. 2018-25 of November 2, 2018 on the Forest Code
- Law No. 86-04 of January 24, 1986 on the Code of Hunting and Wildlife Protection
- Law No. 2015-18 of July 13, 2015 on the Maritime Fisheries Code, their implementing texts
- Law of National Dominion 64-46
- Law for the creation of rural communities 72-25

- the relevant conventions ratified by Senegal. The main ones, in relation to this project, are:
    - the convention on wetlands of international importance (Ramsar, 1971)[103];
    - the International Convention on Endangered Flora and Fauna Species (CITES);
    - the RIO Convention on Biodiversity (1992);
    - the United Nations framework convention on climate change (1992);
    - the convention to combat desertification (1994);
    - the convention on the protection of the world heritage;
    - the United Nations convention on the rights of the sea (Montego Bay, 1982)[104].

These documents describe how to carry out the conservation and sustainable use of environmental resources and biodiversity in Senegal. Among the main rules are the following:

- "Forest management aims at the rational exploitation of forest resources"
- "For forests managed by a municipality or a rural community, the exploitation of forest products is subject to the prior authorization of the mayor or the president of the rural council".

The objectives of the project and its associated activities are fully aligned with local, national, and international law as they seek:

1. to mitigate climate change by the removal of GHG through biomass growth;
2. to improve the well-being of local communities by creating job opportunities, increasing available natural resources, improving livelihoods, and enhancing the capacities of resident women and men;
3. to restore degraded wetlands and to improve soil and environmental conditions, restoring ecological services and enhancing biodiversity, providing monitoring that ensures a good state of conservation.

Through the Monitoring Plan (see Section 5.4), indicators have been chosen that will ensure compliance with these objectives and that are aligned with the law.

The government of Senegal has signed an agreement with the project and is alert about its execution. The project will communicate the progress and results to the government through the steering committees. Likewise, through these committees, the government can participate in possible changes in activities in case not all laws are being complied with. The committees meet in person once a year.

According to the tripartite agreement signed between the government, WeForest, and Oceanium, The Environment Directorate of the Ministry of Environment and Sustainable Development (Government of Senegal) will ensure compliance with the implementation of this framework agreement on behalf of the

[103] Which entered into force in Senegal on 11/11/1977 with the aim of preventing wetlands of international importance as habitat for waterfowl from being subject to destructive interventions.

[104] Which creates explicit rules as well as a complete legal order for seas and oceans, and establishes environmental standards especially on pollution of the marine environment.

government of Senegal and will ensure the environmental assessment of the project and the implementation of the related environmental management framework. It will also support, in collaboration with the National Committee on Climate Change, all verification and certification operations, and the avoidance of double counting of emission credits, within the limits of available resources.

2.5.8 Approvals (G5.7)

The project has been approved by parties. In this way, there are the following signed agreements:

1. Tripartite agreement between the government of Senegal, WeForest, and Oceanium
2. Agreements with 17 communities

For more information on these agreements, please review the supporting documentation.

2.5.9 Project Ownership (G5.8)

In Senegal there are three types of land tenure:

- the lands of the national domain governed by Law No. 64-46 of June 17, 1964. The national domain constitutes a vast space which included, at the time of its constitution in 1964, more than 95% of the Senegalese territory. National domain is subdivided into public domain (ex: roads, seas, natural resources like oil and gas) and private domain (state building, hospitals, schools etc.).

- private land, subject to land titles belonging to individuals and constituted on the basis of the decree of July 26, 1932, now replaced by Law No. 2011-07 of March 30, 2011 on the land ownership regime. Private land represents 5% of the Senegalese territory.

The tripartite agreement signed between the government, WeForest, and Oceanium takes into account its execution in areas of public domain, with permission of exploitation and sustainable use by the communities, according to the agreement and in the forestry code of Senegal. Below are some key provisions of the tripartite agreement:

- The project is being implemented on national domain in Senegal. The land will therefore remain the property of the State.
- In accordance with the signed tripartite agreement: 10% of the carbon credits that will be generated during the thirty (30) years following the start of the project will be retroceded to the communes covered by the project; and 90% of the carbon credits that will be generated during the thirty (30) years following the start of the project will be retroceded to WeForest to cover operational costs.
- The management of the project and the achievement of the results is the responsibility of WeForest and Oceanium according to the means at their disposal.

2.5.10 Management of Double Counting Risk (G5.9)

This project will not seek to generate and has not received any form of environmental or social credit.

The tripartite agreement signed between the Government, Oceanium, and WeForest states clearly that none of the contributions will be double counted. The Government states that it will proceed with corresponding adjustments and won't use the project for its NDC:

The article 6 from the Convention signed with government defines the conditions regarding the NDC:

"This agreement falls within the framework of the voluntary carbon market system and the Verified Carbon Standard of the VERRA association. This implies that the State of Senegal:

• Authorizes WeForest to issue these credits in the VERRA carbon standard registry, directly to an account held by WeForest.

• Authorizes WeForest and any buyer of these credits to transfer them internationally.

• Authorizes the use of these credits for purposes other than the fulfillment of the NDC.

• Will make the necessary accounting adjustments to prevent any risk of double counting"

2.5.11 Emissions Trading Programs and Other Binding Limits

The project will not seek to generate or to receive any form of environmental credits and the GHG emission removals generated by the project will not be used for compliance under such programs or mechanisms.

2.5.12 Other Forms of Environmental Credit

The project has not sought or received another form of GHG-related environmental credit, including renewable energy certificates.

2.5.13 Participation under Other GHG Programs

The project has not been registered, and is not seeking registration under any other GHG programs.

2.5.14 Projects Rejected by Other GHG Programs

The project has not been rejected by any other GHG programs.

2.5.15 Double Counting (G5.9)

The credits generated from the project will be sold as offsets on the VCS registry, and the series number of the issued credits will be tracked to avoid any potential double counting. The Government signed a

contract that stipulates that corresponding adjustments will be done according to the carbon credits volume issued.

3 CLIMATE

3.1 Application of Methodology

3.1.1 Title and Reference of Methodology

The methodology used in this VCS ARR and WRC (RWE) project is the CDM Afforestation and Reforestation Large-scale Methodology: AR AM0014 “Afforestation and reforestation of degraded mangrove habitats, version 3.0.” The project adheres to the ARR and WRC requirements of the VCS.

The project will shift to the VM0033 Methodology for Tidal Wetland and Seagrass Restoration at first verification.

The following methodological tools, to which the selected methodology refers, are used:

- Combined tool to identify the baseline scenario and demonstrate additionality in A/R CDM project activities, v1.0.
- Estimation of non-CO_2 GHG emissions resulting from burning of biomass attributable to an A/R CDM project activity, v4.0.0.
- Estimation of carbon stocks and change in carbon stocks of trees and shrubs in A/R CDM project activities, v4.2 (AR TOOL14).
- Estimation of carbon stocks and change in carbon stocks in dead wood and litter in A/R CDM project activities, v3.1 (AR TOOL12).
- Estimation of the increase in GHG emissions attributable to displacement of pre-project agricultural activities in A/R CDM project activity, v2.0.

Other A/R CDM tools used are:

- Demonstrating appropriateness of allometric equations for estimation of aboveground tree biomass in A/R CDM project activities, v1.0.1.
- Calculation of the number of sample plots for measurements within A/R CDM project activities, v2.1.0.

Default values provided by the VCS Tidal Wetland and Seagrass Restoration methodology (VM0033) are also used.

3.1.2 Applicability of Methodology

The project meets the applicability conditions of the methodology:

- Applicability Conditions of AR-AM0014

a) The land subject to the project activity is degraded mangrove habitat.

According to the literature consulted[105], mangroves have been reduced since the 1980s in the project area due to multiple degradation factors, such as drought in the 1970s and 1980s, infrastructure construction (roads or hydro-agriculture), and other anthropogenic activities, including deforestation for firewood and construction timber, mangrove clearing for fish smoking, unsustainable oyster collection, and some other fishing practices.

b) More than 90% of the project area is planted with mangrove species. If more than 10% of the project area is planted with non-mangrove species, then the project activity does not lead to alteration of hydrology of the project area and hydrology of connected up-gradient and down-gradient wetland area.

The first project activity instance conducts planting between 2020 and 2022. One hundred percent of the project area is planted with mangrove species. The proposed species distribution is the following:

- 75% *Rhizophora mangle*
- 15% *Rhizophora racemosa*
- 10% *Avicennia germinans*

No flooding, excavation, drainage, ditch blocking, or any other direct activity involving alteration of hydrology is planned. The only project activity is the planting of seedlings.

c) Soil disturbance attributable to the project activity does not cover more than 10% of area.

Planting activities will be conducted manually by the local community in the project area and there will be no need to dig holes. Thus, soil treatment is not required, and no soil disturbance caused by the project activity is expected.

Applicability conditions of the tools contained in the methodology and applied by the project activity must also be complied with.

- Applicability conditions of the tools used

Combined tool to identify the baseline scenario and demonstrate additionality in A/R CDM project activities, v1.0 is applicable under the following conditions:

[105] EL Hadji Balla Dieye, Amadou Tahirou Diaw, Tidiane Sané et Ngor Ndour, « Dynamique de la mangrove de l'estuaire du Saloum (Sénégal) entre 1972 et 2010 », *Cybergeo: European Journal of Geography* [En ligne], Environnement, Nature, Paysage, document 629, mis en ligne le 09 janvier 2013, consulté le 14 juin 2024. URL : http://journals.openedition.org/cybergeo/25671 ; DOI : https://doi.org/10.4000/cybergeo.25671

a) Forestation of the land within the proposed project boundary performed with or without being registered as the A/R CDM project activity shall not lead to violation of any applicable law even if the law is not enforced.

The project follows applicable legal and regulatory requirements as demonstrated in Section 2.5.7.

b) This tool is not applicable to small-scale afforestation and reforestation project activities.

This project is a large-scale project based on CDM rules (Section 2.1.2).

- Estimation of non-CO_2 GHG emissions resulting from burning of biomass attributable to an A/R CDM project activity, v4.0

a) The tool is applicable to all occurrences of fire within the project boundary.

b) Non-CO_2 GHG emissions resulting from any occurrence of fire within the project boundary shall be accounted for each incidence of fire which affects an area greater than the minimum threshold area reported by the host Party for the purpose of defining forest, provided that the accumulated area affected by such fires in a given year is ≥5% of the project area.

Biomass burning is not an emission source in this project, and therefore this tool is not applied.

- Estimation of carbon stocks and change in carbon stocks of trees and shrubs in A/R CDM project activities, v04.2 (AR TOOL14)

This tool has no internal applicability conditions.

- Estimation of carbon stocks and change in carbon stocks in dead wood and litter in A/R CDM project activities, version 03.1 (AR TOOL12)

This tool has no internal applicability conditions.

- Estimation of the increase in GHG emissions attributable to displacement of pre-project agricultural activities in A/R CDM project activity, v2.0

This tool has no internal applicability conditions.

- Demonstrating appropriateness of allometric equations for estimation of aboveground tree biomass in A/R CDM project activities, v1.0

This tool has no internal applicability conditions

- Calculation of the number of sample plots for measurements within A/R CDM project activities, v2.1

This tool has no internal applicability conditions.

Therefore, AR-AM0014, v3.0 is applicable for the proposed project.

As a combined ARR+RWE project, the project meets all the WRC requirements in v4.4 of the VCS Standard. As a project located in the coastal zone, the impact of expected sea level rise (SLR) on the planted boundary and carbon stocks, in terms of both loss and gain, have been incorporated into the ex-ante carbon calculations presented in this section. This SLR assessment also confirms the permanence of the soil organic carbon stocks by demonstrating that the CO_2 removals being claimed by the project do not exceed the difference between the baseline and project scenarios at t=100. The project does not alter the hydrology of the project area or adjacent lands, therefore the project will neither be impacted nor impact hydrologically connected areas.

The project will migrate to the VCS tidal wetland methodology, VM0033, at first verification

3.1.3 Project Boundary

ARR+RWE project boundary

The project grouped project area and initial project activity instances are defined in Section 2.1.7 and illustrated in Figures 5 and 6. The initial project activity instances cover an area of 7,019.80 ha.

Geographic boundaries and sea level rise:

An assessment of the impact of sea level rise on project boundaries and carbon stocks has been completed over a period of 100 years (2020-2120). The full details of the mapping and modeling components of this assessment can be found in an Annex. A publicly available digital terrain model (DTM), DeltaDTM[106], was used to complete this analysis. The DeltaDTM has a ground spatial resolution of 1 arc-second (approximately 30 m). Using this DTM, together with the 2020 mangrove extents in the Sine-Saloum and Casamance estuaries as provided by Global Mangrove Watch[107], the current elevation ranges of mangroves near the project area were determined for both estuaries. In Sine-Saloum it's estimated that mangroves currently exist within an elevation range of 0.1-1.3m relative to mean sea level (MSL) whilst in Casamance they exist within 0-0.9m relative to MSL.

To estimate the changes in these elevations due to SLR, the NASA sea level projection tool[108] was used, which depicts the median projections of global and regional SLR relative to a 1995-2014 baseline as per the IPCC 6th Assessment Report. The SLR scenario conservatively used for this analysis was the IPCC's SSP5-8.5, which is a high reference scenario that represents a "business-as-usual" scenario with high

[106] Pronk, M. et al. (2024). DeltaDTM: A global coastal digital terrain model. *Scientific Data*, *11*(1), 273.

[107] Bunting, P. et al. (2022). Global Mangrove Extent Change 1996 – 2020: Global Mangrove Watch Version 3.0. Remote Sensing.

[108] https://sealevel.nasa.gov/ipcc-ar6-sea-level-projection-tool?lat=-19&lon=%2037&data_layer=scenario

greenhouse gas emissions and no additional climate policy. The tool's SLR projection predicts a rise of 1.03 m by 2120 on the coast of Senegal. Given that both estuaries contain rivers with sediment loads that are deposited within the intertidal areas and there is a lack of site-specific data on sediment deposition rates, global analyses were referenced and it was assumed that mangroves can maintain elevations at 50% of the SLR rate. The evolution of SLR over the 100-year analysis period together with the resulting effect on mangrove elevation range in each estuary is summarized in Table 16.

Table 16: Cumulative decadal sea level rise (SLR) for Senegal according to IPCC SSP5-8.5 SLR projection and the impact this has on mangrove elevation ranges in the two estuaries

Year	Cumulative SLR (m)	Cumulative SLR (m) assuming 50% accretion	Predicted mangrove elevation range (m) – Sine-Saloum	Predicted mangrove elevation range (m) – Casamance
2020	0.0	0.0	0.1 - 1.3	0 - 0.9
2030	0.11	0.055	0.155 - 1.355	0.055 - 0.955
2040	0.17	0.085	0.185 - 1.385	0.085 – 0.985
2050	0.25	0.125	0.225 - 1.425	0.125 - 1.102
2060	0.33	0.165	0.265 - 1.465	0.165 - 1.065
2070	0.43	0.215	0.315 - 1.515	0.215 - 1.115
2080	0.54	0.27	0.37 - 1.57	0.27 - 1.17
2090	0.66	0.33	0.43 - 1.63	0.33 - 1.23
2100	0.8	0.4	0.5 - 1.7	0.4 - 1.3
2110	0.9	0.45	0.55 - 1.75	0.45 - 1.35
2120	1.03	0.515	0.615 - 1.815	0.515 - 1.415

Using the predicted mangrove elevation ranges detailed in Table 13 and the DeltaDTM, in ArcGIS Pro the geographical extent of these elevation ranges were mapped in the initial project activity instances every 10 years, from 2020-2120. When an area goes from being within these mangrove elevation ranges to being below the lower end of the range, it is assumed that any mangroves within these areas are submerged. Table 17 details the areas within the initial activity instances that are submerged at each 10-year interval.

In addition to submergence, with increasing SLR and tidal inundation it is assumed that erosion along channel edges will occur within both estuaries. No data are currently available for the rate of erosion within either estuary. However, estimates of coastal erosion have been calculated by several authors. Ankrah et al. (2023)[109] examined erosion rates near the mouths of the Sine-Saloum and Casamance rivers and calculated rates of -3.56 m yr^{-1} and -1.28 m yr^{-1}, respectively. Similarly, Luijendijk et al. (2018)[110] calculated a country-level erosion rate of -1.6 m yr-1. Given the coastal zones are inherently a higher energy environment than the sheltered channels that traverse the project area, visual inspection of the project area in Google Earth Pro indicates an erosion rate in Sine-Saloum of approximately -1.7 m yr^{-1} and little erosion was observed within Casamance. Based on the published values and the visual inspection, a conservative annual erosion loss of -1 m y^{r-1} has been used in this analysis. The areas within the initial activity instances lost due to erosion in each decade of the analysis period are detailed in Table 18.

Table 17: The areas planted by the project that are predicted to be submerged due to SLR at every ten-year interval of the 100-year permanence period, according to IPCC SSP5-8.5 SLR projection.

	Planted area submerged within PA (ha) – Sine Saloum	**Planted area submerged within PA (ha) – Casamance**	**Planted area submerged within PA (ha) – Both estuaries**
2020-2030	-2,963	-1,328	-4,291
2030-2040	-120	-128	-248
2040-2050	-142	-178	-320
2050-2060	-118	-197	-315
2060-2070	-123	-245	-368
2070-2080	-95	-258	-353
2080-2090	-73	-253	-326
2090-2100	-61	-227	-288
2100-2110	-27	-131	-158
2110-2120	-24	-115	-139

[109] Ankrah, J. et al. (2023). Shoreline Change and Coastal Erosion in West Africa: A Systematic Review of Research Progress and Policy Recommendation. Geosciences 13:59.

[110] Luijendijk, A. et al. (2018). The state of the world's beaches. Scientific Report 8: 6641.

Table 18: Area lost within the initial project activity instances between decades due to erosion assuming a loss rate of 1 m yr^{-1}.

Year	Sine-Saloum (ha)	Casamance (ha)	Both estuaries (ha)
2020-2030	-30	-15	-45
2030-2040	-59	-24	-83
2040-2050	-77	-32	-109
2050-2060	-86	-38	-124
2060-2070	-90	-41	-131
2070-2080	-92	-42	-134
2080-2090	-91	-43	-134
2090-2100	-90	-44	-134
2100-2110	-89	-43	-132
2110-2120	-87	-43	-130

If elevation, land-use and hydrological conditions are favorable, mangroves have the capacity to expand laterally in response to rising sea levels. Therefore, based on expert judgment[111] it is also assumed that, with SLR, mangroves within the initial activity instances will have the capacity to expand to higher elevations at a lateral expansion rate of 100 m per decade. Using ArcGIS Pro, 100 m decadal buffers were generated from the edge of each project area polygon. Channels and areas with existing mangroves (2020 Global Mangrove Watch extent) were clipped from the buffers, as were areas that were not immediately connected to the project area (i.e. buffer area that extends across a channel). Areas that overlap with other registered VCS projects were excluded from the buffer zones, as were any areas currently under human use, as per visual inspection in Google Earth Pro.

The areas gained and those submerged within these buffer zones were calculated over each decade in the 100-year analysis period based on the areas within the estimated mangrove elevation range for each estuary assuming the SLR rate that accounts for accretion.

[111] Dr. Lisa Beers, wetlands ecologist at Silvestrum Climate Associates

This analysis was limited to the 300 m buffer zone (Figure 24), due to uncertainties regarding the capacity of the project to secure the necessary ownership rights to incorporate the area within the project. Thus, for the first 30 years of the project, the buffer zone expands by 100 m every decade. After this, the area of analysis remained fixed (Table 19).

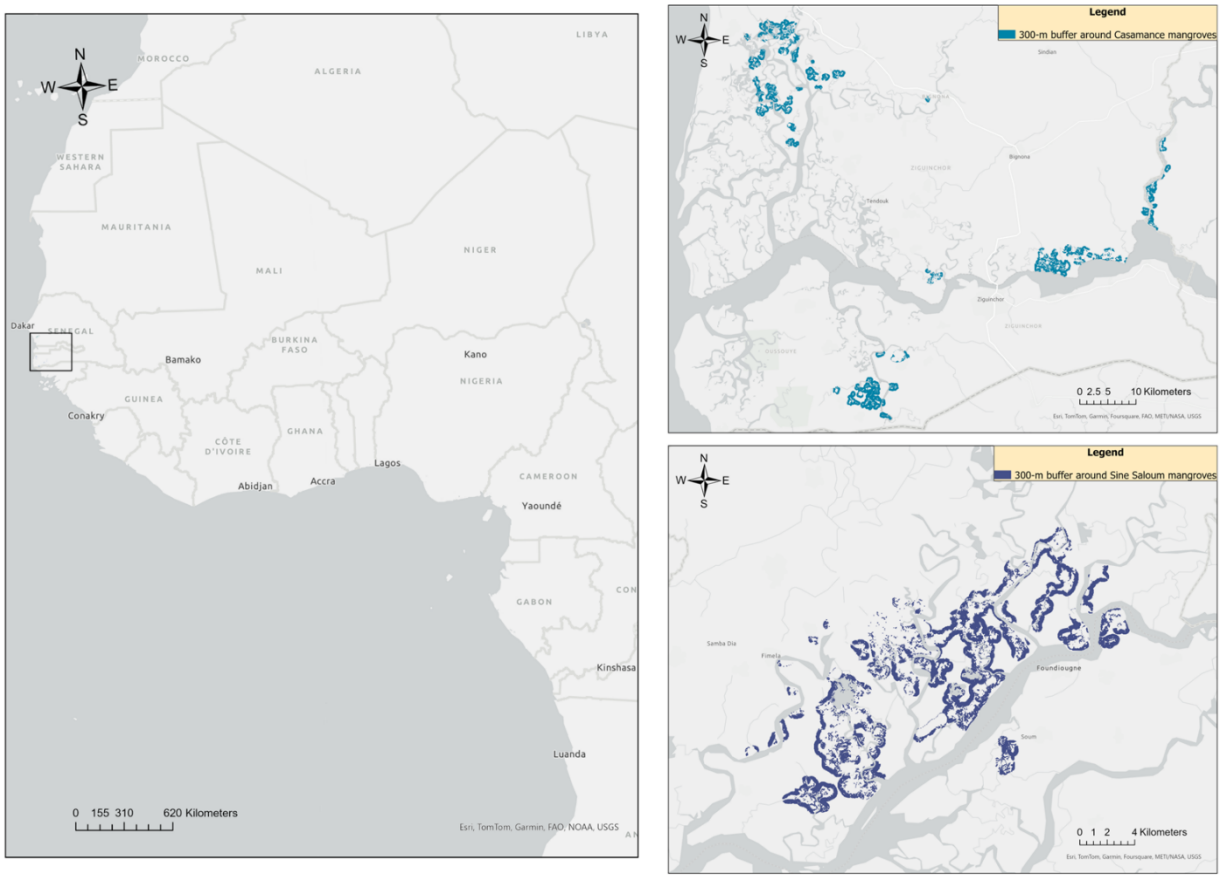


Figure 24: Map showing the 300m buffer zone areas

Table 19: The areas of the buffer zones that are predicted to be gained and submerged due to SLR at every ten-year interval of the 100-year permanence period, according to IPCC SSP5-8.5 SLR projection.

Year and buffer zone size	Sine-Saloum Buffer		Casamance Buffer		Total Buffer Zone	
	Mangrove gain (ha)	**Mangrove sub. (ha)**	**Mangrove gain (ha)**	**Mangrove sub. (ha)**	**Mangrove gain (ha)**	**Mangrove sub. (ha)**
2020-2030 (100m)	1,374	N/A	2,909	N/A	4,283	N/A
2030-2040 (200m)	1,312	124	2,156	182	3,467	306

2040-2050 (300m)	1,253	269	1,803	418	3,056	687
2050-2060 (300m)	15	345	23	618	38	963
2060-2070 (300m)	18	437	25	814	43	1,251
2070-2080 (300m)	18	456	22	889	40	1,345
2080-2090 (300m)	15	449	22	915	37	1,365
2090-2100 (300m)	15	430	21	930	36	1,360
2100-2110 (300m)	8	245	12	560	20	806
2110-2120 (300m)	11	254	14	536	25	789

As with the initial project activity instances, it is also assumed that erosion due to SLR will impact the buffer zones. Using the same assumptions as with the initial project activity instances, Table 20 details the areas of the buffer zones predicted to be lost due to erosion over the 100-year analysis period.

Table 20: Area lost within the buffer zones between decades due to erosion assuming a loss rate of 1 m yr^{1}.

Year	**Sine-Saloum (ha)**	**Casamance (ha)**	**Both estuaries (ha)**
2020-2030	-60	-68	-128
2030-2040	-78	-92	-170
2040-2050	-75	-89	-164
2050-2060	-66	-78	-144
2060-2070	-59	-70	-129
2070-2080	-55	-67	-122
2080-2090	-52	-65	-117
2090-2100	-52	-64	-116
2100-2110	-52	-64	-116

2110-2120	-52	-64	-116

This analysis, together with visual inspection of the elevation ranges and trends within the two estuaries, suggests a dynamic environment, with both mangrove losses and gains over a 100-year period. Given these findings and the potential for significant soil organic carbon sequestration as mangroves migrate inland due to SLR, these buffer zones may be added as subsequent project activity instances at first verification. Therefore, the ex-ante carbon calculations presented in this PD account for project CO_2 emissions and removals across both the initial project activity instances and the 300 m buffer zones.

GHG Boundaries:

The relevant GHG sources, sinks, and reservoirs for the project and baseline scenarios are presented below.

Table 21: Baseline and project carbon pools

Source		Gas	Included?	Justification / Explanation
Baseline	Above and belowground biomass	CO_2	Yes	Major carbon pools subject to the project activity
		CH_4	No	This is not a requirement of the methodology
		N_2O	No	This is not a requirement of the methodology
	Dead wood	CO_2	Yes	Carbon stock in this pool may increase in the baseline
		CH_4	No	This is not a requirement of the methodology
		N_2O	No	This is not a requirement of the methodology
	Litter	CO_2	No	Due to tidal influence, the litter biomass is subject to high turnover and displacement. It is expected that carbon stock in these pools will not increase due to the implementation of the baseline activity, so this pool is conservatively excluded.
		CH_4	No	This is not a requirement of the methodology
		N_2O	No	This is not a requirement of the methodology

Source		Gas	Included?	Justification / Explanation
	Soil Organic Carbon	CO_2	No	This pool has not been considered in the methodology in the calculation of baseline net GHG removals by sinks
		CH_4	No	This is not a requirement of the methodology
		N_2O	No	This is not a requirement of the methodology
Project	Above and belowground biomass	CO_2	Yes	Aboveground biomass is a major carbon pool subject to the project activity. Carbon stock in belowground biomass is expected to increase as a result of the implementation of the project activity.
		CH_4	No	This is not a requirement of the methodology
		N_2O	No	This is not a requirement of the methodology
	Dead wood	CO_2	Yes	Carbon stock in this pool may increase as a result of the implementation of the project activity
		CH_4	No	This is not a requirement of the methodology
		N_2O	No	This is not a requirement of the methodology
	Litter	CO_2	No	Due to tidal influence, the litter biomass is subject to high turnover and displacement. It is expected that carbon stock in these pools will not increase due to the implementation of the baseline activity, so this pool is conservatively excluded.
		CH_4	No	This is not a requirement of the methodology
		N_2O	No	This is not a requirement of the methodology
	Soil Organic Carbon	CO_2	Yes	The methodology provides a conservative default value approach to account for the increase in carbon stock in the soil organic carbon pool
		CH_4	No	This is not a requirement of the methodology. However, the salinity levels within the project area

Source		Gas	Included?	Justification / Explanation
				have been measured to be above 35 ppt. This salinity is above the threshold where methanogenesis occurs, which is approximately 20 ppt. Furthermore, project activities, specifically planting, do not change the flow or salinity of the water within the project boundary so it is extremely unlikely that a change in salinity will occur. Thus, there will be no difference in CH4 emissions between the baseline and project scenarios.
		N_2O	No	This is not a requirement of the methodology. However, the project does not alter the hydrology of the project area or adjacent lands, nor do the project activities include fertilizer application. Thus, N_2O emissions will not increase due to project activities.

3.1.4 Baseline Scenario

The baseline scenario is justified using the "Combined tool to identify the baseline scenario and demonstrate additionality in A/R CDM project activities, v1.0", as is required in the methodology AR-AM0014, Afforestation and Reforestation of Degraded Mangrove Habitat.

STEP 0: Preliminary screening based on the starting date of the ARR project activity

The starting date of the project is July 10, 2020, as referred to in Section 2.1.14. Thus, meeting the requirement of a start date for the reforestation activity after December 31, 1999.

WeForest signed the agreement with Oceanium prior to the project start date, which demonstrates that the incentive from carbon trading was seriously considered in the decision to proceed with the project. In addition, there were ongoing and real actions to ensure its status as a carbon project, with the contracts signed between the funders and the consultants for the development of the project description documents being the evidence to support this.

STEP 1: Identification of alternative land-use scenarios to the proposed A/R CDM project activity

Sub-step 1a: Identify credible alternative land-use scenarios to the proposed CDM project activity

According to the additionality tool, the alternative land-use scenarios of the proposed project includes:

1) Continuation of the pre-project land use, i.e. land remaining as a degraded wetland with some small-scale pre-project land uses e.g. small-scale shrimp/fish farming.

2) Natural regeneration

3) Mangrove regeneration within the project boundaries without being registered as a VCS project

Sub-step 1b: Consistency of credible land-use scenarios with enforced mandatory applicable laws and regulations

All three alternatives scenarios presented, plus scenario of this proposed carbon project, are consistent with enforced mandatory applicable laws and regulations.

STEP 2. Barrier analysis

The below Table 22 demonstrates the barrier analysis, followed by further information on barriers per scenario.

Table 22: Barrier analysis

Scenario	Technological barriers	Investment barriers	Ecological Barriers	Institutional Barriers	Social Barriers
Continuation of pre-project land use: degraded mangrove					
Natural regeneration of mangroves			X		
Mangrove regeneration without being registered as a VCS project	X	X		X	X

Scenario 1: Continuation of pre-project land use

No barriers identified

This is the most likely alternative land use scenario for the degraded mangrove habitat found in the project area. Under this scenario, there would be little regeneration of the mangroves due to low levels of mangrove propagules and propagules not being distributed to areas needing remediation following the 1970s-1980s droughts. Pre-project land uses would continue, for example shrimp and fish farming, but the degraded mangrove habitat would support low fish and shrimp numbers. Ecological conditions for widespread and sustainable mangrove regeneration would not occur in the absence of the project activity.

Scenario 2: Natural regeneration

Ecological Barriers

Ecological barriers make this scenario unlikely to generate significant carbon stocks. This is demonstrated by the limited natural regeneration observed since the drought of the 1980s. Barriers include low availability of mangrove propagules in the project area. Any natural regeneration is likely to be significantly slower and smaller scale than what is possible through a reforestation scheme. Between 1986 and 2001, mangrove growth did occur (demonstrating the suitability of the environment for mangroves), but was considered to be low and insufficient to rely on natural regeneration for the widespread restoration of the area (Dieye et al., 2013)[112]

Scenario 3: Mangrove regeneration within the project boundaries without being registered as a VCS project

Technological, investment, institutional, and social barriers identified.

Mangrove regeneration driven by the government is unlikely given the historic underinvestment by the Senegalese government in mangrove restoration. There has been little evidence of government-led mangrove restoration, and this remains unlikely despite the project being situated on public lands. The Senegalese Government lacks the financial and technical resources to launch a large-scale mangrove restoration project, and this is reflected in the Senegal 2024 National Finance Law Budget, with only 0.88% of the Senegal annual budget allocated to the Ministry of Environment, which must be directed to terrestrial, tidal, and marine ecosystems. This is in contrast to other ministerial priorities like the Ministry of Higher Education, Research and Innovation that receives 5.48% of the annual budget, and the Ministry of Agriculture and Rural Development that also receives a higher budget share with 3.96% of the Senegal state annual budget.[113]

[112] EL Hadji Balla Dieye, Amadou Tahirou Diaw, Tidiane Sané and Ngor Ndour, « Dynamique de la mangrove de l'estuaire du Saloum (Sénégal) entre 1972 et 2010 », Cybergeo: European Journal of Geography [Online], Environment, Nature, Landscape, document 629, Online since 09 January 2013, connection on 15 February 2024. URL : http://journals.openedition.org/cybergeo/25671 ; DOI : https://doi.org/10.4000/cybergeo.25671

[113] Senegal finance act for 2024_ www.budget.gouv_.sn_loi_n_2023_18_du_15_decembre_2023_portant_loi_de_finances_pour_l_annee_2024_2024-01-21_22-39.pdf

The State of Senegal is actively seeking (but not successfully as outlined below) civil society and donor partners to fund and implement mangrove restoration projects to fill the shortfall in nationally available resources. This is reflected in Senegal's Nationally Determined Contributions, which identifies coastal zones as a key priority, but stresses the need for around $5.3bn international support to meet national mitigation targets, and $8.2bn to reach national adaptation targets by 2030.[114] Mangrove regeneration elsewhere in Senegal is primarily driven by other carbon projects, for example as implemented by the Livelihoods Fund, demonstrating the importance of this mechanism for delivering investment and technical expertise.

It is unlikely that mangrove regeneration in the project area will be driven by private or civil society organizations without it being registered as a carbon project. There has been little investment by other organisations in the project area since the droughts of the 1970s and 1980s, and the high costs of mangrove restoration make it prohibitive without the financing mechanism of the carbon project. Access to credit is challenging for activities that are not profitable over time, such as mangrove restoration. Thus, the financing of project activities is only possible thanks to the expected benefits from the commercialization of carbon credits by the funders. Other smaller projects were developed in Senegal, however, even in projects that secured funding for the planting phase, then lacked financial resources for long term monitoring and remediation, leading to high mangrove mortality rates. Carbon financing will unlock activities needed during the entire project period, guaranteeing the appropriate implementation and long-term management of the mangroves.

The restoration activities will be executed by the NGO Oceanium, which has demonstrated a great capacity to mobilize local communities and has experience in similar projects. However, this NGO and the local communities, who also need WeForest and Oceanium's technical expertise to implement the project, do not have financial resources of their own and need external funds to carry out the project activities. Thus, the project is developed through an initial partnership between the proponent (WeForest) and a local NGO providing knowledge and implementation support on the ground (Oceanium).

Finally, it is unlikely that there will be large-scale mangrove restoration driven solely by community groups. Since the area suffered widespread deforestation linked to drought in the 1980s, there has been little attempt at large-scale community-led mangrove restoration within the project area due to limited funds, equipment, technical skills, and seedlings. Although community reforestation initiatives do exist, they are often carried out on small areas (Boquet 2017)[115] (5ha max) and the results often vary greatly from one community to another. Community groups lack access to the equipment and financial resources needed for sustainable restoration on a large-scale. With multiple competing priorities for community development, it is unlikely that there will be social motivation to invest in mangrove restoration without external technological and financial support.

Sub-Step 2b. Elimination of land use scenarios that are prevented by the identified barriers

[114] Government of Senegal (2020) *Contribution Determinee au Niveau National du Senegal.*
[115] Reboisements de mangrove dans le delta du Saloum, Sénégal : Evaluation écologique et sociale (uliege.be)_

The barrier analysis leads to the elimination of Scenario 2 due to ecological barriers, and Scenario 3 due to technological, institutional, investment, and social barriers. This leaves the only likely alternative scenario as being the continuation of the pre-project land use, which is degraded mangroves. This will therefore be used as the without-project baseline scenario.

Step 3, Investment Analysis, resultantly does not need to be performed because there are no viable restoration scenarios other than the Project.

3.1.5 Additionality

Step 4: Common practice analysis

There are no other mangrove afforestation, reforestation, or restoration projects on a similar scale within the project zone. In an adjacent area there is a similar mangrove restoration grouped project managed by the Livelihoods Fund which was registered as a VCS project in 2014, and in which Oceanium also participates. WeForest and the Livelihoods Fund are in regular contact, and there is no overlap in activities.

There are no laws, statutes, or other regulatory frameworks or systematically enforced laws that mandate the project activities. While the Government of Senegal does support and encourage mangrove regeneration, this is not mandated by law. The Senegalese Nationally Determined Contributions document mentions restoring 4,000 hectares of mangroves annually. However, there is no program from the Senegalese government to provide the technical and financial support to operationalise this.

Thus, there is currently no similar project activity identified within the common practice boundary, so step 4 is satisfied and the proposed ARR VCS project activity is not the baseline scenario, so it is additional.

3.1.6 Methodology Deviations

Not applicable.

3.2 Quantification of GHG Emission Reductions and Removals

All the calculations detailed below can be found in the ex-ante carbon calculation sheet, attached as an Annex.

3.2.1 Baseline Emissions

As described in Section 3.1.4, the most likely baseline scenario is considered to be the continuation of existing land use prior to the implementation of the project activity (degraded wetlands).

Based on the applied methodology AR AM0014, v3.0, the baseline net GHG removals by sinks were calculated as follows:

$$\Delta C_{BSL,t} = \Delta C_{TREE\_BSL,t} + \Delta C_{SHRUB\_BSL,,t} + \Delta C_{DW\_BSL,t} \quad \text{(Equation 1, 1 of AR-AM0014)}$$

Where:

$\Delta C_{BSL,t}$	= Baseline net GHG removals by sinks in year t; t CO_2-e
$\Delta C_{TREE\_BSL,t}$	= Change in carbon stock in baseline tree biomass within the project boundary in year t, as estimated in AR-Tool14; t CO_2-e
$\Delta C_{SHRUB\_BSL,,t}$	= Change in carbon stock in baseline shrub biomass within the project boundary in year t, as estimated in AR-Tool14; t CO_2-e
$\Delta C_{DW\_BSL,t}$	= Change in carbon stock in baseline dead wood biomass within the project boundary, in year t, as estimated in AR-Tool12; t CO_2-e

Changes in the carbon stocks in the living biomass – ($\Delta C_{TREE\_BSL,t} + \Delta C_{SHRUB\_BSL,t}$)

As a mangrove restoration project, the pre-existing vegetation in the project area is made up of scattered *Rhizophora spp.* and / or *Avicennia spp.* trees. This vegetation forms part of a highly degraded mangrove ecosystem in which the degradation factors are multiple: the droughts of the 1970s and 1980s (Ndao, 2012; Dieye et al., 2013), the construction of infrastructures (roads or hydro-agricultural) such as the Guidel or Affiniam dam (Manga and Tendeng, 2010; Autumn, 2013) which prevented the mangrove plants from benefiting from the tidal range throughout the duration of the works, causing high mortality of the plants due to the excess salinity, and deforestation caused by the extraction of trees for firewood and construction. Therefore, changes in carbon stocks in the living biomass stock of tree and non-tree vegetation are expected to be zero in the baseline scenario.

As stated in the AR-Tool 14 Methodological Tool "Estimation of carbon stocks and change in carbon stocks of trees and shrubs in A/R CDM project activities", ex-ante and ex-post carbon stocks in trees and shrubs in baseline can be counted as zero since the following conditions are met:

a) The pre-project trees are neither harvested, nor cleared, nor removed;

In the case of the project, trees are neither harvested, nor cleared, nor removed.

b) The pre-project trees do not suffer mortality because of competition from trees planted in the project, or damage because of implementation of the project activity, at any time during the crediting period of the project activity

Pre-project trees are not expected to suffer mortality because planted trees will be smaller and will not compete for light with pre-existing trees. No site preparation is required and planting is done manually, so no damage to pre-project trees is expected.

c) The pre-project trees are not inventoried along with the project trees in monitoring of carbon stocks but their continued existence, consistent with the baseline scenario, is monitored throughout the crediting period of the project activity

Pre-existing tree biomass and carbon stock change will not be monitored, but their continued presence throughout the crediting period will be monitored. A permanent sampling is designed with the objective of monitoring the continuous existence of the baseline trees throughout the crediting period of the project activity. This will be quantified for exclusion from the project and integrated into the monitoring reports.

Changes in the carbon stocks in baseline dead wood biomass - $\Delta C_{DW\_BSL,t}$

According to section 6.2 of AR-Tool12, "Conservative default-factor debased method for estimation of carbon stock in dead wood", $\Delta C_{DW\_BSL,t}$ may be conservatively accounted as zero since changes in the carbon stocks in the living biomass are estimated as zero.

3.2.2 Project Emissions

3.2.2.1 Initial Project Activity Instances

According to the applied methodology AR AM0014, v3.0, the ex-ante actual net GHG removals by sinks may be calculated using the below equation.

$$\Delta C_{ACTUAL,t} = \Delta C_{P,t} - GHG_{E,t} \qquad \text{(Equation 2, 2 of AR-AM0014)}$$

Where:

$\Delta C_{ACTUAL,t}$	= Actual net greenhouse gas removals by sinks at time *t*; t CO_2-e
$\Delta C_{P,t}$	= Change in carbon stocks in project, occurring in the selected carbon pools, at time *t*; t CO_2-e
$GHG_{E,t}$	= Increase of non-CO_2 GHG emissions within the project boundary as a result of the implementation of the A/R CDM project activity, in year *t*, t CO_2-e

Change in carbon stocks in project - $\Delta C_{P,t}$

$\Delta C_{P,t}$ is defined as the sum of changes in living biomass (above and belowground), dead wood, and soil organic carbon stocks. It is calculated using equation 3 of the methodology:

$$\Delta C_{P,t} = \Delta C_{TREE\_PROJ,t} + \Delta C_{SHRUB\_PROJ,t} + \Delta C_{DW\_PROJ,t} + \Delta C_{SOC\_PROJ,t} \quad \text{(Equation 3, 3 of AR-AM0014)}$$

Where:

$\Delta C_{P,t}$	= Change in carbon stocks in project, occurring in the selected carbon pools, at time *t*; t CO_2-e
$\Delta C_{TREE\_PROJ,t}$	= Change in carbon stock in tree biomass in project in year t, as estimated in AR-Tool14; t CO_2-e
$\Delta C_{SHRUB\_PROJ,t}$	= Change in carbon stock in shrub biomass in project in year t, as estimated in AR-Tool14; t CO_2-e
$\Delta C_{DW\_PROJ,t}$	= Change in carbon stock in dead wood biomass in project in year t, as estimated in AR-Tool14; t CO_2-e
$\Delta C_{SOC\_PROJ,t}$	= Change in carbon stock in the soil organic carbon (SOC) pool within the project boundary, as estimated in AR-AM0014, in year t; t CO_2-e

Change in carbon stock in tree biomass - $\Delta C_{TREE\_PROJ,t}$

The tool "Estimation of carbon stocks and change in carbon stocks of trees and shrubs in A/R CDM project activity, v4.2" (AR TOOL14) is used to estimate the change in carbon stock in tree biomass. Following this tool, change in carbon stock in trees between two points of time may be estimated by using different methods or combinations of them. In the case of the first project activity instance, ex-post estimations will be performed using option (a), the "Difference of two independent stock estimations" method (see section 6.1 of AR-Tool14). This method is based on the carbon stock in trees at a point of time by measuring sample plots (see section 8.1 of AR-Tool14).

In the case of the first verification of the first project activity instance, ex-post estimations of change in carbon stock in trees between two points of time will be done using the "Difference of two independent stock estimations" method (see section 6.1 of AR-Tool14). This will be based on measurements of sample plots to estimate carbon stock in trees at a point of time (see section 8.1 of AR-Tool14). However, in the case of subsequent verifications of the first instance or in the case of potential new instances, other methods described in AR-Tool14 can also be used.

The following equations will be used in ex-post estimations:

$$\Delta C_{TREE\_PROJ,t} = \frac{C_{TREE\_PROJ,t2} - C_{TREE\_PROJ,t1}}{T} \times 1\ year \quad \text{(Equation 4, 11 of AR-Tool14)}$$

Where:

$\Delta C_{TREE\_PROJ,t}$	= Change in carbon stock in trees within the project boundary in year *t*; t CO_2-e
$C_{TREE\_PROJ,t2}$	= Carbon stock in trees within the project boundary at time t_2; t CO_2-e
$C_{TREE\_PROJ,t1}$	= Carbon stock in trees within the project boundary at time t_1; t CO_2-e
T	= Time elapsed between two successive estimations ($T=t_2 - t_1$); yr

The following equations are also used:

$$C_{TREE} = \frac{44}{12} \times CF_{TREE} \times B_{TREE}$$ (Equation 5, 12 of AR-Tool14)

$$B_{TREE} = A \times b_{TREE}$$ (Equation 6 13 of AR-Tool14)

$$b_{TREE} = \sum_{i=1}^{M} w_i \times b_{TREE,i}$$ (Equation 7, 14 of AR-Tool14)

$$u_c = \frac{t_{val} \times \sqrt{\sum_{i=1}^{M} w_i^2 \times \frac{s_i^2}{n_i}}}{b_{TREE}}$$ (Equation 8, 15 of AR-Tool14)

$$b_{TREE,i} = \frac{\sum_{p=1}^{n_i} bTREE,p,i}{n_i}$$ (Equation 9, 16 of AR-Tool14)

$$b_{TREE,p,i} = \frac{B_{TREE,p,i}}{A_{PLOT,i}}$$ (Equation 10, 1 Appendix 1, AR-Tool14)

$$BTREE,p,i = \sum_{j} BTREE,l,j,p,i$$ (Equation 11, 2 Appendix 1, Ar-TOOL14)

$$BBTREE,p,i = \sum_{j} BTREE,l,j,p,i$$ (Equation 12, 3 Appendix 1, Ar-TOOL14)

$$B_{TREE,l,j,p,i} = f_j(x_{1,l},x_{2,l},x_{3,l},...) * (1 + R_j)$$ (Equation 13, 4 Appendix 1, AR-Tool14)

For ex-ante estimations, the option (b) “Estimation by modeling of tree growth and stand development” method was used to estimate carbon stock in trees at a point of time (see section 8.2 of AR-Tool14). In this method, existing data is used in combination with tree growth models to predict the growth and development

of trees over time. Thus, using the above equation, ex-ante estimations of change in carbon stock in trees (ΔC_{TREE}) were done following the steps below:

Step 1: Selection of the allometric equations

Three allometric equations were used to estimate the aboveground biomass of trees. Two equations developed by Fromard et al. (1998)[116] were used for *Avicenia germinans* trees with stem diameters (*dbh*) above and below 4 cm. Santos et al.'s (2017) equation[117] was used to estimate the aboveground biomass of *Rhizophora mangle* and *Rhizophora racemosa* trees. Although these equations were selected for ex-ante estimations, it is expected to use site-specific equations for ex-post calculations.

An equation developed for different mangrove species in South-East Asia, including *Rhizophora* sp. by Komiyama et al. (2005)[118] was used for ex-ante estimations of belowground biomass. This equation includes, among others, ρ_j (wood density of tree trunk of species *j*, t/m^3) as an independent variable. A value of 0.910 was used for *R. mangle*, 0.998 for *R. racemosa*, and 0.776 for *A. germinans*.

Table 23: Allometric equations used for ex-ante estimations

Species	Range dbh (cm)	Unit	Equation	R^2
Avicenia germinans	< 4	g d.m.	*agb* = 200.4*(*dbh*)^2.2	0.82
	> 4	kg d.m.	*agb* = 0.14*(*dbh*)^2.4	0.97
Rhizophora sp.		g d.m.	$ln(agb)$=5.534244+2.404770* $ln(dbh)$	0.99
All		kg d.m.	*bgb*=0.199*ρ_j^0.899*(*dbh*)^2.22	0.95

agb = aboveground biomass

bgb = belowground biomass

[116] Fromard, F., Puig, H., Mougin, E., Marty, G., Betoulle, J. L., & Cadamuro, L. (1998). Structure, aboveground biomass and dynamics of mangrove ecosystems: new data from French Guiana. Oecologia, 115(1-2), 39-53.

[117] Santos, H. V. S., Hollanda, F. S. R., Santos, T. D. O., Andrade, K. V. S. D., Santana, M. B. S., Estrada, G. C. D., & Soares, M. L. G. (2017). Allometric models for estimating the aboveground biomass of the mangrove Rhizophora mangle. Brazilian Journal of Oceanography, 65(1), 44-53.

[118] Komiyama, A., Poungparn, S., Kato, S., 2005. Common allometric equations for estimating the tree weight of mangroves. J. Trop. Ecol. 21, 471–477.

dbh = diameter at breast height, cm

ρ_j = wood density of tree species *j*, t d.m. m^{-3}

Step 2: Creation or selection of a diameter growth model

Based on *diameter at breast height (dbh)* data at different ages from Jiménez (1985)[119], and the Chapman-Richards function (Richards, 1959[120]; Pienaar and Turnbull, 1973[121]), a diameter growth model was fitted for *A. germinans*. The diameter growth model used for *Rhizophora* sp. is the same as the model used in ex-ante estimations of aboveground biomass in the "Livelihoods' mangrove restoration grouped project in Senegal" project for *R. mangle* and identical ecological-environmental conditions.

Table 24: Rhizophora sp. and A. germinans diameter growth models

Age (yr)	*dbh* (cm)		Age (yr)	*dbh* (cm)	
	Rhizophora sp.	*A. germinans*		*Rhizophora sp.*	*A. germinans*
1	0.0	0.0	16	4.1	9.5
2	0.0	0.0	17	4.4	10.3
3	0.0	0.1	18	4.8	11.1
4	0.1	0.3	19	5.1	11.8
5	0.2	0.6	20	5.4	12.2
6	0.4	1.1	21	5.7	13.1

[119] Jimenez, J. A. (1985). Avicennia germinans (L) L. Black mangrove; avicenniaceae verbena family (No. 04; FOLLETO, 719.) in Salas-Leiva, D. E., Mayor-Durán, V. M., & Toro-Perea, N. (2009). Genetic diversity of black mangrove (Avicennia germinans) in natural and reforested areas of Salamanca Island Parkway, Colombian Caribbean. Hydrobiologia, 620(1), 17-24.

[120] Richards, F.J. 1959. A flexible growth function for empirical use. Journal of Experimental Botany. 10: 290-300.

[121] LIU Zhao-gang, LI Feng-ri. 2003. The generalized Chapman-Richards function and applications to tree and stand growth. Journal of Forestry Research, 14(1); based on Pienaar, L.V.; Turnbull, K.J. 1973. The Chapman-Richards generalization of Von Bertalanffy's growth model for basal area growth and yield in even-aged stands. Forest Science. 19(1): 2-22.

Age (yr)	*dbh* (cm)		Age (yr)	*dbh* (cm)	
	Rhizophora sp.	*A. germinans*		*Rhizophora sp.*	*A. germinans*
7	0.7	1.7	22	5.9	13.7
8	0.9	2.4	23	6.2	14.2
9	1.3	3.2	24	6.4	14.7
10	1.7	4.0	25	6.6	15.2
11	2.0	4.9	26	6.8	15.6
12	2.5	5.8	27	6.9	15.9
13	2.9	6.8	28	7.1	16.2
14	3.3	7.7	29	7.2	16.5
15	3.7	8.6	30	7.3	16.8

Step 3: Calculation of change in carbon stock in tree biomass

This step was divided into the following sub-steps:

- Sub-step 3.1: Estimation of aboveground and belowground biomass per tree ($f_j(x_{1,l},x_{2,l},x_{3,l},...)$) based on *dbh* growth models and using the corresponding allometric equations
- Sub-step 3.2: Calculation of biomass of tree *l* of species *j* ($B_{TREE,l,j}$) defined as the sum of *agb* and *bgb* per tree
- Sub-step 3.3: Estimation of planting density at different points in time. Although the planting density is planned to be 5,000 trees ha^{-1} in the case of *Rhizophora* sp. and 1,000 trees ha^{-1} in the case of *A. germinans*, density in year 30 is expected to be 2,395 trees ha^{-1} and 600 trees ha^{-1}, respectively. Conservatively, a 23% mortality rate was assumed during the first year after plantation, 15% during the second year, 5% during the third year, and a constant rate of 1% from year 4 to year 30, with a minimum expected density of 600 trees ha^{-1}. Mortality will be closely monitored and accounted for in remediation campaigns.
- Sub-step 3.4: Estimation of the mean tree biomass per hectare in stratum *i* at a given point of time in year *t* ($b_{TREE,t,i}$) based on the planting density and $B_{TREE,l,j.}$
- Sub-step 3.5: Carbon stock in project trees was estimated using equation 5 (12 of AR-Tool 14).

- Sub-step 3.6: For ex-ante estimations, calculation of an area-weighted average biomass growth curve based on the predicted relative aerial extents of each species detailed in the planting plan (Tables 25 and 26).

Table 25: Planting plan

Planting cohort	Planted area (ha)	Area by species (ha)		
		R. mangle	*R. racemosa*	*A. germinans*
2020	1,908.61	1,431.46	286.29	190.86
2021	2,722.63	2,041.97	408.39	272.26
2022	2,388.55	1,791.41	358.28	238.86
Total	7,019.79	5,264.84	1,052.97	701.98

Table 26: Area-weighted average growth curve used for all initial activity instances.

This growth curve extends to 100 years to enable the analysis of the impact of SLR over the 100-year permanence period, however, according to the species growth models, no further biomass growth is assumed in stands over 40 years in age.

Year	Total tree carbon (tCO2e/ha)	Change in total tree carbon (tCO2e/ha)
1	0.00	0.00
2	0.00	0.00
3	0.00	0.00
4	0.01	0.01
5	0.08	0.06
6	0.29	0.21
7	0.81	0.52
8	1.87	1.07

9	3.75	1.87
10	6.70	2.95
11	10.93	4.23
12	16.53	5.61
13	23.52	6.99
14	31.82	8.30
15	41.25	9.43
16	51.59	10.34
17	62.58	10.99
18	73.98	11.40
19	85.52	11.54
20	96.45	10.94
21	108.16	11.71
22	118.92	10.75
23	129.10	10.18
24	138.61	9.52
25	147.46	8.84
26	155.55	8.09
27	162.87	7.32
28	169.42	6.56
29	175.29	5.87
30	180.46	5.16
31	184.94	4.49
32	188.79	3.85
33	192.12	3.33
34	194.91	2.79

35	197.20	2.29
36	199.03	1.83
37	200.44	1.41
38	201.55	1.11
39	202.33	0.78
40	202.80	0.47
41	202.80	0
42	202.80	0
43	202.80	0
44	202.80	0
45	202.80	0
46	202.80	0
47	202.80	0
48	202.80	0
49	202.80	0
50	202.80	0

- Sub-step 3.6: The area-weighted average growth curve detailed in Table 22 was applied to the areas predicted to be remaining following any impact of SLR. It is conservatively assumed that the 2020 planting cohorts are lost first due to SLR.

- Sub-step 3.6: As explained in Section 3.1.3, tree biomass is expected to be lost within the initial project activity instances due to SLR. It was conservatively assumed that all CO_2 stored within tree biomass is lost instantaneously to the atmosphere upon submergence. To calculate the carbon stock losses resulting from this submergence, these areas were multiplied by the area-weighted average growth curve for the three planting cohorts (2020, 2021 and 2022). These carbon stock losses were subtracted from the results of sub-step 3.5 to give $\Delta C_{TREE\_PROJ,t}$.

Change in carbon stock in shrub biomass - $\Delta C_{SHRUB\_PROJ,t}$

No shrubs were found during the baseline measurements and shrub vegetation will not be directly introduced in the project area. Therefore, change in carbon stocks was not considered in ex-ante estimations. This is a conservative assumption.

Change in carbon stock in dead wood - $\Delta C_{DW\_PROJ,t}$

Estimation of carbon stock in dead wood will be set at zero as a conservative default value and in line with the methodology that states dead wood accounting is optional.

$$C_{DW,i} = C_{TREE,i} \times DF_{DW}$$ (Equation 14, 9 of AR-Tool 12)

Where:

$C_{DW,i}$	= Carbon stock in dead wood in stratum *i*; t CO_2-e;
$C_{TREE,i}$	= Carbon stock in trees biomass in stratum *i*; t CO_2-e;
DF_{DW}	=0

Change in carbon stock in the soil organic carbon (SOC) pool - $\Delta C_{SOC\_PROJ,t}$

Equation 4 of the methodology was applied to estimate the change in SOC stock.

$$\Delta C_{SOC\_PROJ,t} = \frac{44}{12} \times \sum_{t=1}^{t} A_{PLANT,t} \times dSOC_t \times 1\ year$$ (Equation 15, 4 of AR-AM0014)

Where:

$\Delta C_{SOC\_PROJ,t}$	= Change in SOC stock within the project boundary, in year *t*; t CO_2-e
$A_{PLANT,t}$	= Area planted in year *t*: ha
$dSOC_t$	= The rate of change in SOC stocks within the project boundary, in year *t*; t C ha^{-1} yr^{-1}

The VCS Tidal Wetland and Seagrass Restoration methodology (VM0033 v2.1) provides a default value of 1.46 t C ha^{-1} yr^{-1} for *in situ* CO_2 removals in the soil organic carbon pool. This value may only be applied to

areas with a crown or vegetation cover of at least 50%. By contrast, for areas with a crown or vegetation cover of less than 15%, this SOC accumulation is assumed to be insignificant and accounted for as zero. For areas with a crown or vegetation cover between 15 and 50%, a linear interpolation may be applied.

In mineral soils, VM0033 requires a deduction for allochthonous carbon to be applied to the default SOC accumulation rate. For the purpose of these ex-ante calculations, field data were collected to estimate the relative coverage of organic soils in the area covered by the initial project activity instances. This process indicates that 64% of the project area is covered by organic soils and thus exempt from an allochthonous carbon deduction.

Based on data from similar environments[122], an allochthonous deduction of 0.51 was applied to the portion of the project covered by mineral soils. Assuming these soils cover 36% of the project area results in an area-weighted average autochthonous SOC accumulation rate (*dSOC*) of **1.28 t C ha^{-1} yr^{-1}** (i.e. based on 36% with a rate of 0.95 t C ha^{-1} yr^{-1} and 64% with a rate of 1.46 t C ha^{-1} yr^{-1}).

Based on canopy cover data from historical plantations in Senegal, it is assumed that the trees planted in for the initial project activity instances reach a crown cover of 15% five years after planting and 50% ten years after planting, with soil accumulation rates scaled linearly between these two time points (Table 27).

Table 27: The evolution of dSOC post-planting

Year after planting:	*dSOC* (t C ha-1 yr-1)
5	0.21
6	0.43
7	0.64
8	0.85
9	1.06
10	1.28
11-49	1.28
49+	0

As described in Section 3.1.3, parts of the initial project activity instances will be either submerged or eroded due to sea level rise. According to VM0033, upon only submergence, SOC is not returned to the atmosphere. However, tree presence and growth is the driver of SOC accumulation in mangrove ecosystems. Therefore, dSOC is only applied to areas prior to any biomass loss due to submergence.

Emissions occur from the SOC pool in an erosional environment. VM0033 provides default values for the % of soil organic carbon lost due to oxidation in an erosional environment, dependent on the type of "carbon

[122] Lovelock et al., 2022. Modeled approaches to estimating blue carbon accumulation with mangrove restoration to support a blue carbon accounting method for Australia. Limnology and Oceanography:

preservation depositional environment". In the context of the project area, the depositional environment is 'Normal Marine' and the default percentage of the eroded carbon that is returned to the atmosphere is 80%.

The areas of the initial project activity instances lost due to erosion are given in Table 18. The SLR modeling detailed in Section 3.1.3 suggests that, during the 30-year project crediting period, the average age at which mangroves are submerged, and thus cease sequestering CO_2, is 12 years. Thus, it was conservatively assumed that the cumulated SOC stock at t=12 (7.02 tC ha^{-1}) is at risk of erosion. The SOC carbon stock losses due to erosion were calculated by multiplying this value by the areas in Table 18 and 80%.

These losses were subtracted from carbon stock increases due to *in situ* accumulation, to give $\Delta C_{SOC\_PROJ,t}$.

The predicted changes in carbon stocks within each carbon pool in the initial project activity instances together with the total carbon stock changes ($\Delta C_{P,t}$) are given in Table 28.

Table 28: Ex-ante net GHG removals by sinks within the initial project activity instances

Project year *t*	$\Delta C_{TREE\_PROJ,t}$	$\Delta C_{DW\_PROJ,t}$	$\Delta C_{SOC\_PROJ,t}$	$\Delta C_{P,t}$
	t CO_2-e	t CO_2-e	t CO_2-e	t CO_2-e
1	0,0	0	0	0,0
2	0,1	0	0	0,1
3	2,7	0	0	2,7
4	27,8	0	0	27,8
5	157,5	0	1.489	1.646,3
6	599,1	0	5.101	5.700,4
7	1.712,8	0	10.577	12.289,7
8	3.951,2	0	16.052	20.003,6

9	7.723,4	0	21.528	29.251,4
10	-14.433,9	0	7.853	-6.581,1
11	5.480,3	0	10.908	16.388,3
12	8.488,7	0	12.771	21.259,8
13	12.004,6	0	12.771	24.775,7
14	15.771,1	0	12.771	28.542,2
15	19.526,2	0	12.771	32.297,3
16	23.030,6	0	12.771	35.801,7
17	26.042,5	0	12.771	38.813,6
18	28.429,6	0	12.771	41.200,7
19	30.123,2	0	12.771	42.894,3
20	7.119,2	0	9.901	17.020,4
21	28.625,4	0	11.610	40.235,9
22	27.129,9	0	11.610	38.740,4
23	29.049,4	0	11.610	40.659,9

24	26.676,2	0	11.610	38.286,6
25	25.259,0	0	11.610	36.869,4
26	23.610,7	0	11.610	35.221,2
27	21.938,2	0	11.610	33.548,7
28	20.064,8	0	11.610	31.675,3
29	18.157,8	0	11.610	29.768,2
30	-41.854,1	0	7.868	-33.985,9
Total	**354.414,2**	**0,0**	**297.940,1**	**652.354,3**

Increase of non-CO_2 GHG emissions within the project boundary - $GHG_{E,t}$

Following the CDM A/R Methodological Tool "Estimation of non-CO2 GHG emissions resulting from burning of biomass attributable to an A/R CDM project activity"[123], it was assumed that $GHG_{E,t}$ is = 0 since fire is not used in site preparation or to clear the land of harvest residue prior to replanting of the land. However, if forest fires occur during the project life, it will be reported and monitored in the ex-post verification estimates. Emission of non-CO_2 GHGs resulting from forest fire ($GHG_{FF,t}$) will be calculated ex-post, specifically using equations 6, 7, and 8 of the mentioned A/R CDM methodological tool.

3.2.2.2 Buffer Zones

Change in carbon stocks in the tree biomass pools

As explained in Section 3.1.3, mangroves are expected to grow within the buffer zones due to sea level rise and the seed availability provided by the project planting. Supplemental planting activities may be considered in future phases of the grouped project if propagule quality/quantity is insufficient to expand into

[123] Annex 31 of the Executive Board report at its 65th meeting.

the 300 m buffer zones at the expected rate. The areas of mangrove gain in each decade of the project crediting period are detailed in Table 16. Carbon stock changes in these areas due to mangrove growth were calculated using the same biomass growth curves and assumptions detailed in Section 3.2.2.1.

As sea levels continue to rise, regions within the buffer zone that are below the elevation range of mangroves become submerged. It was conservatively assumed that all CO_2 stored within tree biomass is lost instantaneously to the atmosphere upon submergence.

Given these are ex-ante calculations and modeling the impact of SLR across multiple strata over 100 years is both complex and hard to validate, conservative simplifications have been made in the ex-ante calculations presented in this PD, to make them easier to understand and validate. To calculate the biomass carbon stock losses resulting from this submergence, these areas were multiplied by the average per hectare tree biomass carbon stock at each point in time, which were calculated by dividing the cumulative biomass carbon stocks within the buffer zone by the cumulative area of gained mangroves. These carbon stock losses were subtracted from the carbon stock gains due to lateral mangrove expansion to give the annual carbon stock change in tree biomass in the buffer zones.

Change in carbon stocks in the SOC pool

SOC accumulation due to lateral mangrove expansion in the buffer zones was calculated using the areas of gain detailed in Table 16 together with the same average autochthonous SOC accumulation rates detailed in Section 3.2.2.1. Tree presence and growth is the driver of SOC accumulation in mangrove ecosystems. The sea level rise assessment outlined in Section 3.1.3 indicated that the average age at which mangroves within the 100 m buffer region surrounding the project are submerged is 49 years (a longer period compared to the average of 12 years for the original project area due to the longer time period over which the SLR-driven migration occurs). As described above, it is assumed that tree biomass is instantaneously lost upon submergence. Therefore, dSOC is only applied for 49 years after initial growth.

SOC loss due to erosion in the buffer zones was calculated using the areas detailed in Table 16, multiplied by the average SOC stocks accumulated in the buffer zones in the year of analysis and the same default percentage of the eroded carbon that is returned to the atmosphere as detailed in Section 3.2.2.1 (80%). These carbon stock losses were subtracted from the carbon stock gains due to lateral mangrove expansion to give the annual carbon stock change in the SOC pool in the buffer zones.

Table 29: Change in carbon stocks in the buffer zone

Project year *t*	Annual carbon stock change in tree biomass in buffer zones	Annual carbon stock change in soil organic carbon pool in buffer zones	Total annual change in carbon stocks in the buffer zone
	$tCO_2e\ yr^{-1}$	$tCO_2e\ yr^{-1}$	$tCO_2e\ yr^{-1}$

1	0	0	0
2	0	0	0
3	0	0	0
4	0	0	0
5	0	0	0
6	0	0	0
7	0	0	0
8	0	0	0
9	0	0	0
10	0	0	0
11	0	0	0
12	6	0	6
13	54	0	54
14	270	3.341	3.610
15	893	6.682	7.574
16	2.233	10.023	12.255
17	4.564	13.363	17.928
18	8.026	16.704	24.730
19	12.642	20.045	32.687
20	16.258	18.462	34.720
21	24.014	20.045	44.059
22	29.955	20.045	50.000
23	35.587	20.045	55.632
24	40.609	22.749	63.359

25	44.997	25.454	70.451
26	48.868	28.158	77.026
27	52.515	30.862	83.377
28	55.918	33.567	89.485
29	57.073	36.271	93.344
30	32.948	31.856	64.804
Total	**467.429**	**357.671**	**825.101**

3.2.3 Leakage

Activity shifting and market leakage:

As described in the new VM0033 methodology, activity-shifting and market leakage are deemed not to occur if the applicability conditions of the methodology are met, and if pre-project land use will continue during the project crediting period. Fishing will continue in the streams next to the plantations (plantations are a nursery and shelter for the fish, and are thus likely to boost fish populations). In addition, fisher communities are consulted to ensure plantation does not occur within their fishing grounds. While not widespread in the project area, sustainable shrimp farming will continue to be allowed in the project area, and the growth of mangroves is expected to have a positive impact on shrimp populations. Shellfish collection can continue with mangrove plantation, and it mainly takes place in water streams on the edges of the mangroves. Sensitization is conducted to improve awareness on how not to damage mangrove trees when collecting shellfish. If project monitoring identifies any evidence of deforestation or mangrove degradation, this will be addressed immediately and compensated for.

According to the applied methodology AR-AM0014 (v3.0), leakage emission is estimated as follows:

$$LK_t = LK_{,AGRIC,t} \qquad \text{(Equation 16, 5 of AR-AM0014)}$$

Where:

LK_t	= GHG emissions due to leakage, in year t; t CO_2-e.

$LK_{,AGRIC,t}$	= Leakage due to the displacement of agricultural activities in year *t*, as estimated in the tool "Estimation of the increase in GHG emissions attributable to displacement of pre-project agricultural activities in A/R CDM project activity"; t CO_2-e.

Project activities are implemented in degraded mangrove areas where there was no agricultural activity previous to the start date. Therefore, no displacement of agricultural activities would occur after the implementation of the project (LK_t = 0).

If displacement of agricultural activities occurs in future project activity instances, then leakage will be calculated using equation 5 of AR-AM0014, and equations 1, 2, and 3 of AR-TOOL15.

Ecological Leakage:

The project activities have no impact on the water table and thus do not influence GHG emissions within wetlands outside the project areas. Therefore, ecological leakage will not occur.

3.2.4 Net GHG Emission Reductions and Removals

The net anthropogenic GHG removals by the project are calculated using equation 6 of AR-AM0014 and are summarized below:

$\Delta C_{ARR\text{-}VCS,t} = \Delta C_{ACTUAL,t} - \Delta C_{BLS,t} - LK_{,t}$ Equation 20, 6 of AR-AM0014)

Where:

$\Delta C_{ARR\text{-}VCS,t}$	= Net anthropogenic GHG removals by sinks, in year t; t CO_2-e
$\Delta C_{ACTUAL,t}$	= Actual net GHG removals by sinks, in year t; t CO_2-e
$\Delta C_{BLS,t}$	= Baseline net GHG removals by sinks, in year t; t CO_2-e
$LK_{,t}$	= GHG emissions due to leakage, in year t; t CO_2-e

This calculation must reflect the net GHG emission reductions in both the initial project activity instances and the buffer zones. Therefore, in equation 20, $\Delta C_{ACTUAL,t}$ represents the actual net GHG removals by sinks in both areas. Table 30 shows the resulting estimated net GHG emissions reductions and removals.

Table 30: Estimated net GHG emission reductions and removals

Year	Estimated baseline emissions or removals ($\Delta C_{BLS,t}$) (tCO_2e)	Actual net GHG removals by sinks ($\Delta C_{ACTUAL,t}$) (tCO2e)	Estimated leakage emissions ($LK_{,t}$) (tCO_2e)	Estimated net GHG emission reductions or removals ($\Delta C_{ARR-VCS,t}$) (tCO_2e)
2020	0	0	0	0
2021	0	0	0	0
2022	0	3	0	3
2023	0	28	0	28
2024	0	1,646	0	1,646
2025	0	5,700	0	5,700
2026	0	12,290	0	12,290
2027	0	20,004	0	20,004
2028	0	29,251	0	29,251
2029	0	-6,581	0	-6,581
2030	0	16,389	0	16,389
2031	0	21,266	0	21,266
2032	0	24,829	0	24,829
2033	0	32,153	0	32,153
2034	0	39,872	0	39,872
2035	0	48,057	0	48,057
2036	0	56,741	0	56,741
2037	0	65,931	0	65,931
2038	0	75,582	0	75,582

2039	0	51,740	0	51,740
2040	0	84,295	0	84,295
2041	0	88,740	0	88,740
2042	0	96,292	0	96,292
2043	0	101,645	0	101,645
2044	0	107,320	0	107,320
2045	0	112,247	0	112,247
2046	0	116,926	0	116,926
2047	0	121,160	0	121,160
2048	0	123,112	0	123,112
2049	0	30,818	0	30,818
Total	0	**1,477,455**	0	**1,477,455**

WRC projects are required to demonstrate that the permanence of their soil carbon stock will be maintained. The maximum quantity of GHG emission reductions that may be sought by the project is limited to the difference between project and baseline scenario after a 100-year time frame. The difference between the project and baseline scenario at t=100 is 3,494,726 tCO_2e. The total net emission removals that the project is expected to produce, 1,477,455 tCO_2e, is below this figure, therefore the project satisfies this requirement of the VCS.

Applying the 13% pooled buffer account allocation to the net removals shown in Table 31 gives the expected net VCUs.

Table 31: Estimated net GHG emission reductions and removals after buffer allocation

Year	Estimated net GHG emission reductions or removals (tCO_2e)	Cumulative estimated net GHG emission reductions or removals (tCO_2e)
2020	0	0

Year	Estimated net GHG emission reductions or removals (tCO_2e)	Cumulative estimated net GHG emission reductions or removals (tCO_2e)
2021	0	0
2022	2	2
2023	24	27
2024	1,432	1,459
2025	4,959	6,418
2026	10,692	17,110
2027	17,403	34,513
2028	25,449	59,962
2029	-5,726	54,236
2030	14,258	68,495
2031	18,501	86,996
2032	21,602	108,597
2033	27,973	136,570
2034	34,688	171,258
2035	41,810	213,068
2036	49,365	262,433
2037	57,360	319,793
2038	65,756	385,549
2039	45,014	430,563
2040	73,336	503,899

Year	Estimated net GHG emission reductions or removals (tCO_2e)	Cumulative estimated net GHG emission reductions or removals (tCO_2e)
2041	77,204	581,103
2042	83,774	664,877
2043	88,431	753,308
2044	93,369	846,677
2045	97,655	944,332
2046	101,725	1,046,058
2047	105,409	1,151,467
2048	107,107	1,258,574
2049	**26,812**	**1,285,386**

3.3 Monitoring

3.3.1 Data and Parameters Available at Validation

Table 32: Data and parameters available at validation

Data / Parameter	$\Delta C_{BSL,t}$
Data unit	t CO_2-e
Description	Baseline net GHG removals by sinks in year *t*
Source of data	N/A
Value applied:	0
Justification of choice of data or description of measurement methods and procedures applied	Value based on section 5 of AR-TOOL12 as described in Section 3.2.1 of this document

Purpose of data	Calculation of ex-ante and ex-post baseline emissions
Comments	-

Data / Parameter	CF_{TREE}
Data unit	t C (t d.m.)$^{-1}$
Description	Carbon fraction of tree biomass
Source of data	Kauffman JB, Donato D. Protocols for the measurement, monitoring and reporting of structure, biomass and carbon stocks in mangrove forests. Center for International Forestry Research Center (CIFOR) Working paper. 86. 2012
Value applied:	0.47 for aboveground biomass; and 0.39 for belowground biomass
Justification of choice of data or description of measurement methods and procedures applied	Default value of AR-TOOL14 is used.
Purpose of data	Calculation of ex-ante and ex-post project emissions/removals
Comments	-

Data / Parameter	$f_j(x_{1,l},x_{2,l},x_{3,l},\ldots)$
Data unit	t d.m.
Description	Aboveground and belowground biomass of the tree returned by the allometric equation for species *j* relating the measurements of tree *l* to the aboveground biomass of the tree
Source of data	For ex-ante: Fromard et al. (1998) and Santos et al. (2017) are used for aboveground biomass estimations, and Komiyama et al. (2005) are used for belowground biomass estimations.

<table>
<tr><td></td><td>For ex-post estimations: project- and species-specific equations will be used.</td></tr>
<tr><td>Value applied:</td><td>
<table>
<tr><th>Species</th><th>Unit</th><th>Equation</th><th>R^2</th></tr>
<tr><td>A. germinans (< 4 cm)</td><td>g d.m.</td><td>agb = 200.4*(dbh)^2.2</td><td>0.82</td></tr>
<tr><td>A. germinans (> 4 cm)</td><td>kg d.m.</td><td>agb = 0.14*(dbh)^2.4</td><td>0.97</td></tr>
<tr><td>Rhizophora sp.</td><td>g d.m.</td><td>$ln(agb)$=5.534244+2.404770* $ln(dbh)$</td><td>0.99</td></tr>
<tr><td>All</td><td>kg d.m.</td><td>bgb=0.199*ρ_j^0.899*(dbh)^2.22</td><td>0.95</td></tr>
<tr><td colspan="4">agb = aboveground biomass

bgb = belowground biomass

dbh = diameter at breast height, cm

ρ_j = wood density of tree species j t d.m. m^{-3}</td></tr>
</table>
</td></tr>
<tr><td>Justification of choice of data or description of measurement methods and procedures applied</td><td>Group-of-species-specific allometric equation derived from trees growing in edapho-climatic conditions similar to those in the project area</td></tr>
<tr><td>Purpose of data</td><td>Calculation of ex-ante and ex-post project emissions / removals</td></tr>
<tr><td>Comments</td><td></td></tr>
</table>

Data / Parameter	DF_{DW}
Data unit	per cent
Description	Conservative default factor expressing carbon stock in dead wood

Source of data	Dead wood is optional and won't be taken in account
Value applied:	0
Justification of choice of data or description of measurement methods and procedures applied	Ex-ante, the most conservative value for tropical biome and elevation below 2,000m has been selected from the table. Ex-post Zero will be used as default value as it is conservative and optional in the methodology
Purpose of data	Calculation of ex-ante and ex-post baseline emissions
Comments	-

Data / Parameter	$dSOC_t$
Data unit	t C ha-^{1} yr^{-1}
Description	The rate of change in SOC stocks within the project boundary, in year t.
Source of data	VCS Tidal Wetland and Seagrass Restoration methodology v2.1 (VM0033)
Value applied:	

Year after Planting:	***dSOC* (t C ha-1 yr-1)**
5	0.21
6	0.43

	7	0.64
	8	0.85
	9	1.06
	10	1.28
	11-49	1.28
Justification of choice of data or description of measurement methods and procedures applied	Default value for *in situ* SOC accumulation in VM0033 with a deduction applied for allochthonous carbon accumulation according to the relative coverage of organic and mineral soils. The SLR assessment models that trees will be submerged due to SLR at an average age of 49 years. No *in situ* SOC accumulation is assumed to occur following submergence.	
Purpose of data	Calculation of ex-ante and ex-post project emissions/removals	
Comments	-	

Data / Parameter	ρ_j
Data unit	t d.m. m^{-3}
Description	wood density of tree species *j*
Source of data	Zanne, Amy E. et al. (2009), Data from: Towards a worldwide wood economics spectrum, v2, Dryad, Dataset, https://doi.org/10.5061/dryad.238
Value applied	- R. mangle: 0.910 - R. racemosa: 0.998 - A. germinans: 0.776

Justification of choice of data or description of measurement methods and procedures applied	Global wood density database
Purpose of data	Calculation of ex-ante and ex-post project emissions/removals
Comments	-

Data / Parameter	t_{val}
Data unit	Dimensionless
Description	Two-sided students t-value, at infinite degrees of freedom for the required confidence level
Source of data	Calculation of the number of sample plots for measurements within A/R CDM project activities (Version 02.1.0) [124]
Value applied	1.645
Justification of choice of data or description of measurement methods and procedures applied	Use the 90% confidence level for determination of biomass stock in A/R CDM project activities
Purpose of data	Calculation of number of sample plots for measurements
Comments	-

Data / Parameter	t_{val}
Data unit	Dimensionless

[124] Annex 15 of the Executive Board report at its 58th meeting.

Description	Two-sided students t-value, at infinite degrees of freedom for the required confidence level
Source of data	Calculation of the number of sample plots for measurements within A/R CDM project activities (Version 02.1.0) [125]
Value applied	1.645
Justification of choice of data or description of measurement methods and procedures applied	Use the 90% confidence level for determination of biomass stock in A/R CDM project activities
Purpose of data	Calculation of number of sample plots for measurements
Comments	-

3.3.2 Data and Parameters Monitored

Table 33: Data and parameters to be monitored

Data / Parameter	A_i
Data unit	Ha
Description	Stratum *i* area
Source of data	Ex-post stratification
Description of measurement methods and procedures to be applied	Once the criteria for ex-post stratification have been selected, the project area will be stratified, and A_i will be calculated using GIS.
Frequency of monitoring / recording	At least for the first monitoring but can be updated in every verification.

[125] Annex 15 of the Executive Board report at its 58th meeting.

Value applied	See section 3.3.3 of this PD, including the stratification of first project activity instance
Monitoring equipment	GIS and other spatial information software
QA / QC procedures to be applied	Quality control / quality assurance (QA / QC) procedures prescribed under national forest inventory are applied. In the absence of these, QA / QC procedures from published handbooks, or from the IPCC GPG LULUCF 2003, are applied
Purpose of data	Calculation of project emissions / removals
Calculation method	GIS tool
Comments	-

Data / Parameter	n_i
Data unit	Dimensionless
Description	Number of sample plots in stratum *i*
Source of data	Calculated
Description of measurement methods and procedures to be applied	N/A
Frequency of monitoring / recording	n_i is calculated for each monitoring event, at least every five years
Value applied	See ex-ante n_i in Section 3.3.3 of this PD
Monitoring equipment	N/A

QA / QC procedures to be applied	N/A
Purpose of data	Calculation of project emissions / removals
Calculation method	The calculation method is described in the tool "Calculation of the number of sample plots for measurements within A/R CDM project activities" (version 02.1.0)
Comments	-

Data / Parameter	$A_{PLOT,i}$
Data unit	Ha
Description	Size of sample plot in stratum *i*
Source of data	Calculated
Description of measurement methods and procedures to be applied	N/A
Frequency of monitoring / recording	Before every verification event, at least every five years
Value applied	0,011 (for ex-ante calculation of n_i)
Monitoring equipment	N/A
QA / QC procedures to be applied	Quality control / quality assurance (QA / QC) procedures prescribed under national forest inventory are applied. In the absence of these, QA / QC procedures from published handbooks, or from the IPCC GPG LULUCF 2003, are applied

Purpose of data	Calculation of project emissions / removals
Calculation method	N/A
Comments	-

Data / Parameter	$A_{BURN,i,t}$
Data unit	Ha
Description	Area burnt in stratum *i*
Source of data	Field measurement, remote sensing measurement, or any other spatial information available
Description of measurement methods and procedures to be applied	The area shall be delineated either on the ground using GPS, from georeferenced remote-sensing data, or from any other spatial information available
Frequency of monitoring / recording	This area is measured whenever forest fire has occurred
Value applied	N/A
Monitoring equipment	GPS (if applied)
QA / QC procedures to be applied	Quality control / quality assurance (QA / QC) procedures prescribed under national forest inventory are applied. In the absence of these, QA / QC procedures from published handbooks, or from the IPCC GPG LULUCF 2003, are applied
Purpose of data	Calculation of project emissions / removals
Calculation method	N/A

Comments	Only used in case wildfires occur

Data / Parameter	X_i
Data unit	Variable
Description	Variables measured per tree for the calculation of aboveground biomass and allometric equation for species
Source of data	Measured
Description of measurement methods and procedures to be applied	Depending on the variable
Frequency of monitoring / recording	Measured every monitoring event, at least every five years
Value applied	N/A
Monitoring equipment	Depending on the variable (tape, calliper, etc.)
QA / QC procedures to be applied	Quality control / quality assurance (QA / QC) procedures prescribed under national forest inventory are applied. In the absence of these, QA / QC procedures from published handbooks, or from the IPCC GPG LULUCF 2003, are applied
Purpose of data	Calculation of project emissions / removals
Calculation method	N/A
Comments	Ex-ante the allometric equation is based only on *dbh* (diameter at breast height in cm). Ex-post the project will develop own equations based on several variables.

Data / Parameter	*T*
Data unit	Year
Description	Time period elapsed between two successive estimations
Source of data	Recorded time
Description of measurement methods and procedures to be applied	N/A
Frequency of monitoring / recording	N/A
Value applied	N/A
Monitoring equipment	N/A
QA / QC procedures to be applied	N/A
Purpose of data	Calculation of project emissions / removals
Calculation method	N/A
Comments	If the two successive estimations of carbon stock in trees are carried out at different points of time in year t_2 and t_1, then a fractional value is assigned to *T*

Additional parameters including canopy cover and proportion of area with mineral soils will be considered for inclusion when aligning the project with VM0033 at first verification.

3.3.3 Monitoring Plan

According to AR-AM0014, v3.0 requirements, the Monitoring Plan shall provide for collection of all relevant data necessary for:

1. Verification that the applicability conditions of the methodology have been met. The applicability conditions that shall be demonstrated ex-post during the next verification event are:
   a) More than 90% of the project area is planted with mangrove species. If more than 10% of the project area is planted with non-mangrove species, then the project activity does not lead to alteration of hydrology of the project area and hydrology of connected up-gradient and down-gradient wetland area
   b) Soil disturbance attributable to the ARR project activity does not cover more than 10% of area
   c) Displacement of agricultural activities does not cause, directly or indirectly, any drainage of wetlands
2. Verification of changes in carbon stocks in the pools selected: methodology described in the sub-section “Monitoring of net anthropogenic GHG removals”.
3. Verification of project emissions and leakage emissions: methodology described in the sub-section “Monitoring of net anthropogenic GHG removals”.

The monitoring plan will be refined and brought in line with VM0033 before first verification.

PROJECT BOUNDARY MONITORING

This is a key activity during the monitoring of the project. Thus, the geographic coordinates of the boundary of each parcel within the project area have been and will be defined. This includes all areas of lateral expansion and/or planting in the buffer zone. Field surveys using GPS, satellite imagery, and GIS software have been used in this activity.

Usually, two teams have been working simultaneously, one in the Casamance Delta and the other one in the Sine-Saloum Delta. The team leader was a GIS and GPS expert in charge of the training of the teams, the work planning, and the data collection, merge, storage, and analysis.

Due to the particular nature of the project, with multiple small and scattered plots, it is necessary to plan the fieldwork before the measurement campaign. Key aspects considered for planning were tide, parcel location, and means of transport (motorbike, pirogue, etc.).

STRATIFICATION AND SAMPLING DESIGN

Stratification

Biomass distribution over the project area is not homogeneous; therefore, stratification should be carried out to improve the precision of biomass estimation. Different stratifications may be required for the baseline and the project scenarios are always looking for higher homogeneity inside each stratum to improve precision.

Baseline stratification was done based on the land-use type. Since in the first project activity instance the whole area is severely degraded mangrove habitat, only one strata was considered in baseline estimations (see Section 3.2.1).

Stratification for ex-ante estimations of actual net GHG removals by sinks was primarily conducted based solely on tree species and planting year. In future verifications, and as the differences in growth and mortality rates become noticeable between the different zones of the project area, the stratification criteria might be readapted before first verification.

The following table summarizes the nine strata described in Section 3.2.2.

Table 34: Stratification of first project activity instance

Stratum	Planting year	Mangrove species	w_i	Area (ha)
1	2020	*A. germinans*	0.03	190.86
2		*R. mangle*	0.2	1,431.46
3		*R. racemosa*	0.04	286.29
4	2021	*A. germinans*	0.04	272.26
5		*R. mangle*	0.29	2,041.97
6		*R. racemosa*	0.06	408.39
7	2022	*A. germinans*	0.03	238.86
8		*R. mangle*	0.26	1,791.41
9		*R. racemosa*	0.05	358.28
Total			1.00	7,019.79

Sampling design, plot selection, and location

The project will use an independent monitoring that will be based on a fixed size plot and a random sampling using temporal sample plots to estimate carbon stock in trees for monitoring of project activities. Both monitoring will be independent and the location of the selected pre-existing trees will not depend on the different stratifications that may occur in each verification event.

Pre-existing trees monitoring:

Remote sensing images from 2020 will be compared with those taken at each verification event to monitor the presence of pre-existing trees.

Sampling for carbon stocks estimation:

The project will use temporal circular sample plots randomly located in each stratum, ensuring that the entire area of the plot is within the boundaries of the planting area. The sample plot area will be determined before each verification event. For the first verification, the size of the sample plot in every stratum was defined ex-ante to be 314 m^2 (radius = 10m). This sample plot size is according to recommended size by the IPCC[126] of 100m².

The number of samples and sample size will be determined using "Calculation of the number of sample plots for measurements within A/R CDM project activities (Version 02.1.0)" to reach the targeted precision level of ±10% of the mean of the measured variables at the 90% confidence level in a cost-effective manner.

The number of required sample plots (n) will be calculated using equation 2 of the abovementioned tool, since the sampled area is expected to be less than 5% of the project area:

$n = \left(\frac{t_{val}}{E}\right)^2 \times \left(\sum_i \quad w_i \times s_i\right)^2$	(Equation 17)

Where:

n	= Number of sample plots required for estimation of biomass stocks within the project boundary; dimensionless
$t_{,val}$	= Two-sided students t-value at infinite degrees of freedom for the required confidence level; dimensionless
E	= Acceptable margin of error (i.e. one-half the confidence interval) in estimation of biomass stock within the project boundary; t d.m. (or t d.m. ha^{-1})
w_i	= Relative weight of the area of stratum *i* (i.e. the area of the stratum i divided by the project area); dimensionless
s_i	= Estimated standard deviation of biomass stock in stratum *i;* t d.m. (or t d.m. ha^{-1})

[126] IPCC (Intergovernmental Panel on Climate Change) 2003. Good practice guidance for land use, land-use change and forestry. Intergovernmental Panel on Climate Change (Section 4.3.3.4.2).

The number of plots allocated to each stratum will be calculated using equation 4 of the tool:

$$n_i = n \times \left(\frac{w_i \times s_i}{\sum_i w_i \times s_i}\right)^2 \qquad \text{(Equation 18)}$$

Where:

n_i	= Number of sample plots allocated to stratum *i*; dimensionless
n	= Number of sample plots required for estimation of biomass stocks within the project boundary; dimensionless
w_i	= Relative weight of the area of stratum *i* (i.e. the area of the stratum i divided by the project area); dimensionless
s_i	= Estimated standard deviation of biomass stock in stratum *i;* t d.m. (or t d.m. ha^{-1})

During the monitoring process, a re-assessment of the plot size and plot number based on the variance may be necessary depending on the characteristics of the ex-post strata. The date of last measurement of sample plot will be considered to be the date of estimation of carbon stock, even if the full process of measurement extends over a period of time.

MONITORING OF NET ANTHROPOGENIC GHG REMOVALS

Ex-post estimation of the baseline net GHG removals by sinks

The AR-TOOL14 methodological tool is used to estimate baseline net GHG removals by sinks in A/R CDM project activities, as described in Section 3.2. Baseline net GHG removals by sinks shall not be monitored during the crediting period.

Ex-post estimation of the actual net GHG removals by sinks

The monitoring of the GHG removals will be based on the above explained monitoring of the project boundary, the stratification of the project and the sampling design.

Forest establishment will be supervised, reporting on the verification that the planting has been completed. This process will be monitored after the end of the planting period and recorded in a database (during the first two years).

Ex-post estimation of leakage

Displacement of pre-project agricultural activities will not occur in the first project activity, being duly justified, but specific data will not need to be monitored for the assessment of this source of leakage. In future instances of the project activity, if displacement of agricultural activities occurs, these will be monitored based on AR-TOOL15.

QUALITY ASSURANCE AND QUALITY CONTROL (QA / QC) PROCEDURES

QA and QC procedures shall be implemented to ensure that anthropogenic net removals of GHGs by sinks are measured and monitored in an accurate, verifiable, and credible manner. The implementing organization will be required to design a quality management and quality assurance system to ensure good management, quality, and reliability of the information. The QA / QC system shall conform to IPCC recommendations. To provide consistency in the processes, protocols and manuals should be developed for all project activities as follows:

Verification of field data

Data recorded on the field forms will be monitored and evaluated to identify the accuracy and consistency of the sampling data, and to verify that the required percentage error is met (10%). If errors are identified, they will be corrected and documented, not to exceed 5%; if the error is greater, sources of the mistakes will be identified and the plantation monitoring protocol will be updated. The same procedures will be used throughout the life of the project to ensure continuity.

Review of information processing: in order to identify possible inconsistencies, the data collected in the field and recorded in the digital systems will be reviewed for a permanently selected sample of 10% of the records. If the typing error is greater than 10%, the entire data should be reviewed, and the necessary corrections made.

Data recording and archiving system

Standard operating procedures will be established for all procedures such as GIS analysis, field measurements, data entry, data documentation, and data storage.

The information collected will be stored in an organized and secure manner in both digital and physical formats. Each file should contain field forms, estimates of changes in carbon content (equations and calculations), geographic information (GIS), and measurement and monitoring reports.

Collected data will be archived for a period of at least two years after the last crediting period of the project activity, in accordance with AR-AM0014 methodology.

OPERATIONAL AND MANAGEMENT STRUCTURE

A well-trained monitoring unit will perform the monitoring (field survey, data collection, QA / QC, GHG removals, etc.). The monitoring unit will have the following structure:

- Monitoring teams: in charge of field measurements and data collection in field forms and digital databases. It is expected that each team will be formed at least by two people, one in charge of measurements and the other in charge of data collection and Unmanned Aerial Vehicle (UAV) flight performance (if required). These teams will be coordinated by the implementing partner (Oceanium in the case of the first activity instance).
- Coordinator: will be responsible for the coordination of the monitoring teams and the person in charge of data analysis and data quality. This person, belonging to the implementing partner, will be in charge of team training, data quality, data processing and storage, and technical and logistical management.
- Forest carbon expert: in charge of GHG removals and QC / QA calculations.

Financial resources for the Monitoring Plan will be provided by WeForest.

3.3.4 Dissemination of Monitoring Plan and Results (CL4.2)

The Monitoring Plan, documentation, and information on the results of monitoring, as well as each verification of this project will be published on the VERRA platforms, where stakeholders will be able to easily download them.

During each verification, the monitoring unit will summarize the Monitoring Plan and results to be communicated to the communities and other stakeholders. In addition, the monitoring unit will summarize all comments received from stakeholders and related responses regarding the Monitoring Plan and results, and will post them on the VERRA website along with the monitoring report for each monitoring period. See Section 2.3.2 for more details on the dissemination of project documents to communities and workers.

4 COMMUNITY

4.1 Without-Project Community Scenario

4.1.1 Descriptions of Communities at Project Start (CM1.1)

Sections 2.1.6 and 2.1.9 mentioned that there are 17 communities included in the project zone, twelve from Casamance and five from Sine-Saloum. In each community, different villages are included. The total population of all communities is 297 794, based on projections from the last census conducted in Senegal in 2014 (Agence Nationale de la Statistique et de la Démographie).

The inhabitants' survival in both areas heavily depends on natural resources. Their economic activities differ depending on their proximity to the mangrove. While the communities near the mangrove are more oriented toward aquaculture activities (fishing and oyster collection), the more inland communities base their economic activities on agriculture. Most families raise some animals for their consumption.

The main ethnic groups are described in Section 2.1.6. Traditional and religious leaders are very relevant in how communities are structured and how they make decisions.

Senegal's Marine Protected Areas (MPAs) are community based. This means that the governance of Senegal's community marine areas is ensured by the riparian communities (through the management committee) and the State services (Directorate of Community Marine Protected Areas and Fisheries Services). The community marine-protected areas are therefore community-based mechanisms, although they are co-managed with public institutions[127]. Senegalese marine and coastal areas play an important role in the socio-economic life and the conservation of national, sub-regional, and global biodiversity (migratory species). For example, at the national level, fishing contributes significantly to job creation (600,000 jobs), food security (more than 70% of animal protein intake), wealth creation (more than 240 billion per year), and significantly reducing national debt (first foreign exchange inflow sector) (Ministry of Fisheries and Maritime Affairs, 2013; Diouf et al., 2016)[128].

Tourism, which largely takes place in the marine and coastal zone, is the second largest source of foreign exchange inflows in Senegal after fishing. Revenue from tourism represented nearly 500 billion CFA francs, or 7% of GDP in 2017. This sector generates more than 100,000 jobs nationally.

As described in Section 2.1.9, residents in Casamance villages are active in a variety of livelihoods. Rice growing remains the central activity of the population, but they are also involved in animal husbandry, fishing and traditional fish farming, market gardening, and collection of sea products, etc.

In Sine-Saloum, as in all the villages of the groundnut basin, the primary activity is agriculture, with family farms for self-consumption including groundnuts, millet, and corn. Rice cultivation is also an essential activity with areas of up to 100ha. Rice is both marketed and consumed by households, except in the village of Sakhor, where production is entirely consumed by households. The people of the Sine-Saloum who live near mangrove areas are more involved in the fisheries sector (mainly shrimp, fish and oyster harvesting).

Households in the Saloum Delta are developing strategies to diversify their activities to meet their needs (see Figure 11). Thus, in addition to income from mangrove socio-economic goods and services, households practice agriculture, trade, livestock (poultry, sheep, goats, etc.), market gardening, and benefit from purchases from migrants. [129]

[127] El hadj Bara Deme, Pierre Failler et Grégoire Touron-Gardic, « La gouvernance des aires marines protégées au Sénégal : difficulté de la gestion participative et immobilisme des comités de gestion », VertigO - la revue électronique en sciences de l'environnement [En ligne], Volume 21 numéro 1 | mai 2021, mis en ligne le 17 mai 2021, consulté le 29 juin 2022. URL : http://journals.openedition.org/vertigo/30880 ; DOI : https://doi.org/10.4000/vertigo.30880

[128] See Plan national d'adaptation du secteur de la pêche et de l'aquaculture face au changement climatique horizon 2035 as supporting documentation

[129] See étude de base du programme mangrove capital Africa du delta du Saloum as supporting documentation

The mangrove ecosystem goods and services on which the majority of members of households in the Sine-Saloum depend, include oyster farming, mangrove beekeeping, seafood harvesting, fishing, salt exploitation, and the processing of fishery products.

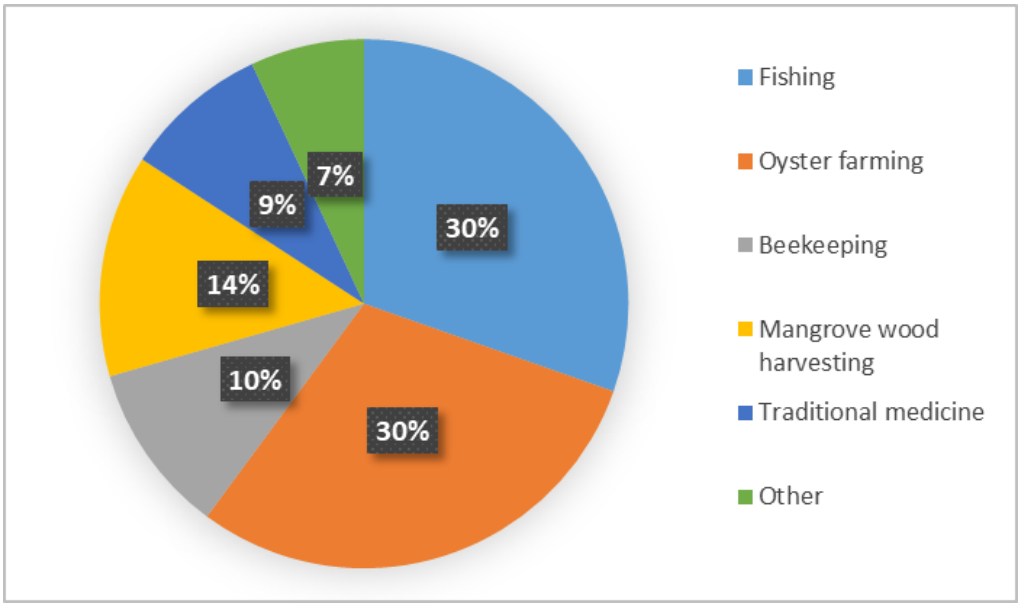


Figure 25: Major traditional activities carried out in the mangrove ecosystem of the Saloum Delta[130]

In Casamance, rice is still the main crop, with an estimated area of more than 40,000ha and an annual production of nearly 100,000 tons. Millet, peanuts, corn, sorghum, and cowpeas are the next top crops. The region also produces a lot of fruits, the most cultivated being mango, but also oranges, mandarins, grapefruits, and bananas.

The cultivation of cashew is also important to the area. The cashew nut is mostly exported and used as an appetizer and in the chocolate industry. The pulp of the cashew apple, very rich in vitamin C, is used to make jam and fruit juice and 'soum-soum', an artisanal alcohol obtained after fermentation of the pulp.

After the rice harvest, the Casamance people engage in other activities. The men fish, build, or maintain houses, build bamboo hedges, and harvest palm wine, called 'bunuk'. This area is known for its palm wine production. The women carry out several activities including market gardening, salt production, mangrove oyster collection, and shellfish harvesting, fish processing, and palm oil preparation. Livestock farming is also an important activity for this region, which has a high forage potential. Its contribution to the income of

[130] See Strategic Environmental Assessment (SEA) of the Mangrove Restoration Project for the Sine-Saloum and Casamance Communities (MANCO Project)

the populations is quite important. Livestock is mainly made up of small ruminants (sheep and goats) and large ruminants, typically owned by wealthier families. Sales involve both small and large ruminants, depending on the circumstances. These livestock sales are generally used for food expenses.

The populations traditionally use the mangrove for beekeeping, salt collection, and the exploitation of halieutic resources: fish, oysters, and other shellfish (See Figure 26).

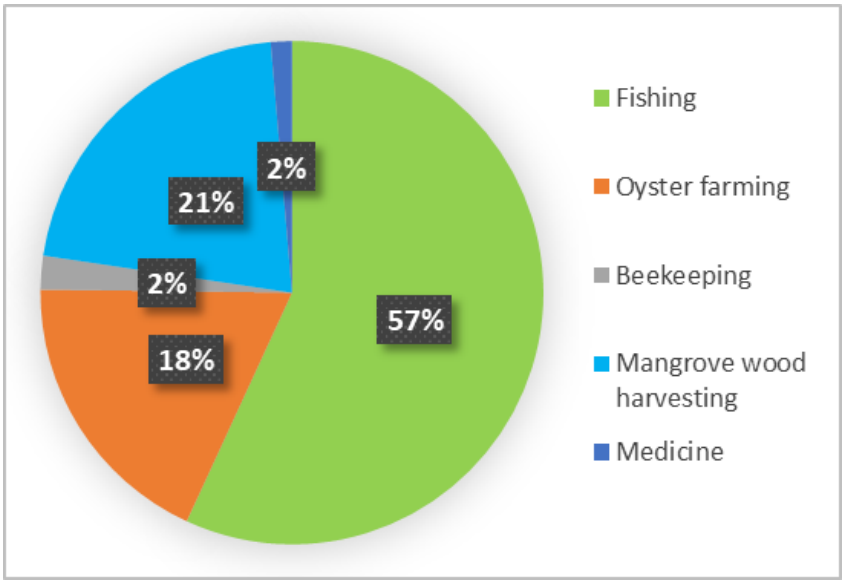


Figure 26: The main traditional activities carried out in the Casamance mangrove ecosystem[131]

Rice cultivation remains the main activity in Casamance. Fishing is also practiced by a large part of the population, especially men. However, it remains a secondary activity, as it is practiced at the end of the work day in the field during the rainy season and throughout the dry season. The catches generally consist of fish (tilapia, ethmalosa, 'captain' fish, etc.), and shrimp (pink or black), which are mainly used for family consumption. The gathering of oysters and the collection of shellfish is the work of women as well as the production of salt. Both salt and oysters are for family consumption, donation, and sale in homes, by hawking, or at the market (Bassene et al., 2016)[132].

[131] See Strategic Environmental Assessment (SEA) of the Mangrove Restoration Project for the Sine-Saloum and Casamance Communities (MANCO Project)
[132] See L'évolution des mangroves de la Basse Casamance au sud du Sénégal au cours des 60 dernières années as supporting documentation

In Casamance, after the rice-growing work of the rainy season, people devote themselves to small-scale food production and, increasingly, to commercial production[133]. Several competing activities intermingle: market gardening, planting fruit trees, crushing palm nuts for oil, fishing in the rice fields, fish processing, oyster harvesting, salt extraction, shellfish and dead wood collection, etc.

In Section 2.1.6 there is a detailed description of communities. The following describes the main activities linked to mangrove areas. In Casamance, men mainly fish and women mainly collect oysters, fixed on the *Rhizophora* roots (*Crassostrea gazar*). In the Saloum Delta, women collect oysters (yoxos in Wolof), but mainly bivalves (Anadara senilis, Murex sp., Cymbium sp., respectively in Wolof pañe, tuffë, and yeet).

The Diola women of Casamance are primarily oyster gatherers, while the Niominka and Soce women of the Saloum give priority to the harvesting of the arches (Anadara senilis) on the mudflats of the delta. According to the inquiries in the Saloum Delta made by the authors[134], shellfish work (harvesting and processing) represents the major activity of nearly 92% of the women of Saloum Delta in terms of time allotted to that activity and the main source of income for nearly 76% of those women (the sole source of income for nearly 7% of them). In Casamance, a similar importance is linked to oyster work in the villages of the Casamance river estuary or Lower Casamance, notably in the islands of Blis-Karone, Boulouf, and Bandial. In the vicinity, and upstream of Ziguinchor, most of the harvesters are Arame Diola or Felupe, refugees coming from Bissau-Guinea and settled in the city of Ziguinchor. Table 35 shows the task distribution in Casamance according to seasonality.

Table 35: Tasks distribution in Casamance according to seasonality

Season	Month	Particularity	Women	Men
Houlé	Feb/May	Dry season	commerce transport market gardening rice pounding	palm wine village work house building general maintenance

[133] Borrini-Feyerabend, Chatelain et Tous. Rapport pour l'Association des Pêcheurs de la Communauté Rurale de Mangagoulack:https://www.iccaconsortium.org/wp-content/uploads/2015/08/example-kawawana-en-marche-borrini-feyerabend-2009-fr.pdf

[134] Cormier-Salem M-C. Let the Women Harvest the Mangrove. Carbon Policy, and Environmental Injustice. *Sustainability*. 2017; 9(8):1485. https://doi.org/10.3390/su9081485

Season	Month	Particularity	Women	Men
Bouling	June/July	First rains	wood collection fertilizer collection nurseries salt collection oyster and other shellfish collection	kadiandou (rice) labor clearing fishing
Houli	August/Sep	Wet season	transplanting	kadiandou (rice) labor
Boughit	Oct/Nov	End of rains	beans draft trade	
Koaugène	Dec/Jan	Rice collection	rice harvesting bean harvesting	palm wine fishing

4.1.2 Interactions between Communities and Community Groups (CM1.1)

As the mayors are the traditional authority that the project engages with, this section looks at the interactions between the mayors and various important community groups and stakeholders.

Interaction between mayors and community groups

According to article 71 of the general code of territorial authorities, the commune is a territorial collectivity, a legal entity under public law. It groups together the inhabitants (community) of a given locality, made up of neighborhoods and/or villages united by a sense of solidarity resulting from neighborliness, willing to look after their own interests and able to find the necessary resources for action that is specific to them within the national community and in the interests of the nation. The mayor is elected by the community and is

representative of the commune and its inhabitants and is in charge of the local development and the execution of the acts of the state. The residents elect the mayor and the municipality council members.

Once the results of the municipal elections have been published, the whole community accepts the results and recognizes the authority of the mayor and his council to make decisions binding on the commune and the community. However, it cannot be ruled out that community members supporting the opposition may analyze the mayor's actions through a political prism. It is possible that certain activities promoted by the mayor and his council could be analyzed by them as partisan activities (even if this is not based on evidence). To avoid this, the project will organize community awareness-raising activities to involve them more closely in the project's decisions, and to help them understand the reasons behind the decisions taken.

Interaction between mayors and local authorities

The mayors are supported in all their activities by decentralized government departments. In the case of this project, the mayors are supported and advised by the conservators of community protected areas and the water and forestry inspectorate. In addition, the capacity of the mayors of the project's communes vary widely (from very literate to not very literate). Thus, for all decisions taken by the municipal council, the prefect or sub-prefect must ensure the validity of decisions taken by the municipal council and acts signed

Interaction between mayors and foreign fisherman

Some of the waterways in the communities where we work are frequented by fishermen from other communities or even other countries. These fishermen are not anchored in the intervention communes, but stay there occasionally for the fishing campaigns. These foreign fishermen do not form a compact, unchanging group, which makes it difficult to keep track of them. Mayors do not have the necessary resources to implement communication strategies aimed at these foreign fishermen, as they are dispersed and change from one year to the next. In order to communicate with these players, town councils rely on the artisanal fishing committees, which each year provide awareness-raising activities aimed at foreign fishermen, informing them on a number of subjects, including biological rest periods, authorized fishing zones, the ban on cutting mangrove wood, and the risks incurred by non-compliance with the rules.Interaction between mayors and socio-economics groups.

The mayors wish to support all economic operators active in their communities. However, not all town halls have the financial or technical capacity to support foreign economic operators. The mayors are aware of the economic operators present in their communes and invite those who are not to formalize in order to benefit from possible subsidies (infrequent) from the government, banking institutions or development projects. Mayor support for socio-economic operators can be considered extremely limited and the relation between those two groups are limited.

4.1.3 High Conservation Values (CM1.2)

Since there is no specific report for the HCV assessment in Senegal, an evaluation has been made following the Common Guidance for the Identification of HCV. According to the Guide, the only HCV identified in the project zone is HCV 6: Cultural values. Two sites exist which are identified as HCV 6, as shown in the tables below.

Table 36: High Conservation Value Emblematic ICCA

High Conservation Value (HCV 6)	Emblematic ICCA: The rural community of Mangagoulack, in the Casamance region of Senegal (HCV6)
Qualifying attribute	The community of Mangagoulack is identified as "territory and area conserved by indigenous peoples and local communities" (ICCA). This community is an area inhabited nearly exclusively by Djola people. The Djola people are aware of the degradation of the coastal environment due to indiscriminate fishing and resource extraction, and they have created an association of fishermen to conserve and preserve the mangroves. The representative of the community, the mayor of Mangagoulack, has been invited to the participative process and has signed an agreement for the participation of the community in the project. https://www.iccaconsortium.org/index.php/2014/12/15/an-icca-in-casamance-the-story-of-kawawana/
Focal area	Community of Mangagoulack in the region of Ziguinchor, in Casamance.

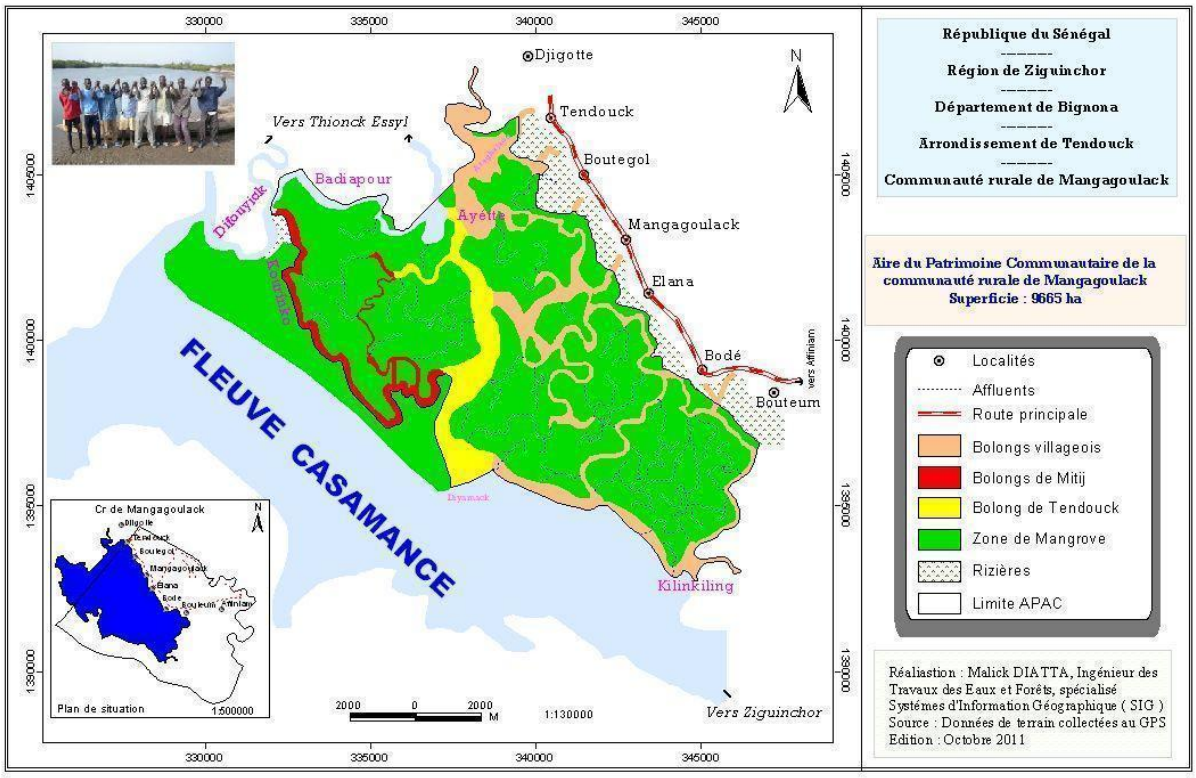


Figure 27: Map of the area of community heritage of the Rural Community of Mangagoulack. Source: ICCA website

Table 37: High Conservation Value UNESCO World Heritage Site

High Conservation Value (HCV 6)	UNESCO World Heritage Site: Saloum Delta in Senegal
Qualifying attribute	The Saloum Delta is a UNESCO cultural landscape that has traditional importance to local people. According to the UNESCO website, this property measures at about 5,000 square kilometers in size. “Fishing and shellfish gathering have sustained human life” in the site. “There are 218 shellfish mounds, some of them several hundred meters long, produced by its human inhabitants over the ages”. “Burial sites on 28 of the mounds take the form of tumuli where remarkable artifacts have been found. They are important for our understanding of cultures

	from the various periods of the Delta's occupation and testify to the history of human settlement along the coast of West Africa." https://whc.unesco.org/en/list/1359/
Focal area	Community of Djirnda in the region of Fatick.

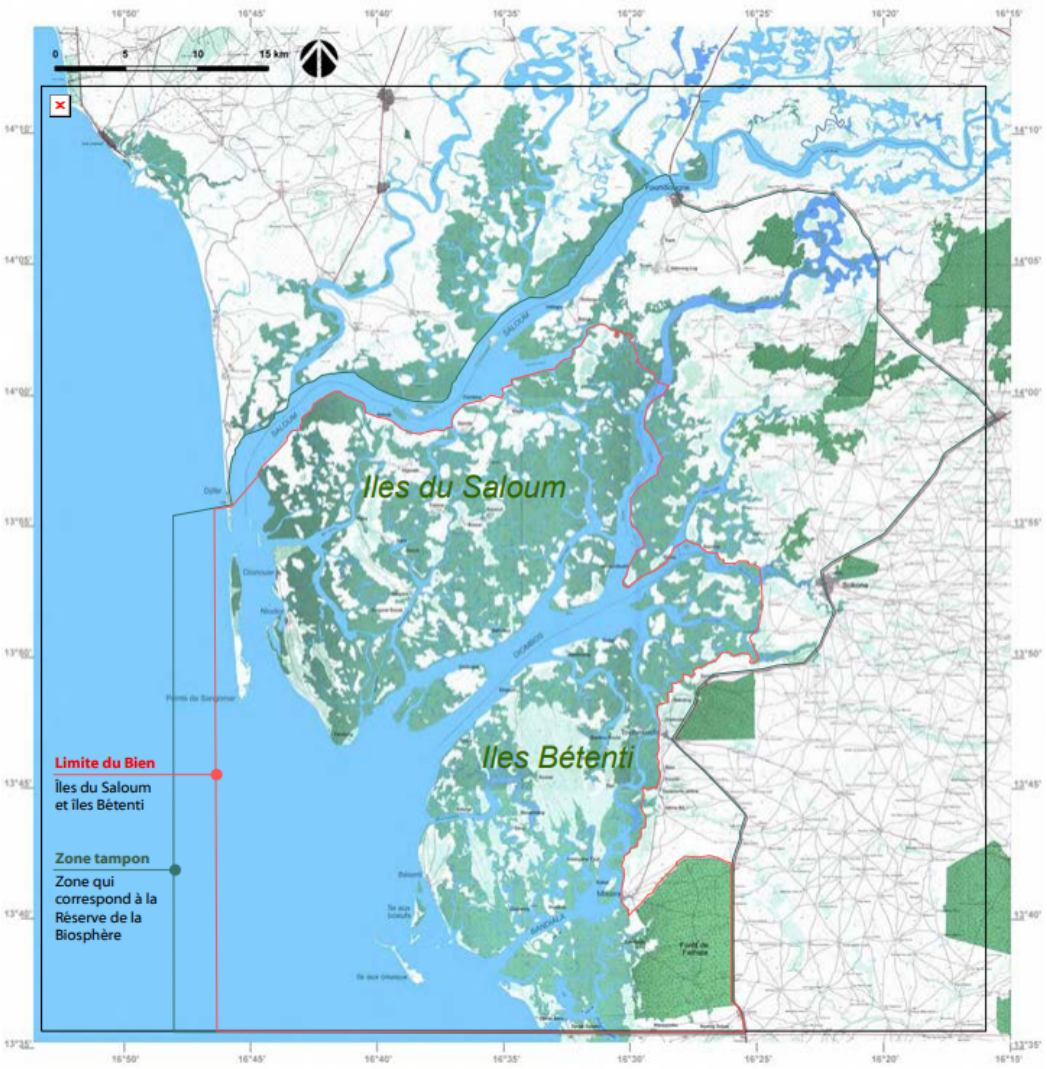


Figure 28: Map of the area of the Sine-Saloum Delta UNESCO World Heritage Site showing the Rural Community of Mangagoulack community heritage area Source: UNESCO website ICCA website

4.1.4 Without-Project Scenario: Community (CM1.3)

The without-project scenario is described in Section 2.2 and analyzed in Section 3.1.4. The most-likely land-use scenario is continuation of pre-project use (the land as a degraded wetland). Under the without-project scenario, no changes in the well-being conditions of the communities are expected.

Income activities are mainly based on natural resources exploitation like fishing and agriculture for example. In the areas of the project that are close to agricultural land, the phenomenon of salinisation of the land will continue, leading to a reduction in the number of rice fields in Casamance. In addition, education level is low, and very often they lack resources to buy school supplies. Cases of inappropriate use of resources are not exceptional, and conflicts between the local communities and foreign fishermen (table 33) could continue to happen. In 2020, a conflict occurred between native and non-native fishermen based on the non-respect of local resources management rules. In the framework of a slow mangrove natural regeneration, the competition for natural resources access will continue.

During the participatory process, two workshops were performed in Sine-Saloum and Casamance areas. Social and biodiversity projections under a without-project land-use scenario were conducted and the following was concluded:

- Lack of political will in the development framework due to a lack of identification of local resources from government
- Weak training and information for communities
- Weak organization of local producers
- Weak access to finance
- Lack of access to alternative employment opportunities

The communities will continue using the local resources (oysters, salt, fish, etc.) as main livelihoods using the existing traditional ways of production.

Mangrove oysters grow on mangrove roots. Whilst it is a widely consumed product in Senegal, the absence of mangroves represents a loss of income for local people, who could have generated income by sustainably collecting oysters from the roots of reforested mangroves (using a knife to remove oysters from the roots while leaving the roots intact). In addition, there is a lack of access to markets due to the long distances from fishing sites to markets and poor producer group organization[135].

[135] See Project MANCO, analyse sectorielle, available as supporting documentation

Figure 29: Project area before the plantation[136] *(*Source: WeForest)

Production of honey in Senegal has fallen to less than 100kg/beekeeper and campaign. National production fell by 20% from 2003 to 2015, and the prices are variable: 3,000-5,000 FCFA/kg (4.5-7.6 €/kg). Under these conditions, the profit margin for beekeepers is very low. At national and local levels a legal framework does not exist to define the standards for honey production. There is a lack of organization in the sector despite the high demand because of the weak integration of the honey sector's actors in the market system. The beekeeping sector will likely continue to reduce because of the precarious conditions derived from the production and sale of honey.

In the project zone, the fishermen organizations are weak, and the main fishery organizations (National Federation of Fishing Economic Interest Groups of Senegal and local artisanal fisheries committee) are under-represented at the village level. A lack of infrastructure exists for the conservation of fishery products and for the correct development of fisheries. The prices are variable depending on the kind of species: the rarer fish are sold by 1021-6167 FCFA (1.56-9.40 €/kg), and the more common fish are sold at 50-964

[136] Other pictures of the initial stages of the project can be found in Section 5.1.1.

FCFA (0.08-1.47 €/kg). The majority of the fishery products are sold to wholesalers (70%), and the rest are sold in local markets[137].

In the long term, mangrove resources will continue to be scarce and so will the income they can generate (oysters, fish, etc.). The low opportunities in natural resources exploitation and the lack of income will cause displacement and food insecurity for local communities.

The possible projections under the without-project scenario were worked on during the project Social and biodiversity impact assessment (SBIA) workshop. The key outcomes highlighted by the communities if the project is not implemented included: (1) cessation of implementation of reforestation and socio-economic activities; (2) conflicts between project stakeholders due to poor communication between actors; (3) threatened resources due to continued pressure.

Without the project, the following trends are expected:

- Fewer income activities relying upon unproductive systems due to the deterioration of the mangrove.
- Lack of training in sustainable fishing and agriculture resulting in very rudimentary and environmentally unfriendly methods.
- Lack of training in sustainable governance resulting in poor governance outcomes (conflicts among stakeholders and the risk of corruption).

4.2 Net Positive Community Impacts

4.2.1 Expected Community Impacts (CM2.1)

The socio-economic component of the project aims to sustainably improve the livelihoods of communities living alongside mangrove ecosystems by strengthening their access to, and participation in, the market system for local produce.

The project will be implemented in 17 communes in the natural regions of Casamance and Sine Saloum, following a systemic "Market Access" approach.

Activities are articulated around four outcomes that will address the above-mentioned gaps in support services, coordination in value chains and governance of interventions. It will be implemented through a participatory diagnostic process, with the following results:

- Result 1: Market shares and incomes of mangrove producers are increased by strengthening their capacities in sustainable production techniques, organization and entrepreneurship;

[137] See monographie de la pêche artisanale et de la forêt, 2008, Ministère de l'économie et des finances / ANSD as supporting documentation

- Result 2: Barriers to producers' effective participation in the market system are reduced through better market knowledge, networking, and the development of strategic partnerships within a fair trade logic;
- Result 3: Fair and transparent ecological mangrove value chains are established through a participatory certification process;
- Result 4: livelihood intervention's effectiveness is strengthened by developing synergies with other mangrove interventions and facilitating institutionalized exchange frameworks.

The project's main activities are: i) strengthening technical, organizational, and entrepreneurial capacities; ii) upgrading value-added chains through the development of strategic partnerships and SGP agro-environmental certification; and iii) reinforcing concerted action between stakeholders and action synergies. Their implementation will aim to increase the income of mangrove producers, while guaranteeing sustainable protection and management of these ecosystems.

In addition to supporting market access, the project is implementing awareness-raising activities (ex: cinema debate) aimed at communities, so that they can have an informed opinion on the decisions they will be making, particularly when it comes to exploiting resources from mangrove forests.

The planting of almost 7,020 ha of land, and the promotion of sustainable value chain (fisheries, oyster collection, beekeeping, salt, etc.), will be a great opportunity to strengthen the resilience of the local populations in the face of food insecurity. The specific consideration given to women and young people, through support for their integration into market systems, helps to boost the gender aspect of the economic and social development process in the communes concerned by the project.

Figure 30: Cinema debate (Source: Oceanium)

The following tables have been completed for each community group in order to identify the expected impacts resulting from the implementation of the project activities.

Table 38: Expected impacts: Local community groups

Community Group	Local community groups
Impact(s)	Increase in protection of the mangrove Increase in economic livelihood opportunities (fish, oysters, honey, non-timber product, shrimps, salt) Increase in perception and recognition on the benefits of mangrove restoration and protection Improvement in knowledge and skills in mangrove management Improvement in trust and support of community stakeholder groups

	Consultation frameworks bringing together representatives of technical services, local authorities, producers and other stakeholders will strengthen social relations and limit conflicts linked to competition between uses and access to resources.
Type of benefit / cost / risk	Real, positive, and direct impacts
Change in well-being	In general, the local community groups are involved in all project activities. They have increased their knowledge in the mangrove ecosystem and its function, as well as developed sustainable businesses based on the mangrove ecosystem. They have received capacity building and new employment opportunities. Project activities will improve the mangrove cover and biodiversity, and will provoke an increase of fish, oysters, and other species that are relevant for livelihoods. It has been agreed that revenue from 10% the VCU will be for the communities to improve basic services. The structure of this 10% share will be defined by the national and regional committees that are being established by the Senegalese government. WeForest and Oceanium will have observer status in these committees.

Table 39: Expected impacts: Fishermen

Community Group	Fishermen
Impact(s)	Increased presence of fish, shrimp, mussel, crabs, and other commercial natural resources Increase in perception and recognition of mangrove restoration and protection benefits Strengthening the fishery value chain Increase in cash income Increase / stabilization of quality for their livelihoods
Type of benefit / cost / risk	Real, positive, and direct impact

Change in well-being	Fishermen are developing and managing sustainable and stable fishery businesses associated with mangroves, increasing their incomes and quality of life

Table 40: Expected impacts: Women

Community Group	Women (oyster collectors)
Impact(s)	Increased presence of mollusks Increase in perception and recognition of mangrove restoration and protection benefits Strengthening the oyster value chain Increase in cash income Increase / stabilization of quality for their livelihood Women, who are essential stakeholders in the organization and leadership of certain processing groups, will play an active part in the project's activities, from which they will be privileged beneficiaries in terms of increased income, mastery of technologies, and mentoring.
Type of benefit / cost / risk	Real, positive, and direct impacts
Change in well-being	Women participate in oyster collection activities and they are managing and developing a sustainable and stable business associated with mangroves, increasing their income and quality of life

Table 41: Expected impacts: Beekeepers

Community Group	Beekeepers
Impact(s)	Strengthening of the honey value chain Increase in perception and recognition of mangrove restoration and protection benefits

	Increase in cash income Increase / stabilization of quality for their livelihood
Type of benefit / cost / risk	Real, positive, and direct impacts
Change in well-being	Beekeepers are developing and managing a sustainable and stable business associated with the forest, increasing their incomes and thereby improving their quality of life

Table 42: Expected impacts: Mayors

Community Group	Mayors
Impact(s)	Increase in perception and recognition of mangrove restoration and protection benefits Improvement in their recognition and credibility in local communities Improvement of the skills and tools for management and leadership regarding the sustainable use of mangroves
Type of benefit / cost / risk	Real, positive, and direct impacts
Change in well-being	In supporting the project, mayors could improve their credibility and better represent their villages in making appropriate decisions for their community in the mangrove restoration process.

Table 43: Expected impacts: Community marine protected areas

Community Group	Co-management between state services and local community[138]

[138] El hadj Bara Deme, Pierre Failler et Grégoire Touron-Gardic, « La gouvernance des aires marines protégées au Sénégal : difficulté de la gestion participative et immobilisme des comités de gestion », VertigO - la revue électronique en sciences de l'environnement [En ligne], Volume 21 numéro 1 | mai 2021, mis en ligne le 17 mai 2021, consulté le 28 juin 2022. URL: http://journals.openedition.org/vertigo/30880 ; DOI : https://doi.org/10.4000/vertigo.30880

Impact(s)	Increase in awareness of mangrove restoration and protection benefits Improvement in their recognition and credibility in local communities Improvement of the skills and tools for management and leadership regarding the sustainable use of mangroves in a marine community protected area
Type of benefit / cost / risk	Real, positive, and direct impacts
Change in well-being	In general, the community MPA is involved in all project activities implemented in this MPA. They have increased their knowledge of the mangrove ecosystem and its function, as well as developed sustainable businesses based on the mangrove ecosystem. They have received capacity building for MPA management and new employment opportunities. They will achieve their objectives in terms of reforestation and support to socio-economic activities based on resources from the mangrove forests of the protected area.

4.2.2 Negative Community Impact Mitigation (CM2.2)

No critical ecosystem services have been negatively affected by the project activities. Nevertheless, the following and hypothetical potential impacts were identified in the SBIA workshop.

Table 44: Negative impacts and mitigation measures identified during the SBIA workshop

Negative impact	Mitigation measure
Conflict of interest between beneficiaries and the project implementer e.g. around employment opportunities or expectations around the project	A communication plan will be implemented to ensure there is equal understanding of project activities and expected outcomes to avoid any conflict due to lack of understanding or unmet expectations. This will include awareness-raising, talks, and workshop debates. The project implementer follows a project recruitment policy that prioritises equal opportunities and non-discrimination to mitigate

Negative impact	Mitigation measure
	any chance of conflict based on lack of equal opportunities. In particular, there is the potential for conflict between foreign fishermen and the project, and foreign fishermen and the local community. The mitigation measures for this risk are expanded on in Section 1.3.2. Mitigation measures mainly involved inviting a representative of foreign fishermen to take part in the project design at all stages.
Restoration activities are unsuccessful e.g. mortality rates are high	Continued community with communities to set expectations on expected mortality rates. Restoration best practice guidance implemented to increase potential for successful restoration.
Failure to sustain the effects of the project's support for economic operators.	Participatory identification of the value chains to be supported under the project, to ensure that they are clearly identified as promising and capable of generating increased income for beneficiaries. Involvement of government services and national support programs for economic operators, so that they can finance the necessary investments to enable sustainable market integration. Project support focused primarily on players already involved in the sectors supported.

4.2.3 Net Positive Community Well-Being (CM2.3, GL1.4)

The net positive well-being impacts of the project have been identified by the stakeholders during the workshops and described in this document. The objective of the project is the mangrove restoration and protection, as well as the support of local people in developing sustainable ways of using mangrove resources.

Under the with-project scenario, local people will be made aware of the relevance of mangrove ecosystems, and develop sustainable economies based on traditional knowledge. Business development will incorporate training and capacity building involving local people in other project activities.

Figure 31: Workshop at Sine-Saloum (Source: Oceanium)

It is expected that around 10,900 people from local communities involved in the project will improve their skills and knowledge resulting from training (on plantations and socio-economics activities) provided as part of the project activities (5,000 people through socio-economic activities, and 5,900 through plantation activities and HSSE training). The implementation of project activities will allow local people to obtain sustainable economic development and land use. Around 5,000 people (3,000 women)[139] will see their incomes increased due to the development of sustainable businesses associated with mangrove forests.

[139] The project aimed to support at least 5 000 producers involved in socio-economics value chains. See the Proposition Technique Eclosio Livelihoods Final WF-VF as supporting documentation. The target beneficiaries are women and young people. Thus, we plan to support at least 60% of women in the IGAs.

The project is expected to generate temporary employment for 5,900[140] people (community members hired for planting activities) during the total project lifetime, with 1,770[141] of them being women.

The anticipated net well-being impact has been identified thanks to impact assessment carried out in 2017 on the mangrove restoration project implemented by Oceanium and the Livelihoods Carbon Fund 10 years after the plantation[142]. This assessment highlights the most net positive impacts that have been identified. It includes:

- Fish harvesting, oysters, shrimps, and shellfish
- Social impacts: awareness, pride, social mobilization, solidarity

Regulatory services: less erosion, salinization, swell, wind impact, and protection of rice fields, coasts, villages, and channels (bolongs).

4.2.4 High Conservation Values Protected (CM2.4)

None of the HCVs related to community well-being (Section 4.1.3) will be adversely affected by the project. The project activities considered in Section 2.1.11 have as their primary objective their conservation.

4.3 Other Stakeholder Impacts

4.3.1 Impacts on Other Stakeholders (CM3.1)

Table 45: Government institutions

Stakeholder Group	Government institutions
Impact(s)	Government institutes will benefit from the project's financial and logistical resources to help them carry out their regular missions to preserve the mangrove ecosystem (awareness-raising activities, acquisition of materials, project monitoring activities). In addition,

[140] For the 2020 Rhizophora plantation campaign 2,892 community members were engaged and planted 1845ha. To reach the 7020 ha, the project will engage and trained 5,900 community members and teach them how to plant. See the number of people hired for the 2020 plantation campaign in the Juin-Septembre 2020 narrative report as supporting documentation.

[141] At least 30% of the people recruited for the project will be women. See the politique de recutment MANCO as supporting documentation

[142] MANGROVE RESTORATION Impacts after 10 years of the largest mangrove restoration project of the Livelihoods Carbon Fund in Senegal with Océanium https://www.livelihoods.eu/wp-content/uploads/2020/03/MANGROVE-RESTORATION-IN-SENEGAL-Impact-Summary-Report-LIVELIHOODS-FUNDS-March-19-2020.pdf

	the government institutions will improve their credibility from local communities based on the activities that the government's institutions will implement in the framework of this project. Potential negative impact, risk of delays (due to administrative slowness) in implementing project activities that require the endorsement or support of government agencies.
Type of benefit / cost / risk	Real, positive, and direct impacts
Change in well-being	Improving mangrove conservation approach, and exchange of experience and information related to mangrove management and sustainable use of resources.

Table 46: University and research institutions

Stakeholder Group	Educational and research institutions
Impact(s)	Improvement in knowledge and scientific findings related to mangroves
Type of benefit / cost / risk	Real, positive, and direct impacts Potential negative impact, poor dissemination of research results to the national scientific community.
Change in well-being	The project includes a scientific component that will monitor the impacts of the project and carry out research activities on mangrove forests. The project includes three scientific activities which are: ● Activity 1: Installation of three gas flow measurement towers ● Activity 2: Collection and characterization of DNA traces in soil and water ● Activity 3: Study of carbon in soil ● Activity 4: Deployment of mini-buoys to assess hydrological site suitability for mangrove restoration The institutions will provide consistent knowledge based on mangrove studies which may enhance some practices and / or

	activities, improving national and international recognition in mangrove restoration.

Table 47: Foreign fishermen

Stakeholder Group	Foreign fishermen from Mali, Burkina Faso, and Guinea
Impact(s)	Increase in economic livelihood opportunities (fish) Increase in perception and recognition of the benefits of mangrove restoration and protection
Type of benefit / cost / risk	Real, negative and positive, direct impacts Potential negative impact if there is a perception that they will be excluded from the community benefit sharing mechanism. Risk mitigated by involvement in project design. Potential positive impact if mangrove restoration increases ecosystem services and therefore fish populations in the area
Change in well-being	Improve their knowledge of the mangrove ecosystem and its function, as well as develop sustainable fisheries based on the mangrove ecosystem.

Table 48: Schools

Stakeholder Group	Students in local schools
Impact(s)	Improvement in knowledge related to mangrove ecosystems
Type of benefit / cost / risk	Real, positive, and direct impacts
Change in well-being	The schools in the project villages will provide their students with general environmental knowledge in order to raise the students' awareness of environmental conservation.

Table 49: Non-governmental organization, association, and development project funded by private and public funders

Stakeholder Group	Non-governmental organization, association, and development project funded by private and public funders
Impact(s)	Search for synergies between the different interventions implemented by the NGOs / development projects or associations in the project area.
Type of benefit / cost / risk	Real, positive, and direct impact Potential negative impact, lack of synergy, leading to duplication of activities and support for the same targets.
Change in well-being	Better coordination between projects implemented in the project area (better efficiency). This limits the implementation of similar activities in different projects in the project area.

Table 50 Tourist operators

Stakeholder Group	Tourist operators (hotels, restaurants, guides, etc.)
Impact(s)	Mangrove landscape restoration that will attract more tourists
Type of benefit / cost / risk	Real, positive, and direct impacts
Change in well-being	Mangrove restoration landscape will help tourist operators to attract more tourists and generate sustainable incomes.

4.3.2 Mitigation of Negative Impacts on Other Stakeholders (CM3.2)

One of the focal aspects proposed during the workshops was taking into account the foreign fishermen in the design of the project, and so a representative of foreign fishermen was invited to participate in the design[143]. Through this process it was determined that the main measure needed to mitigate any negative impact in the well-being of foreign fishermen people is the strengthening of awareness for and communication with them, in order to obtain a good understanding of the ecological and socio-economic aspects of the project, and enhance their participation in all stages of the project.

[143] See the social and biodiversity impact assessment report as supporting documentation

Figure 32: Workshop at Casamance (Source: Oceanium)

4.3.3 Net Impacts on Other Stakeholders (CM3.3)

The net impacts on the well-being of other stakeholders are positive and are similar to those expected for the local communities, as mentioned above: there will be an exchange of experiences, technical knowledge and skills between the actors involved, a better and sustainable use of the natural resources resulting in the conservation and protection of mangrove areas.

4.4 Community Impact Monitoring

4.4.1 Community Monitoring Plan (CM4.1, CM4.2, GL1.4, GL2.2, GL2.3, GL2.5)

The Community Monitoring Plan takes into account the net community impacts expected for the local people from the project. The information collected in the cinema debates, the field visits, workshops, interviews, and surveys has been used to develop the community baseline of the project. Regular surveys will monitor the project's impact on communities in the project zone. Communities will be surveyed with quantitative and qualitative questions, including open and closed questions. The survey will be conducted regularly before each verification period and in a representative number of households both in Sine-Saloum and Casamance (at least 100 households – 50 in each region will be considered).

The indicators selected will be monitored in the future to assess the impact of the project on the local communities, and they will demonstrate that the HCV related to community well-being will not be negatively affected by the project activities.

The table below includes the key variables to be observed for this monitoring period. It is worth mentioning that some of the indicators included in the Community Monitoring Plan are the same as those considered for the Biodiversity Monitoring Plan since they serve to demonstrate both community and biodiversity aspects. These include: (a) water quality; (b) abundance and structure of fish and oysters; (c) the number of anthropogenic events, such as illegal logging or poaching.

The protocols for monitoring and evaluating these indicators will be developed before first verification with a standardized scoring system for replicability.

All impact indicators (perceived changes, benefits, etc) are planned over 30 years, except activity indicators (eg. training, sensitization activities) that are only planned within the first 10 years.

Table 51: Community Monitoring Plan and indicators

Parameter	Indicator	Indicator unit	Frequency	Location	Method (MoV)
Livelihood strengthening through value chain-based project interventions - quantitative indicators (all indicators will be disaggregated by value chain/ product)	# community-based organizations (CBOs) strengthened by the project and # of CBO members (disaggregated by gender)	# CBOs, # members (male - female)	annually in first 10 years, every 5 years after implementation phase	Target villages/areas for the specific value chain project support	List of CBOs and CBO membership lists
	# CBOs having increased their annual turnover associated with selected products	# CBOs	annually in first 10 years, every 5 years after implementation phase	Target villages/areas for the specific value chain project support	CBO accounts
	Increase in annual turnover for CBOs, associated with selected products	turnover (West African CFA franc)/CBO/year/ product	annually in first 10 years, every 5 years after implementation phase	Target villages/areas for the specific value chain project support	CBO accounts
Community perception indicators	perceived change in household wellbeing	average quantitative wellbeing change score/ HH	every 5 years	Target villages for the specific value chain project support	KoboCollect-based survey data (HH surveys) of representative sample of full target population
	perceived project benefits for people	Frequency & list of project benefits identified across all surveyed HHs	every 5 years	Target villages for the specific value chain project support	KoboCollect-based survey data (HH surveys) of representative sample of full target population

	perceived project benefits for environment/ nature	Frequency & list of project benefits identified across all surveyed HHs	every 5 years	Target villages for the specific value chain project support	KoboCollect-based survey data (HH surveys) of representative sample of full target population
Awareness & Sensitization	# Sensitization activities performed since project start (incl. cinema debates & radio podcasts)	cumulative # Sensitization activities	annually in first 10 years (implementation phase)	Across full project intervention area	Overview lists of different sensibilization activities
Capacity building	# people that attended project-related trainings and workshops	cumulative # people trained	annually in first 10 years (implementation phase)	Across full project intervention area	Lists of performed trainings & attendee lists
Changes in the frequency or intensity of anthropogenic impacts that are directly harmful to biodiversity in the project area	Qualitative assessment based on focus group discussions, interviews and available public reports from technical departments (Protected Marine Area Dpt, Water & Forest Dpt and mayors)	average change score	every 5 years	Across full project intervention area	Public reports from water and forest, and mayors' register + qualitative data collection methods (FGDs/ KIIs)

4.4.2 Monitoring Plan Dissemination (CM4.3)

The Monitoring Plan is fully developed and included in this document. As part of the dissemination of the PDD, the Monitoring Plan and results will be made available to local stakeholders through the dissemination of the Project Implementation Report (PIR). The Monitoring Plan and results of every verification period will be published on the VCS and CCB websites, which can be easily downloaded by stakeholders. Depending on the target group, the project Monitoring Plan will be made available through the appropriate communication channels (cinema-debate, Oceanium and Weforest website, project quarterly reports and meetings with the elected council of the 17 communities involved in the project).

4.5 Optional Criterion: Exceptional Community Benefits

The project does not seek to be validated to the Gold Level for exceptional community benefits.

5 BIODIVERSITY

5.1 Without-Project Biodiversity Scenario

5.1.1 Existing Conditions (B1.1)

Mangrove forests grow at tropical and subtropical latitudes[144]. They grow in the muddy soil of deltas, riverbanks, lagoons, and seashores[145]. They contribute not only to the filtering of pollution and the quality of coastal waters (Schaffelke et al., 2005)[146] but they also constitute a physical barrier that mitigates the erosive (and sometimes deadly) effect of storms, hurricanes, or even tsunami swells (e.g. Tanaka et al., 2007)[147]. In addition, these ecosystems are refuges and habitats acting as feeding and reproduction places for many animal species (birds, crabs, shrimp, mollusks, etc.).

[144] https://oceanservice.noaa.gov/facts/mangroves.html

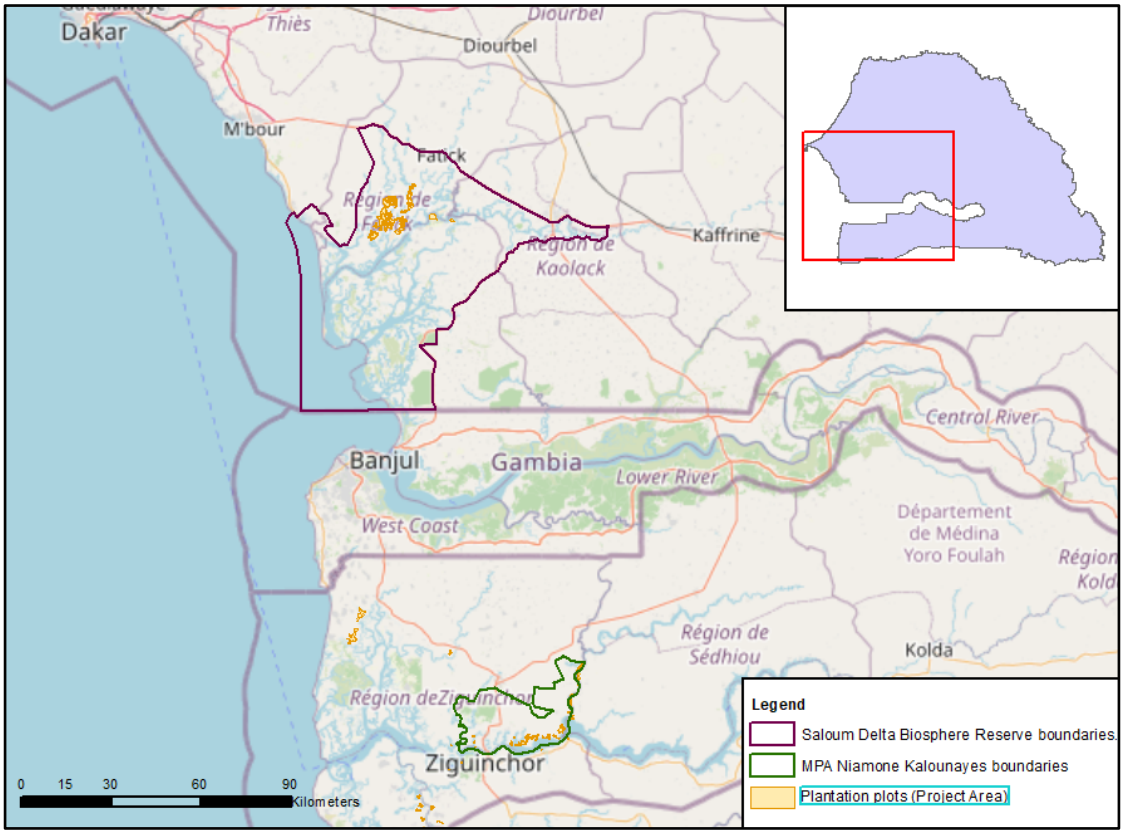
[145] http://www.ntiposoft.com/domaine_200/pdf/document_politique_senegal.pdf

[146] Schaffelke, B., Mellors, J., Duke, N.C., 2005. Water quality in the Great Barrier Reef region: responses of mangrove, seagrass and macroalgal communities. Mar. Pollut. Bull. 51, 279–296

[147] Tanaka, N., Sasaki, Y., Mowjood, M.I.M., Jinadasa, K.B.S.N., Homchuen, S., 2007. Coastal vegetation structures and their functions in tsunami protection: experience of the recent Indian Ocean tsunami. Landscape Ecology and Engineering 3, 33e45

Senegal's mangroves are located in the Casamance Estuary, in the Saloum Delta, and the mouth of the Senegal River. They cover an estimated area of about 2,000km^2 (Oceanopolis, 2020)[148]. The project zone is included within the Casamance Estuary and the Saloum Delta. These two areas have in common a fairly dense network of bolongs, surrounded by a vast expanse of mangroves functioning as an inverted estuary. Salinity is a factor for the mangrove ecosystem and this increases from downstream to upstream (Sow, 2019)[149].

These estuarine areas have been classified as important mangrove ecosystems in Senegal, and for this reason, they have been protected in recent years. It is important to mention that the plantation areas in Saloum Delta are completely within the Saloum Delta Biosphere Reserve (abbreviated in French as RBDS), and around 45% of the areas in Casamance belong to the MPA Niamone Kalounaye (Figure 33).



[148] Océanopolis (2020). [ÉCO]systèmes & Co. Les mangroves pp. 60

[149] SOW El Hadj, Taibou BA, Boubou Aldiouma SY, 2019. Impact de la variabilité pluviométrique sur la dynamique de la mangrove de la réserve de biosphère du delta du Saloum (Sénégal). Journal of Animal & Plant Sciences (J.Anim.Plant Sci.), 2019. Vol.40, Issue 2: 6619-6635.

Figure 33: Project area and protected areas boundaries

The following sections describe the habitat and biodiversity in Saloum Delta and Casamance Estuary.

A. Saloum Delta: vegetation and fauna

The Saloum Delta is located 150km south of Dakar, around 50km southwest of Kaolack, and 20km from Banjul, in northern Gambia. The Delta, which also extends across the border into Gambia, is formed by several rivers, including the Saloum, Sine, Bandiala, and Diombos. The Delta covers an estimated area of 500,000ha, which includes around 60-80,000ha of mangroves (UNESCO, 2011)[150], that is, about 30% of the mangroves in Senegal. The information on biodiversity in the Delta has been fully studied due to the protected area status in the region. It was first named a national park in 1976, a Biosphere Reserve in 1981, then Ramsar Site in 1984, and finally a UNESCO World Heritage Site in 2011 (PAG-PNDS, 2021)[151]. The project area in Saloum Delta is completely within the Saloum Delta Biosphere Reserve.

Vegetation

The Delta is characterized by a mosaic of ecosystems. First, a continental domain, represented by clear and dry forests interspersed by forest galleries (classic habitats of the Colobus bai in Saloum), and mangrove vegetation. The mangrove vegetation in the Delta is composed of six species which occupy 25% of the RBDS[152]:

- *Rhizophora racemosa*
- *Rhizophora mangle*
- *Rhizophora harrisonnii* (rarely)
- *Laguncularia racemosa*
- *Avicennia africana*
- *Conocarpus erectus*

The distribution of mangrove species is different according to their geographical and ecological conditions. Thus, *Rhizophora* formation is dominant within the islands, while *Avicennia spp.* appears on the transition between the inlets and the continent where *Avicennia spp.* and *Rhizophora* coexist with good topographic positions in trenches: *Rhizophora spp.* is found on the lower parts and *Avicennia spp.*on the higher parts. The continental mangrove of Saloum extends from the mouth to Foundiougne where the *Rhizophora* occupies the northern and southern banks of the rivers, while the *Avicennia spp.* grows behind the

[150] https://whc.unesco.org/document/152465

[151] See supporting documentation: Sine Saloum Biosphere Reserve Management Plan.

[152] IUCN, 2007- Les mangroves du Sénégal, situation actuelle des ressources, leur exploitation, leur conservation. Rapport final. 66 p.

Rhizophora band. However, upstream from Foundiougne, *Avicennia spp.* becomes dominant on a thinner strip[153].

This mangrove ecosystem is frequently separated from the forest by a sandy and muddy expanse: the tannes[154].

Fauna

Salinity is very pronounced in some areas of the RBDS, ranging from 20% to 94%[155]. The differences in salinity between the coast and inland benefit fish biodiversity, because ecological conditions change from downstream to upstream. Historical studies[156] have identified more than 200 species of fish. Crustaceans, mollusks, turtles, and marine mammals, such as dolphins and manatees, are present in the RBDS. As for avian fauna, more than 250 species have been listed in the RBDS[157].

The following list shows the species that have some degree of vulnerability according to the IUCN red list. The complete list of species can be found in the supporting documentation.

Table 52: List of vulnerable or endangered species according to the IUCN red list in Saloum Delta (2021)

Class	Scientific name	Common name	IUCN Red List Category
Fish	Fontitrygon margarita	Daisy stingray	EN
	Epinephelus marginatus	Dusky grouper	VU
	Gymnura altavela	Spiny butterfly ray	VU
	Hippocampus algiricus	West African seahorse	VU

[153] IUCN, 2007- Les mangroves du Sénégal, situation actuelle des ressources, leur exploitation, leur conservation. Rapport final. 66 p. https://journals.openedition.org/cybergeo/25671

[154] Dieye H., Diaw, A., Sané, T., Ndour, N. (2013). Dynamique de la mangrove de l'estuaire du Saloum (Sénégal) entre 1972 et 2010. Cybergeo: European Journal of Geography. Document 629.

[155] Lombard, F., Andrieu, J., Descroix, L. (2020) La population d'Avicennia germinans du delta du Saloum est-elle relictuelle depuis la dernière période humide? Bois et Forêts des Trop., 346, 51–64.

[156] Inventories carried out by the Directorate of Community Marine Protected Areas (DAMCP) from 2015 until now associated with the work of Diouf in 1996

[157] DPN, 2021. Plan d'aménagement et de gestion du Parc National du Delta du Saloum(PNDS) 2021-2025. 137 pp

Class	Scientific name	Common name	IUCN Red List Category
	Pentanemus quinquarius	Royal threadfin	VU
	Pseudupeneus prayensis	West African goatfish	VU
	Pseudotolithus senegalensis	Cassava croaker	EN
	Pseudotolithus senegallus	Law croaker	VU
	Rhinobatos albomaculatus	Whitespotted guitarfish	VU
	Glaucostegus cemiculus	Blackchin guitarfish	CR
	Rhinobatos	Common guitarfish	VU
	Sardinella maderensis	Madeiran sardinella	VU
Mammals	Trichecus senegalensis	West African manatee	VU
	Sousa teuszii	Atlantic humpback dolphin	CR
Reptiles	Chelonia mydas	Green sea turtle	EN
	Lepidochelys kempii	Kemp's ridley sea turtle	EN
	Lepidochelys olivacea	Olive ridley sea turtle	VU
	Eretmochelys imbricata	Hawksbill sea turtle	CR
	Dermochelys coriacea	Leatherback sea turtle	VU
	Caretta	Loggerhead sea turtle	VU

B. Casamance Estuary: vegetation and fauna

In the Casamance Estuary, as well as in the Saloum Delta, very diverse ecosystems are present. Indeed, it is traversed by a dense hydrographic network composed of two large rivers as well as countless tributaries, marigots, and bolongs.

Vegetation

Two categories of physical environments can be distinguished within this area: on the one hand, a wetland of maritime marshes and basins along the coast, and watercourses sheltering massive mangroves, tannes, and rice fields flooded. On the other hand, a dry land environment where varied rainfed agriculture is practiced within wooded formations of varying density between gallery forest to open savannah.

In the Casamance Estuary, mangrove ecosystems cover 9% of its area (Borrini-Feyerabend et al., 2009)[158]. They are composed of *R.racemosa*, *R. harissonii*, and *R. mangle*, of the genus *Rhizophora*; *Avicennia nitida* or *Avicennia africana*, *Laguncularia racemosa* and *Conocarpus erectus*, all *Combretaceae* (Diatta et al., 2017)[159].

Species of the genus *Rhizophora* are found along streams, while of the genus *Avicennia* species are found in mudflats. The distribution of these species is influenced by salinity. *Avicennia* spp. can tolerate higher salinity than *Rhizophora* sp., due to an adaptation that allows leaves and roots to exude salt (Laffargue, 2010)[160].

Laguncularia racemosa, sometimes mixed with *Rhizophora* species, develops on mounds, sometimes with *Avicennia nitida*, and does not have a determined ecological area. Its position depends on tide level and topography. It is a small shrub in Casamance (1 to 2m height). Behind *Rhizophora* sp. grows *Avicennia* spp. The species *Conocarpus erectus* occupies the rear mangrove, rarely inundated.

Fauna

Kantousasan et al. (2012)[161] has revealed the presence of 59 species of fish in the Casamance Estuary. Crustaceans (shrimps and crabs) and mollusks dominated by oysters are present. Other species such as turtles (*Pelusios castaneus* and *Chaelonia mydas*), mammals including the manatee (Trichechussenegalensis), and dolphins (*Tursiops truncatus*, *Souza Teuszii*) are also reported in the

[158] Borrini-Feyerabend G., Chatelain C. & Tous P. 2009 – Rapport pour l'Association des Pêcheurs de la Communauté Rurale de Mangagoulack. CENESTA, le PNUD/FEM/SGP et la FIBA, 79 p.

[159] Diatta C.S., Diouf M., Karibuhoye C. & Sow A.A. 2017 – Sites naturels sacrés et conservation des ressources marines et côtières en milieu traditionnel diola (Sénégal). Revue d'ethnoécologie 11.

[160] Laffargue C. 2010 – Bilan écologique & proposition de suivi participatif de la biodiversité dans l'Aire du Patrimoine Autochtone et Communautaire de KAWAWANA et dans la Communauté Rurale de Mangagoulack. APCRM / FIBA, 80 p. Cited in: https://journals.openedition.org/ethnoecologie/5855?lang=fr

[161] Kantoussan, J., Ecoutin, J.M., Simier, M., Tito de Morais, L. & Laë R. (2012) Effects of salinity on fish assemblage structure: An evaluation based on taxonomic and functional approaches in the Casamance estuary (Senegal, West Africa). Estuarine, Coastal and Shelf Science, 123, 152–162.

Estuary. The 2020 monitoring report of the Directorate of National Parks revealed the presence of 82 species of birds (DAMCP, 2020)[162].

The Casamance species included in the IUCN red list are shown in the following table. The complete list of species reported by the biodiversity survey carried out for the project can be found in the supporting documentation.

Table 53: List of vulnerable or endangered species according to the IUCN red list in Casamance (2021)

Class	Scientific name	Common name	IUCN Red List Category
Birds	Balearica pavonina	Black-crowned crane	VU
Fish	Balistes punctatus	Bluespotted triggerfish	VU
	Gymnura altavela	Spiny butterfly ray	VU
	Pentanemus quinquarius	Royal threadfin	VU
	Pseudotolithus senegalensis	Cassava croaker	EN
	Pseudupeneus prayensis	West African goatfish	VU
	Rhinobatos cemiculus	Blackchin guitarfish	CR
	Sardinella maderensis	Madeiran sardinella	VU
Mammals	Trichecus senegalensis	West African manatee	VU
	Sousa teuszii	Atlantic humpback dolphin	CR
	Tursiops truncatus	Bottlenose dolphin	EN

C. Description of existing conditions in the project area

[162] Report on the bioecological monitoring of the population fisheries (year 2019) of the Marine Protected Areas network, Senegal.

The sites to be reforested are degraded mangrove areas that are practically bare. These sites are classified as suitable areas for the development of certain mangrove species, according to the site selection study[163] and the evidence based on the presence of mangroves in the surroundings.

The process of identifying sites comprises several stages, looking to achieve a successful reforestation. The success of reforestation will depend on the ecological conditions, the selection of species, and the plantation design. Seedlings or propagules should be planted in submerged areas at each high tide, including low tides in the dry season (Figures 34, 35, 36).

Figure 34: Restoration sites in Sine-Saloum Delta. Photograph by Oceanium (2021)

[163] The stages of the process of identifying places for reforestation have been described in the document Méthodologie de sélection de sites du projet MANCO" and include: 1) Identification of zones on satellite image, 2) Recognition of zones with technical services and local authorities 3) Establishment of a buffer zone, 4) Consideration of the management plan for Marine Protected Areas (MPAs) and the Biosphere Reserve (RBDS), 5) Plantation and relation with village structures and 6) Relations with administrative and territorial authorities. This document is available upon request.

Figure 35: Mangrove ecosystems surrounding restoration sites in the RBDS. Photograph by Oceanium (2021)

Figure 36: Reforestation sites in Casamance Estuary. Photograph by Oceanium (2021)

Studies of tropical habitat structure[164] have shown that the structural complexity maintains the greatest level of biodiversity (Gratwicke & Speight, 2005[165]; Fuchs, 2013[166]). Mangrove forests provide a wide range of niches maintained by sub-strata such as mangrove roots, which maintain a high level of biodiversity (Gratwicke & Speight, 2005). According to the biodiversity survey, the biodiversity of the areas selected for restoration is quite reduced. This is due to the low diversity of habitats in degraded lands or tannes. However, in the surrounding areas, where mangroves are in good condition, the biodiversity is much richer, including the six mangrove species described above, and the hundreds of species of fauna found in the Saloum Delta biosphere reserve and in the Casamance Estuary. These mangroves offer many different types of habitats that allow the feeding, nesting, and breeding of different species of birds, fish, mollusks, mammals, reptiles, and other animals.

D. Threats to the biodiversity

Different studies report losses in global mangrove cover of more than 50% in some parts of the world (Romañach et al., 2018)[167]. FAO (2007) reported a significant decrease in mangroves in the world between 1980 and 2005, with an annual loss rate of 1% to 3%. Romañach et al. (2018) state that: "the global loss of mangroves can be attributed largely to human population growth and development in the coastal zone. Specific reasons are urban development, aquaculture, conversion to agriculture such as rice farming, and overexploitation of timber throughout the world". Besides, Alongi (2002)[168] also attributes the loss of mangroves to "urban development, aquaculture, mining and overexploitation of wood, fish, crustaceans and shellfish." He also explains that: "in the coming years, unrestricted logging, aquaculture and overexploitation of fisheries will be the biggest threats."

In Senegal, specifically in Saloum Delta, human activities such as mangrove cutting for fish smoking, oyster picking, and some fishing practices have led to mangrove degradation, reducing its area (Dieye et al.,

[164] Hendy IW, Michie L, Taylor BW. 2014. Habitat creation and biodiversity maintenance in mangrove forests: teredinid bivalves as ecosystem engineers. PeerJ 2:e591 https://doi.org/10.7717/peerj.591

[165] Gratwicke & Speight (2005) Gratwicke B, Speight MR. The relationship between fish species richness, abundance and habitat complexity in a range of shallow tropical marine habitats. Journal of Fish Biology. 2005;66:650–667. doi: 10.1111/j.0022-1112.2005.00629.x

[166] Fuchs (2013) Fuchs T. Effects of habitat complexity on invertebrate biodiversity. Immediate Science Ecology. 2013;2:1–10. doi: 10.7332/ise2013.2.1.dsc.

[167] Romañach et al., 2018. Conservation and restoration of mangroves: Global status, perspectives, and prognosis. *Ocean & Coastal Management 154(2):72-82*. DOI: 10.1016/j.ocecoaman.2018.01.009. Link: https://www.researchgate.net/publication/323239009_Conservation_and_restoration_of_mangroves_Global_status_perspectives_and_prognosis/citations

[168] Alongi, D.M. 2002. Present State and Future of the World's Mangrove Forests. *Environmental Conservation 29(03):331 – 349*. Environmental Conservation 29(03):331 – 349. Link: https://www.researchgate.net/publication/231955066_Present_State_and_Future_of_the_World's_Mangrove_Forests

2010[169]; Sow & Ba, 2019[170]). Regarding Casamance, the degradation of mangroves is mainly attributed to population growth, the significant withdrawal of its resources by communities, and the implementation of inappropriate development techniques (Bassène, 2016)[171]. However, the intensity of these impacts has not been quantitatively assessed. This degradation of mangroves has led to a reduction in biodiversity (Solly et al., 2018)[172]. Indeed, mangrove ecosystems are habitat, nesting, reproduction, and feeding areas for many marine species (Ndour et al., 2011)[173].

[169] DIEYE E.B, DIAW A.T, SANE T., NDOUR N., 2013, Dynamique de la mangrove de l'estuaire du Saloum (Sénégal) entre 1972 et 2010, Cybergéo: European Journal of Geography [En ligne], Environnement, Nature, Paysage, document 629, URL: http://cybergeo.revues.org/25671 ; DOI : 10.4000/cybergeo.25671

[170] Sow El Hadji et Ba Taîbou, 2019. Evolution de la Mangrove de la Reserve de Biosphère du Delta du Saloum, Sénégal. European Scientific Journal edition Vol.15, No.15 ISSN: 1857 – 7881

[171] Bassène Olivier Aghandoul, 2016. L'évolution des mangroves de la Basse Casamance au Sud du Sénégal au cours des 60 dernières années : surexploitation des ressources, pression urbaine, et tentatives de mise en place d'une gestion durable. Géographie. Université de Lyon; Université de Saint-Louis (Sénégal), 2016. 312 p.

[172]Solly B., Dièye E.H.B., Sané T. & Diaw A.T. 2018 – Dynamique de la Mangrove de Thiobon dans l'estuaire de la Casamance (Sénégal) entre 1972 et 2017. European Scientific Journal 14 (33) : 118-133. Doi: 10.19044/esj.2018.v14n33p118. [En ligne :] http://dx.doi.org/10.19044/esj.2018.v14n33p118 DOI : 10.19044/esj.2018.v14n33p118

[173] Ndour Ngor, Dieng, Sara Danielle Dieng et Mamadou Fall (2011), Rôles des mangroves, modes et perspectives de gestion au Delta du Saloum (Sénégal), Vertigo – la revue électronique en sciences de l'environnement [online], Volume 11, Numéro 3, décembre 2011. [http:// journals.openedition.org/vertigo/11515

Since the beginning of the century, some projects[174] have been successful in the recovery of mangroves[175]. Some studies (Soumaré et al., 2020[176]; Fatoyinbo et al., 2018[177]) confirm a slight recovery of the mangrove in some specific areas, at the local level, which could mean that the implementation of reforestation projects does have a positive impact. However, although it seems that the global climate is becoming more wet, the threat of unsustainable use of wood for firewood and other biodiversity resources is still very present.

According to Aghandoul (2017)[178], the French Development Agency (FDA), the Ministry of Environment and Sustainable Development of Senegal (2020)[179], and Wetlands International[180], the main threats to the mangroves in Casamance and Sine-Saloum are:

- Climatic changes, which since the 1970s led to years of drought in the Sahel area, with a decrease in rainfall and river flow, increased temperatures, and evaporation. This situation

[174] The Mangrove Capital Africa program seeks to safeguard and restore African mangrove ecosystems for the benefit of people and nature. They expect that by 2027, 1 million hectares of African mangroves are conserved or restored, maintaining their biodiversity while also benefiting some 2 million people (https://www.wetlands.org/casestudy/mangrove-capital-africa/)

https://www.thenewhumanitarian.org/report/80906/senegal-protecting-livelihoods-through-mangroves

[175] The number of rehabilitation and restoration projects is increasing worldwide with some countries showing increases in mangrove area Alongi, D.M. (2002). Link: https://www.researchgate.net/publication/231955066_Present_State_and_Future_of_the_World's_Mangrove_Forests

[176] Soumare S., Fall, A., Andrieu J., Marega, O., Dieme B., 2020. Dynamique spatio-temporelle de la mangrove de Kafountine dans l'estuaire de la Basse-Casamance des années 1972 à nos jours. Approche par télédétection. IOSR Journal of Engineering, vol. 10, p. 1-14.

[177] Fatoyinbo, T., Simard, M. (2013). Height and biomass of mangroves in Africa from ICESat/GLAS and SRTM. International Journal of Remote Sensing, 34 (2), 668-681.

[178] Olivier Aghandoul Bassene (2017). L'évolution des mangroves de la Basse Casamance au Sud du Sénégal au cours des 60 dernières années : surexploitation des ressources, pression urbaine, et tentatives de mise en place d'une gestion durable. Géographie. Université de Lyon; Université de Saint-Louis (https://tel.archives-ouvertes.fr/tel-01559306/document)

[179] brought from the formulation of project "Projet d'appui à la politique d'aires marines protégées du Sénégal à travers la conservation et la mise en valeur durable des mangroves de la Casamance et du Sine-Saloum", which is being developed through the Senegalese Ministry of the Environment with funding from ADF (see link: https://damcp.sec.gouv.sn/content/projet-d%E2%80%99appui-%C3%A0-la-politique-d%E2%80%99aires-marines-prot%C3%A9g%C3%A9es-du-s%C3%A9n%C3%A9gal-%C3%A0-travers-la-conservation)

[180] Wetlands International. Etude De Base -Delta Du Saloum. Link: https://africa.wetlands.org/publications/la-reserve-de-biosphere-du-delta-du-saloum-une-zone-humide-marine-estuarienne-lacustre-palustre/

favored the increase of saline waters and reduced the suitable space for the mangrove swamp.
- Implementation of hydro-agricultural improvements, which led to the felling of mangroves and construction of roads, blocking water flows inland.
- Impact of demographic movements resulting from droughts and political issues, among others, causing the overexploitation of mangroves in new urban areas.
- Unsustainable logging and use of firewood in mangroves.
- Unsustainable fishing practices that overexploit fish and shellfish resources.
- Conversion of mangrove areas into rice fields.

In the project area, these threats translate into concrete and direct risks for the success of the project. These risks have already been identified in Section 2.1.18 Risk to the Project. Risks for biodiversity include:

- If the selection of species and sites is not adequate, the climatic threat (drought, increased salinity, etc.) will materialize in an increase of mortality rate of the trees.
- If proper monitoring of the project is not carried out, the threat of unsustainable wood harvesting may increase.
- If fishing and use of resources is not carried out with adequate and sustainable methods, the threat of overexploitation and decrease in the richness of fish biodiversity can become a reality.

5.1.2 High Conservation Values (B1.2)

The project zone includes the following HCVs related to biodiversity:

Table 54: HVCs related to biodiversity

High Conservation Value (HCV 1)	Protected Area: Saloum Delta Biosphere Reserve (RBDS)
Qualifying attribute	The protected area was recognized by the government of Senegal in 1976 as a national park. It was recognized as a Biosphere Reserve in 1981 and later designated as a Ramsar Site in 1984. As described above, the condition of high salinity, added to the diversity of terrestrial, marine, and 'amphibian' ecosystems (such as mangroves) make this area one of the most biodiverse in the world, finally declared a World Heritage Site in 2011 by UNESCO. The Saloum Delta Biosphere Reserve is also an extensive landscape of about 4,402 square kilometers, in which mangrove forests occupy 25% of its surface. In terms of ichthyofaunic diversity, the combination of data collected by DAMCP from 2015 to present, and the work carried out by Diouf in 1996,

	inventoried more than 200 species[181], from which some Mugilidae (*Chelon dumerili, Neochelon falcipinnis, Parachelon grandisquamis*) and Cichlidae species (*Coptodon guineensis, Sarotherodon melanotheron*) are endemic. These species are dominated both in numbers and biomass, by Clupeidae (*Sardinella maderensis, Ethmalosa fimbriata*), Pristigasteridae (*Ilisha africana*), Gerreidae (*Gerres nigri*), and Carangidae species (*Chloroscombrus chrysurus*). In Sine-Saloum, Cichlidae and Mugilidae are the most consumed fish species by the local community. Crustaceans and mollusks are also well represented, with a dominance of shrimp (*Penaeus notialis*) and oysters (*Crassostrea gasar*). Being a wintering and feeding site, more than 200 species of birds have been inventoried. The reserve is home to 13% of Senegal's waders and is also the world's leading breeding and wintering site for the Royal Tern (hosting more than 1/3 of the world's population). Also, an important population of medium and large fauna stay there partially: green monkeys (*Cercopithecus aethiops sabaeus*), warthogs (*Phacochoerus aethiopicus*), harnaché guibs (*Tragelaphus scriptus*), colobus bais (*Procolobusbaduis temmincki*)[182], and sitatungas (*Tragelaphus spekei*), among others. It is a spawning and breeding site for a multitude of endangered species included in the IUCN red list, such as the manatee (*Trichechus senegalensis*) [VU], the Atlantic humpback dolphin (*Sousa teuszii*) [CR], and some sea turtles (*Chelonia mydas*, [EN], *Lepidochelys kempii* [EN], *Lepidochelys olivacea* [VU], *Eretmochelys imbricata* [CR], *Dermochelys coriacea* [VU], *Caretta* [VU]).
Focal area	The project area in Sine-Saloum (communities of Djilass, Fimela, and Loul Séssene) belongs to the Biosphere Reserve.

[181] Diouf, 1996. Les peuplements de poisons des milieux estuariens de l'Afrique de l'Ouest. L'exemple de l'estuaire hyperhalin du Sine-Saloum. Thesis: L'universite de Montpellier II. Link: https://horizon.documentation.ird.fr/exl-doc/pleins_textes/pleins_textes_7/TDM_7/010008130.pdf

[182] Being the northern limit for this species.

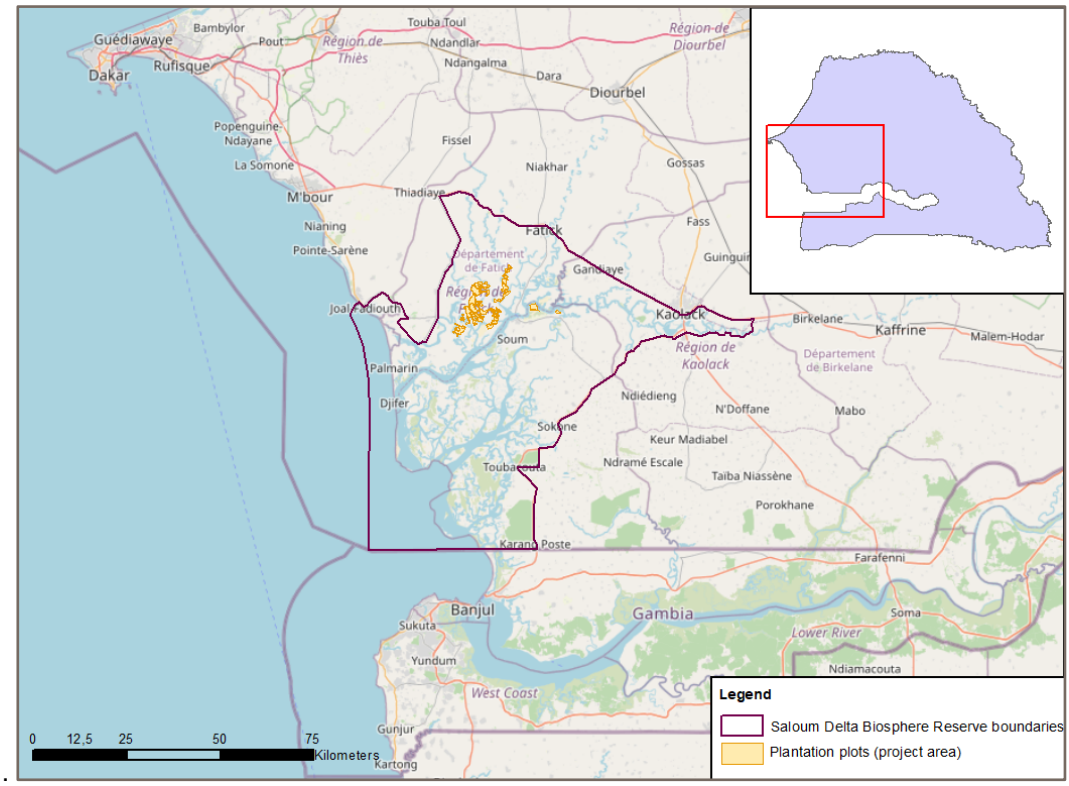


Figure 37: Sine-Saloum project area and Saloum Delta Biosphere Reserve boundaries

High Conservation Value (HCV 1)	Niamone Kalounaye Marine Protected Area (MPA)
Qualifying attribute	The growing interest in conservation worldwide, the application of the Convention on Biological Diversity, in particular in compliance with Aichi goal 11 that commits states to create 10% of MPAs by 2020, added to the interest of the local communities, contributed to the creation of this MPA in 2015, together with the publication of its management plan[183]. Niamone-Kalounaye MPA is part of Casamance Estuary. It is characterized by an important area occupied by mangrove

[183] Directorate of Community Marine Protected Areas (DAMCP), 2015. MPA Niamone – Kalouyane Development and Management Plan.

	ecosystems. The vegetation of the MPA is similar to the Casamance Estuary (see Section 5.1.1.2). The mangrove is composed of *Rhizophora racemosa, Rhizophora harissonii, Rhizophora mangle, Avicennia nitida, Laguncularia racemose,* and *Conocarpus erectus*. In terms of fish species, 32 taxa belonging to 20 families were inventoried in the MPA during the monitoring in 2019.[184] Among them, the endemic species such as Cichlidae and Mugilidae species were mostly dominant. According to local knowledge, these species are the most widely consumed by the community. In terms of species richness, 47 bird species were inventoried in the MPA.[185] Shrimp (*Penaeus notialis*) and oysters (*Crassostrea gasar*) are exploited by the community in this area.
Focal area	Plantation areas of the Coubalan and Ouonck communities belong to the AMP (approximately 18% of total plantation areas).

[184] Ibid.
[185] Ibid.

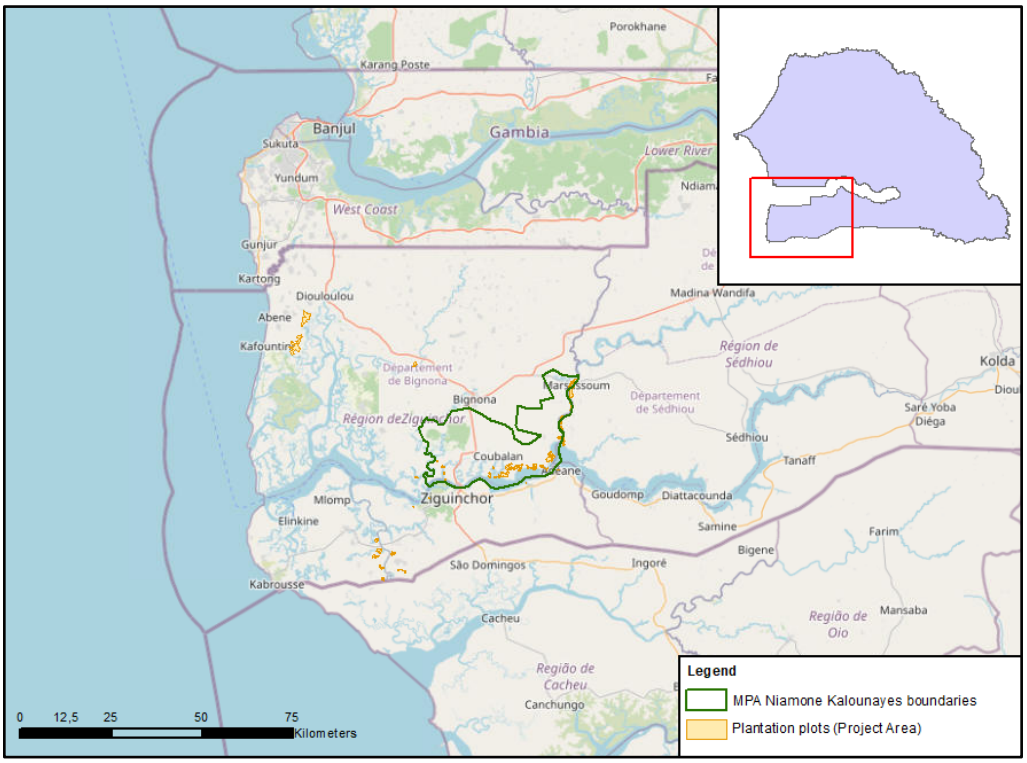


Figure 38 Casamance Project Area and MPA Niamone Kalounaye boundaries

5.1.3 Without-project Scenario: Biodiversity (B1.3)

Without the project, according to the biodiversity survey and Section 3.1.4, the project zone would continue to be degraded mangroves or tannes. These areas were degraded during the severe droughts of the 1970s and 1980s and there has not been natural recovery. Approximately 2,400ha of mangrove was recorded lost from 1970 to 1973 in Casamance (HARZA, 1984)[186].

In the Lower Casamance, Marius (1985)[187] reported that since 1969, 70% to 80% of *Rhizophora* areas have disappeared due to a decrease in rainfall, increases in salinity, acidification of the land, and excessive logging. Even after a period of stability followed by a return of rainfall in the 1980s, the mangrove still experienced a pronounced decline.

[186] HARZA 1984 – Plan directeur de développement agricole en Basse Casamance. Rapport final, 2 T., 354-302 p

[187] Marius C. 1985 – Mangroves du Sénégal et de Gambie (Écologie, Pédologie, Géochimie, Mise en valeur et aménagement). Paris, ORSTOM, 357 p. (Travaux et Documents ; 193).

Even after some mangrove restoration efforts (Cormier-Salem et al., 2015; Solly, 2018[188]), there are some pockets of degradation. However, local people from the neighboring communities highly value the reforestation projects undertaken by Oceanium (Chazée, 2019)[189]. According to this study, people point out the importance of continuing mangrove reforestation projects.

In terms of biodiversity, as explained above (5.1.1 Existing Conditions), and as explained by various studies (Gratwicke & Speight, 2005[190]; Fuchs, 2013[191]), greater structure and complexity in ecosystems leads to greater biological diversity. The roots of the mangrove tree species provide food and shelter for fish and the branches allow the feeding of birds and mammals, among other benefits (Gratwicke & Speight, 2005). The structural differences of a mature mangrove (with *Rhizophora* in the first line, *Avicennia* further back, and other species behind the *Avicennia spp.*), allow a mosaic of different niches and habitats that generate a greater biodiversity of invertebrates, birds, mammals, fish, reptiles, and amphibians. In degraded mangroves, residents report a much lower diversity of fauna species (IRIN News, 2008)[192]. Therefore, in the without-project scenario, which includes degraded mangroves or tannes, the biological diversity remains poor, in contrast to the expected changes in biodiversity generated with the project, as explained in the next figure.

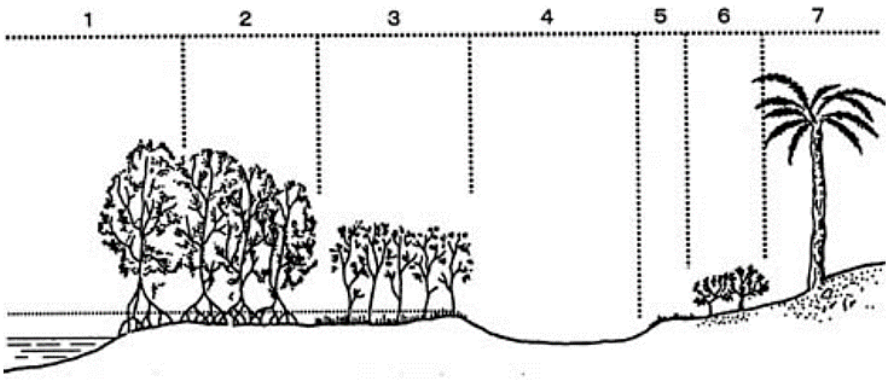
[188] Cormier-Salem M.-C., Sané T. & Dieye E.H.B. 2015 – Légitimité des politiques de reboisement des palétuviers en Casamance. In : Descroix L., Djiba S., Sané T., Tarchiani V. (Ed.) Eaux et sociétés face au changement climatique dans le bassin de la Casamance : actes de l'Atelier scientifique et du lancement de l'initiative "Casamance : un réseau scientifique au service du développement en Casamance". Paris, L'Harmattan : 189-210. [En ligne : https://hal.ird.fr/ird-01546905v2/document]

[189] Chazée, L., Tour de Valat, 2019. Impact evaluation report of plantations of Mangroves in Senegal. Report prepared for Livelihoods from Tour de Valat to measure the impact of the project. A summary of it can be consulted at this link: https://livelihoods.eu/the-proof-by-10-results-of-the-study-on-the-social-impacts-of-the-largest-mangrove-restoration-project-of-the-carbon-livelihoods-fund-in-senegal/

[190] Gratwicke & Speight (2005) Gratwicke B, Speight MR. The relationship between fish species richness, abundance and habitat complexity in a range of shallow tropical marine habitats. Journal of Fish Biology. 2005;66:650–667. doi: 10.1111/j.0022-1112.2005.00629.x

[191] Fuchs (2013) Fuchs T. Effects of habitat complexity on invertebrate biodiversity. Immediate Science Ecology. 2013;2:1–10. doi: 10.7332/ise2013.2.1.dsc.

[192] IRIN News, 2008. Planting Mangroves to Protect Livelihoods. Website: http://sustainablefootprint.org/planting-mangroves-to-protect-livelihoods/



1. Mangrove : *Rhizophora harrisonii/racemosa* (hauteur moyenne: 5 à 12 m);
2. Mangrove : principalement *Rhizophora mangle* (hauteur moyenne : 1 à 3 m);
3. Mangrove : espèce dominante, *Avicennia africana* (hauteur moyenne: 1 à 2 m);
4. Tanne : sol sec dépourvu de végétation ou quelques Cypéracées (*Seirpus sp);*
5. Bordure : Aizoacées, *Sesuvium portulacastrum;*
6. Côte sableuse : Arbustes (*Conocarpus crectus*);
7. Végétation continentale : *Adansonia, Ptercarpus, Acacia sp.*, etc.*

Figure 39: Linear structure of natural mangrove population in Senegal (Source: ADG, 2012)

5.2 Net Positive Biodiversity Impacts

5.2.1 Expected Biodiversity Changes (B2.1)

Table 55: Expected biodiversity changes

Parameter	Mangrove cover in the project area
Estimated change	Increase
Justification of change	The project consists of afforestation of degraded lands and tannes without vegetation. The first project activity instance is the restoration of 7,019.8 ha to be converted into mangrove areas. This is the main activity of the project. The GHG calculations have been made in Section 3.2 (Quantification of GHG Emission Reductions and Removals) and the Monitoring Plan described in Section 5.4.1 of this document.

[193] Aide au Développement Gembloux (ADG), 2012. La mangrove, un écosystème à protéger. Guide pratique à l'usage des Communautés Rurales du Delta du Saloum, Sénégal. Link: http://docplayer.fr/21140645-La-mangrove-un-ecosysteme-a-proteger.html

Parameter	Water quality
Estimated change	Improve
Justification of change	The presence of the mangrove helps to improve the parameters that define the quality of the water. The roots of the mangroves improve the transparency of the water, reducing the solid particles in suspension. Likewise, the presence of the mangrove stabilizes the pH, reduces salinity, and increases the dissolved oxygen (Jitthaisong, 2012)[194]. The water temperature is also lowered, and lastly, better water quality is associated with higher fish biodiversity (López-López et al., 2015)[195].

Parameter	Fish (abundance and structure)
Estimated change	Increase
Justification of change	Mangrove forests are structurally diverse ecosystems, sustaining high biodiversity as well as rich seafood supplies. Partly submerged in the ocean, mangroves create a unique and complex habitat for all sorts of life. These species are attracted to mangrove forests for the

[194] Jitthaisong, O., et al, 2012. Water Quality from Mangrove Forest: The King's Royally Initiated Laem Phak Bia Environmental Research and Development Project, Phetchaburi Province, Thailand. *Modern Applied Science;Vol. 6, No. 8; 2012.* ISSN 1913-1844 E-ISSN 1913-1852. Link: https://www.researchgate.net/profile/Sakhan-Teejuntuk/publication/267380449_Water_Quality_from_Mangrove_Forest_The_King's_Royally_Initiated_Laem_Phak_Bia_Environmental_Research_and_Development_Project_Phetchaburi_Province_Thailand/links/55398d8b0cf2239f4e7da05c/Water-Quality-from-Mangrove-Forest-The-Kings-Royally-Initiated-Laem-Phak-Bia-Environmental-Research-and-Development-Project-Phetchaburi-Province-Thailand.pdf

[195] López-López, E., Sedeño, Jacinto Elías, 2015. Biological Indicators of Water Quality: The Role of Fish and Macroinvertebrates as Indicators of Water Quality. Environmental Indicators. Springer. DOI: 10.1007/978-94-017-9499-2_37. Link: https://www.researchgate.net/publication/270761016_Biological_Indicators_of_Water_Quality_The_Role_of_Fish_and_Macroinvertebrates_as_Indicators_of_Water_Quality

	high food availability, cooler water with higher oxygen content, and wildlife refuge habitat (IUCN, 2017)[196]. Due to the growth of new mangrove forests, food, oxygen, and shelter for fish and mollusk species will increase, creating new opportunities for recolonization, feeding for fattening, and refuge for laying eggs and rearing.

Parameter	Mollusks (abundance and structure)
Estimated change	Increase
Justification of change	Even relatively small-scale modifications to the structure of mangrove ecosystems can lead to significant effects on the diversity and abundance of mollusks in these habitats (Kabiret al., 2014)[197]. In general, the mangrove ecosystem is closely related to the presence of this type of fauna, while in current conditions (tannes or degraded mangroves) the presence of mollusks is very low or non-existent. In the project area, a large increase in oysters that adhere to the mangroves is expected, due to the large network of tree roots that will support them. This will be monitored as described in chapter 5.4.1 of the Monitoring Plan.

Parameter	Birds (abundance and population status)
Estimated change	Increase
Justification of change	The bird population is expected to increase as mangrove cover and density increases. The presence of the mangrove benefits the

[196] https://www.iucn.org/news/forests/201708/mangroves-nurseries-world%E2%80%99s-seafood-supply

[197]Kabir M., Abolfathi M., Hajimoradloo A., Zahedi S., Kathiresan K., Goli S. 2014. Effect of mangroves on distribution, diversity and abundance of molluscs in mangrove ecosystem: a review AACL Bioflux, Volume 7, Issue 4.

	population of fish, mollusks, crabs, and other invertebrates. Birds, as the highest link in this food chain, benefit from more fish and invertebrates, and their population is expected to increase as mangrove cover increases. In particular the wader population, birds that eat from bare ground, and especially invertebrates from mud, is expected to stay as is or increase due to the increase of mangrove habitat. To maintain some areas without reforestation and because biodiversity will increase in the plantation areas.

5.2.2 Mitigation Measures (B2.3)

As mentioned in the previous section, a positive impact is expected because of the return of vegetation cover to the mangrove sites.

The growth of mangroves will provide more niches and habitat for the arrival of invertebrates, fish, birds, amphibians, reptiles, and mammals. Besides the reforestation activity, small unrestored areas will be kept (maintaining the initial bare area). This will favor a future mosaic of habitats, allowing waders to forage in these areas. These areas are filled with invertebrates (crustaceans, mollusks, among others) at high tide, which is used by these waders at low tide.

Regarding the HCVs designated in the project (the RBDS and MPA Niamone-Kalounaye Protected Areas), and taking into account that 100% of the areas to be restored belong to the RBDS, and more than 50% of the areas to be restored in Casamance belong to the Niamone-Kalounaye MPA, the activities to be implemented in the project will influence these HCVs. Therefore, all project activities are focused on achieving a mature mangrove in the next 30 years. As explained above, a better vegetation structure enhances biodiversity. In conclusion, the measures and activities of the project will improve and enhance the attributes of the project's HCV.

The precautionary principle is also taken into account in the project through a total involvement of all stakeholders in decision-making, thanks to the steering committee (see Section 2.3 Stakeholder Engagement). Before being implemented, any activity or action will be debated by the communities and stakeholders, scientifically tested by Oceanium professionals, and finally approved by the project implementer (WeForest). An environmental assessment will be developed with the inclusion of the precautionary principle in the project.

5.2.3 Net Positive Biodiversity Impacts (B2.2, GL1.4)

As mentioned previously (see 5.2.1), positive changes in biodiversity are expected: increased mangrove coverage, increased abundance, and improved structure of fish, mollusks, and birds, among others. Specifically, the IUCN reports show how the quantity and diversity of fish increases, due to the submerged

root network, creating a unique and complex habitat, and improving the quality of the water. Fish are attracted to mangrove forests because of the high availability of food, cooler water, and higher oxygen content, as well as the shelter they provide (IUCN, 2017)[198]. Crustaceans, shellfish, and other mollusks have a place to grow (the roots) and reproduce, benefiting from a better quality of water and food. In addition, fish-eating birds are attracted by the increased availability of fish. Also, other animals such as amphibians, insects, or mammals, are also attracted by the greater availability of food and shelter. Finally, mangroves offer, through their flowering, opportunities for pollinating insects, such as bees.

In Section 5.1.1, the threats to biodiversity were discussed. Among them, it was written how human pressures have been in the past and are in present time, according to numerous authors (Romañach et al., 2018; Alongi, 2002), the most important threats to the persistence of the mangrove. That is why the project will not only monitor the state of biodiversity, but will also monitor pressure and response indicators as well (see Section 5.4.1).

The project, in addition to improving the biodiversity in the project area, also implies an improvement in net biodiversity in surrounding areas and through indirect actions with communities involved. These activities will promote the sustainable use of biodiversity. The communities will be strengthened in knowledge and tools to improve their livelihoods and, among them, the local natural capital.

5.2.4 High Conservation Values Protected (B2.4)

The HCVs identified are the protected areas of the Saloum Delta Biosphere Reserve and the MPA of Niamone Kalounayes. Both protected areas seek to conserve and improve the area occupied by the mangroves, its health, and its density. The reforestation project of degraded areas and tannes helps these objectives and there are no anticipated negative impacts that would affect these areas.

The main activity of the project (restoration of degraded mangrove areas) is carried out according to the agreement with the Ministry of the Environment and the Directorate of Protected Areas of Senegal, taking into account the management plans of these areas, the projects in the planning phase and execution, and the actors involved. The project's environmental impact study[199] will properly describe the environmental impacts on HCVs.

5.2.5 Species Used (B2.5)

The project will use only native species for the main reforestation activity. Thus, the main species used will be *Rhizophora mangle* (at an approximate density of 5,000 trees per ha) and *Avicennia germinans / Avicennia africana* (at an approximate density of 1,000 trees per ha). Other species that will be used, when

[198] https://www.iucn.org/news/forests/201708/mangroves-nurseries-world%E2%80%99s-seafood-supply

[199] Document subject to request.

ecological conditions allow, and looking for the existing mixture in natural conditions, are: *Rhizophora racemosa, Rhizophora harisonnii, Laguncularia racemose,* and *Conocarpus erectus*.

The planting of *Rhizophora* species will be carried out through propagules obtained from areas close to the places to be reforested. The people who will collect these propagules will be trained to select those of good quality, and ensure they are not damaged during transport or planting work.

In addition, the reproduction of *Avicennia* species will be carried out through nurseries, using reproductive material from the project region.

All these details are described in the document 'Plantation design'[200], available as supporting documentation.

5.2.6 Invasive Species (B2.5)

Considering the list of species used in Section 5.2.5 and the information in the 'Global Invasive Species Database'[201], no invasive species will be introduced into the area affected by the project.

5.2.7 Impacts of Non-native Species (B2.6)

As explained above, invasive plants will not be used for project activities. The plants to be used are endemic plants and also come from areas near to the project area. Therefore, negative impacts from non-native species are not expected.

5.2.8 GMO Exclusion (B2.7)

Genetically Modified Organism (GMOs) will not be used in project activities.

5.2.9 Inputs Justification (B2.8)

The project will not use fertilizers, pesticides, or biological control agents. However, at each verification, the plantation will be monitored in order to evaluate its sanitary conditions and state of the mangrove.

5.2.10 Waste Products (B2.9)

Project activities will not, by themselves, create waste products to be handled in the project area. In this way, the propagules to be planted will be transported in baskets, which will later be returned for future uses. In the case of garbage from the people who will carry out the planting, care will be taken to check that no

[200] Document available subject to request.

[201] http://www.iucngisd.org/gisd/

product is thrown in the area to be planted and the people who will participate in the activity will be made aware.

The environmental awareness will be included in different activities of the project, such as the following:

- Training in HSSE (before every plantation activity).
- Radio broadcasts, cinema debates, and other tasks included in the communication plan.

Finally, the ongoing advisory work (see activity C.2 in Section 2.1.11 of this document) includes an environmental component on caring for the environment in general. The awareness of the society for the care of the environment will be progressive and continuous throughout the lifetime of the project.

5.3 Off-site Biodiversity Impacts

5.3.1 Negative Off-site Biodiversity Impacts (B3.1) and Mitigation Measures (B3.2)

As described above (see Section 5.2), being an ARR project, no negative impacts are expected from the project. In this sense, the restoration of mangrove areas would positively impact (see Section 5.2.1) and would benefit the identified HCVs (see Section 5.2.4). In conclusion, no negative off-site biodiversity impacts are expected to result from the project.

5.3.2 Net Off-site Biodiversity Benefits (B3.3)

The benefits of the project, outside the project zone, compared to the without-project scenario, are expected to occur. First, a large number of the plantation areas are within protected areas (100% of the plots in Sine-Saloum are within the RBDS, and more than 50% of the plots in Casamance are located in the MPA Niamone Kalounaye). The mangrove plantation is aligned with the management objectives of the areas, which seek the conservation of biological resources and habitat[202]. The management plan of these areas has been taken into account during the restoration activities.

Second, the project will increase the mangrove area in Sine-Saloum and Casamance, which will increase the positive functions (ecosystem services) that mangroves provide to communities and their biodiversity.

Third, the location of the project area contributes to the continuity of habitat and ecosystems. In this sense, there is a continuity of the mangrove areas in Casamance from the coast to (at least) the town of Goudomp, around 100km, as commented on by local scientific experts, the biodiversity survey, and the eligibility study of the land, available as supporting documentation.

[202] Plan D'amenagement et de Gestion Du Parc National Du Delta Du Saloum (PNDS) 2021-2025

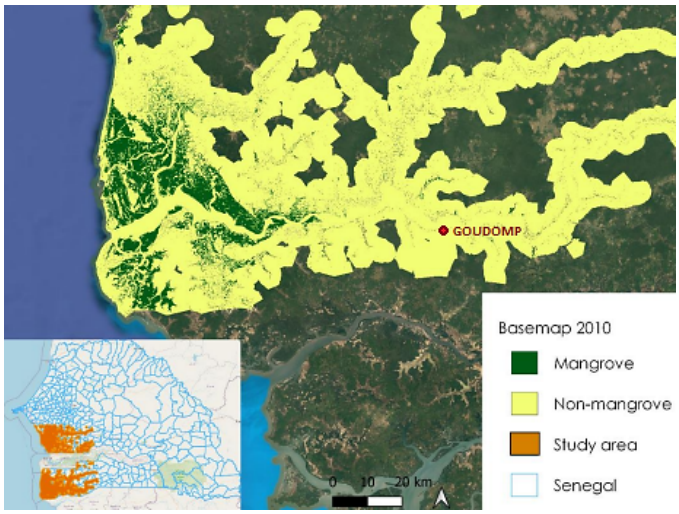


Figure 40: Map of mangrove areas from the Eligibility Study for the Casamance area (2021) and approximate location of the town of Goudomp

Fourth, the location of the restored plots will improve the connectivity of ecosystems as a whole, increasing the mosaic of vegetation structure and key habitats for biodiversity; and connecting green infrastructure in the territory.

Figure 41: Restoration of project area increases the connectivity of mangroves and ecosystems

Finally, the project proponent and implementer are in contact with researchers and skilled technicians within scientific committees and others. However, further studies are still needed regarding the effects of climate change on the plantations. For this reason, as an additional benefit, the project will contribute to obtaining more knowledge about this matter for future improvement in the restoration and conservation of mangroves.

5.4 Biodiversity Impact Monitoring

5.4.1 Biodiversity Monitoring Plan (B4.1, B4.2, GL1.4, GL3.4)

The Biodiversity Monitoring Plan takes into account: (i) that the main activity of the project is the reforestation activity of degraded mangroves areas; and (ii) the net biodiversity impacts that have been described (see Section 5.2.3). The plan will monitor these impacts considering cost-efficient indicators which are easy to use and learn by local people, without high technical needs.

Among the indicators chosen, there are indicators of status (such as vegetation cover or the quantity and diversity of some species of fauna), pressure (such as monitoring of interference concerning illegal logging, poaching, and land encroachment), and response (increased awareness of local people and re-planted trees). The following table shows in detail the type of indicator, its description, name, units, monitoring method, and monitoring frequency.

Table 56: Monitoring indicators for biodiversity

Parameter (proxy for)	Pressure/state/response	Indicator	Indicator unit	Frequency	Location	Method (MoV)
Mangrove tree species **diversity**	state/ response	# woody species present/ restoration site (polygon)	# species/ polygon	every 5 years	random subset of restoration polygons (25%)	field assessment: random monitoring plots
	state/ response	average evenness index of woody species/ restoration site (polygon)	evenness index/ polygon	every 5 years	random subset of restoration polygons (25%)	field assessment: random monitoring plots
Mangrove forest structure	response	restoration area planted with ***Rhizophora*** sp. and seedling density > 1500 trees/ha or average canopy cover > 20%	ha	every 5 years	random subset of restoration polygons (25%)	field assessment: random monitoring plots (and/or drone flights)
	response	restoration area planted with ***Avicennia germinans*** and seedling density > 500 trees/ha or average canopy cover > 20%	ha	every 5 years	random subset of restoration polygons (25%)	field assessment: random monitoring plots (and/or drone flights)
fish species diversity in the water channels ('bolong')	response	# (commercial) fish species identified per market	# species/ market	every 5 years	larger food markets in project area	Data to be collected by DAMPC based on experimental fisheries & local market assessments
	response	abundance of target (selected IUCN red listed) fish species / sampling site	# individual/ species	every 5 years	selected sampling sites across estuary: can range from secondary to primary tributaries to main channel + range from upper to lower delta	Targeted fish sampling campaigns for target species performed by DAMPC

bird species diversity	response	# wader bird species per sampling site	# species/ site	every 5 years	selected sampling sites across estuary: - mangrove estuary channel - bird dormitory - high-tide bird resting place - bird feeding area	Systematic field monitoring campaigns (bird transects/ observation points)
	response	abundance of target (IUCN red listed) wader bird species/ sampling site	# individuals/species	every 5 years	selected sampling sites across estuary: - mangrove estuary channel - bird dormitory - high-tide bird resting place - bird feeding area	Systematic field monitoring campaigns (bird transects/ observation points)
Mollusc (abundance and structure)	response	# (commercial) mollusc species identified per sampling site	# species/ site	every 5 years	Subset of sites used by local communities for mollusc sampling	experimental mollusc harvesting
	response	abundance of target mollusc species / sampling site	# quantity (kg) /species /site	every 5 years	Subset of sites used by local communities for mollusc sampling	survey from local communities
water quality	state	water total suspended solids (water turbidity)	mg/L (estimated through sechi disk depth)	every 5 years	Selected sampling sites across estuary (in vicinity of restoration sites)	field assessment (Sechi disk)

Some considerations for the implementation of the Monitoring Plan are listed below:

- All monitoring activities will be carried out within the project zone.
- The sampling procedures will follow the appropriate tools and methodologies described in the Climate section.
- Flora and fauna species are sensitive to changes in water quality. Changes in water quality (one of the indicators of our Monitoring Plan) can impact flora and fauna. Water quality monitoring will be carried out more frequently (every three months). Therefore, any changes in this indicator should be analyzed with the perspective of taking the necessary actions to avoid negative impacts for the expected biodiversity changes (Section 5.2.1).
- The focal species of fish to be monitored have been selected for their endemicity and their situation of vulnerability on the IUCN red list. The list of fish species to monitor before each verification is presented below. However, other fish species may be added or removed from this list if the project's biodiversity experts suggest it, in order to improve the Monitoring Plan, and after approval of the project management bodies.

Table 57: List of focal fish species to be monitored (2021)

Endemic fish species
Cichlidae (Coptodon guineensis and Sarotherodon melanotheron)
Mugilidae (Chelon dumerili, Neochelon falcipinnis, Parachelon grandisquamis, Mugil curema, Mugil cephalus)
Endangered fish species
Pseudotolithus senegalensis [EN]
Rhinobatos spp. [CR]

As well as for the rest of the project activities, monitoring will be carried out with the participation of stakeholders and local residents. The Monitoring Plan will be communicated to the communities at the appropriate time, after discussion among the project partners, through the instruments identified in the communication plan (radio podcast, cinema debate, and through the support provided along with the project).

5.4.2 Biodiversity Monitoring Plan Dissemination (B4.3)

The different stakeholders involved will participate in the monitoring. The following stakeholders will participate in data collection and analysis: 1) The Directorate of Marine Protected Areas of the Ministry of Environment and Sustainable Development; 2) communities involved in the project (coordinating with mayors); 3) organizations with interests in the project.

The monitoring results will be published on the VCS and CCB websites, which can be easily downloaded by stakeholders. In addition, they will be conveniently communicated to each of the stakeholders directly involved or with interests in the project. The communication channels will be adjusted to each type of stakeholder and to the available means according to the communication plan. This will include:

- Executing and collaborating entities: communicating the results via email and during official project coordination meetings.
- Institutions and decision makers: communicating the results by email and through the steering committee sessions, while collecting the points of view of each of the stakeholders represented in them.
- Civil society: through the cinema debates and radio podcasts. Likewise, the presence in the field of Oceanium, close to each of the villages where the project is carried out, will allow them to work closely with local actors regarding the data obtained in the monitoring and proposals for the next data collection, in the interest of maintaining a good impression and transparency with local residents.
- Sectorial institutions (fishermen, merchants, farmers, etc.): the results will be communicated through email, while they will be allowed to reply through this means or others proposed by them.
- Academia: during the coordination for the execution of the research activities of the project (Strategic line "D.Research, innovation and development"), fluid communication will be maintained by phone, email, and other channels with the heads of the main academic institutions. The results of the monitoring will be communicated and can be applied in the successive investigations to be carried out.

5.5 Optional Criterion: Exceptional Biodiversity Benefits

Project does not seek to validate Gold Level for biodiversity benefits.

ANNEXES

- **Annex 1: Project Activities and Theory of Change Table**

Activity description	Expected climate, community, and / or biodiversity			Relevance to project's objectives
	Outputs (Short term)	Outcomes (Medium term)	Impacts (Long term)	
A. Mangrove restoration	Increase in area planted with mangroves Improved wildlife habitat: prevent continued degradation of mangrove ecosystem Generation of job opportunities for local communities during the implementation of the activity	Generation of GHG emissions removals Establishment of a resilient mangrove ecosystem (based on a multi-specific criteria) Obtaining expected revenues from the VCU Improvement of medium-term environmental conditions by reducing degradation produced by soil erosion	Mitigation of climate change Improve well-being of local residents Permanence of a resilient mangrove ecosystem (based on a multi-specific criteria) Improvement of long-term environmental conditions Increase local biodiversity (habitats and local species) Improvement of water quality	Climate Community Biodiversity

Activity description	Expected climate, community, and / or biodiversity			Relevance to project's objectives
	Outputs (Short term)	Outcomes (Medium term)	Impacts (Long term)	
B. Identification and protection of non reforested areas inside the project area to conserve habitat for waders	Expanded existence of habitats for wader birds Generate job opportunities for the local communities during the implementation of the activity	Higher existence of wader birds in the area	Presence of wader birds Increase biodiversity index in birds Increase local biodiversity (habitats and local species)	Biodiversity
C. Awareness campaign	Signing of agreements with communities and national government Dissemination of the communication plan Performance of cinema debates and radio podcasts Development of awareness-raising workshops prior to validation Establishment and implementation of a grievance procedure Create awareness of climate change Establishment and maintenance of contact between the project and the residents of the communities	Strengthened awareness of climate change and role of mangroves in mitigation and adaptation Improved governance of the project and engagement of local communities Establishment of effective information and communication channels between the project and the communities	Long-term behaviour change in response to strengthened awareness on climate change and role of mangroves in mitigation and adaptation Social acceptance of the project by local communities based on understanding of importance Increase mangrove protection by reduction in degradation-related activities Increase in local biodiversity (habitats and local species)	Community Climate

Activity description	Expected climate, community, and / or biodiversity			Relevance to project's objectives
	Outputs (Short term)	Outcomes (Medium term)	Impacts (Long term)	
			through the environmental awareness	
D. Supporting sustainable use of resources (oysters, beekeeping, fishery)	Improved productivity from value chains related to oystering, beekeeping, and fish production linked to enhanced mangrove habitats Increased awareness on importance of mangrove ecosystem health on natural resources that underpin livelihood activities	Increased income generating opportunities for local communities linked to enhanced natural resources in the mangrove areas Improve sustainability of value chains based on natural resources in the mangrove areas Increase in price and quantity of oysters harvested from the mangrove areas Increased implementation of sustainable harvesting practices Fair and equitable distribution to local residents of mangrove products and benefits	Sustainable increase in household incomes of local residents Improved well-being of local residents Improved social acceptance of the project Prevention of mangrove degradation due to increase in the perceived value of mangrove areas due to strengthened income generating opportunities from natural resources in mangrove areas Generation of job opportunities for local communities	Community

Activity description	Expected climate, community, and / or biodiversity			Relevance to project's objectives
	Outputs (Short term)	Outcomes (Medium term)	Impacts (Long term)	
E. Scientific research activities	Implementation of biomass and biodiversity monitoring activities, including using innovative technologies (flux towers, eDNA etc.) Recognition of indigenous and local knowledge about mangrove ecosystems, which is built into research activities. Collaborations established between international and Senegalese research associations Capacity development of local residents and project staff to implement new techniques and processes	Development and innovation of research skills in Senegal Development of knowledge on sustainable carbon sequestration at both project level to feed into adaptive design Development of new research projects based on collaborations established Contribution to global public goods on improved knowledge of CO_2 exchange into atmosphere from mangrove ecosystem Generation of jobs for local residents in implementation of research activities	Improvement and innovation in ecosystem monitoring and knowledge in Senegal Improvement of programming on mangrove carbon sequestration based on outcomes from research projects Increased skills and knowledge base in Senegal on research activities	Climate Community Biodiversity
F. Surveillance monitoring of mangrove use activities	Implementation of strengthened surveillance and monitoring systems for use of mangroves	Identification of illegal mangrove activities and stakeholders involved Implementation of measures to reduce illegal use of mangrove resources	Increase in effectiveness of mangrove protection activities Protection of local biodiversity (habitats and local species)	Climate Biodiversity

- **Annex 2: Project Activities Stage of Development**

Area	Commune	Area reforested (ha)	Stakeholders invited to the SBIA workshop	Local stakeholders consultation	Meetings between Oceanium staff and mayors (before 2021 & 2023 plantation campaign)	Cinema debates	workshops to identify economic products to support	Product/ market to be supported by the project	Targeted villages for phase 1 of support to socio-economic activities	se 2 of support to
Localization			Communication				Socio-economic activities			
Sine-Saloum	Fimela	1674.76	President of the communes' environmental commission (represent all project villages),	Project manager, economic operator, mayor	11/06/2021 22/05/2023 (CLD)	01/03/2021	juil.-22	Fish (Tilapia) and Shrimps	X	
	Djilass	1056.31	Mayor of the commune (representing all project villages) Youth association for Faoye development + interest economic group that collect and process salt	mayor	22/05/2023 (CLD)	19/03/2021	juin-22	Fish (Tilapia) and Salt	X	

Area	Commune	Area reforested (ha)	Stakeholders invited to the SBIA workshop	Local stakeholders consultation	Meetings between Oceanium staff and mayors (before 2021 & 2023 plantation campaign)	Cinema debates	workshops to identify economic products to support	Product/ market to be supported by the project	Targeted villages for phase 1 of support to socio-economic activities	se 2 of support to
Localization			Communication				Socio-economic activities			
	Djirnda	346.30	Mayor of the Djirnda commune President of the Local Union of Economic Interest Groups of Djirnda representative of the Local Artisanal Fishing Committee of Djirnda Village chief Gandoul MPA management committee and conservator member of economics interest group that collects oysters	General administrator, city councilor, DER association	14/06/2023 (CLD)	06/04/2021	juil.-22	Fish (Tilapia) and Shrimps	X	
	Loul Sessene	42.37	Mayor of the Loul Sessene commune Village chief	Fisheries inspector, city councilor, community development	13/06/2021 22/05/2023 (CLD)	23/03/2021	01/03/2021 and update scheduled on SS 2024	To be known after product identification with community members (Q2 2024)		X

Area	Commune	Area reforested (ha)	Stakeholders invited to the SBIA workshop	Local stakeholders consultation	Meetings between Oceanium staff and mayors (before 2021 & 2023 plantation campaign)	Cinema debates	workshops to identify economic products to support	Product/ market to be supported by the project	Targeted villages for phase 1 of support to socio-economic activities	se 2 of support to
Localization			Communication				Socio-economic activities			
	Mbam	134.53	Mayor of Mbam	Teacher, economic operator	14/06/2023 (CLD)	27/03/2021	août-24	On progress (to be known on Q2 2024)		X
	Bemet Bidjini	221.06	Mayor of the commune	Trader, teacher	02/05/2023 03/05/2023 (CLD)	17/04/2021	05/07/2022	Shrimps and white bissap	X	
	Djibabouya	74.76	Mayor of the commune	Housewife, farmer, teacher	15/06/2021 & 04/04/2023 03/05/2023 (CLD)	19/04/2021	05/07/2022	Fish (Tilapia) and Shrimps	X	
	Adeane	0	Mayor of the commune	Housewife, health worker	19/06/2021 & 28/04/2023 22/09/2023 (CLD)	N/A	scheduled for S1 2025	On progress (to be known on Q1 2025)		X
	Oukout	90.11	Forestry expert and management committee president from Niamone Kalounayes MPA	Housewife, teacher	25/08/2023 05/07/2023(CLD)	24/04/2021	juil.-22	Fish (Tilapia) and Oysters	X	
Casamance	Djinaky	346.30	Baline village village chief	N/A	18/06/2021 & 26/09/2023 28/04/2023(CLD)	14/04/2021	scheduled for S2 2024	On progress (to be known on Q2 2024)		X

Area	Commune	Area reforested (ha)	Stakeholders invited to the SBIA workshop	Local stakeholders consultation	Meetings between Oceanium staff and mayors (before 2021 & 2023 plantation campaign)	Cinema debates	workshops to identify economic products to support	Product/ market to be supported by the project	Targeted villages for phase 1 of support to socio-economic activities	se 2 of support to
Localization			Communication				Socio-economic activities			
	Kafountine	981.67	Representative of mangrove planters and oyster collectors – from an interest economic group	Teachers, farmer	18/06/2021 & 21/09/2023 28/09/2023 (CLD)	18 & 16/04/2021	scheduled for S2 2024	On progress (to be known on Q2 2024)		X
	Nyassia	221.21		Teacher, city clerk	23/0/2023 09/05/2023 (CLD)	18/04/2021	juin-22	Mango & citrus fruits	X	
	Mangagoulack	57.82	Mayor of the commune	Teacher, ecologist, housewife	17/06/2021 & 28/09/2023 28/04/2023 (CLD)	N/A	scheduled for S2 2024	On progress (to be known on Q2 2024)		X
	Coubalan	987.30		Housewife, farmer, economist	17/06/2021 & 01/05/2023 28/04/2023 (CLD)	13/04/2021	juil.-22	Fish (Tilapia) and Honey	X	
	Santhiaba Mandiaque	254.97	Mayor of the commune	Housewife, farmer, teacher	08/05/2023 05/07/2023 (CLD)	13/04/2021	juil.-22	Madd (non timber product) & gardening	X	

Area	Commune	Area reforested (ha)	Stakeholders invited to the SBIA workshop	Local stakeholders consultation	Meetings between Oceanium staff and mayors (before 2021 & 2023 plantation campaign)	Cinema debates	workshops to identify economic products to support	Product/ market to be supported by the project	Targeted villages for phase 1 of support to socio-economic activities	se 2 of support to
Localization			Communication				Socio-economic activities			
	Ouonck	22.45	President of the MPA management committee that gathered all the stakeholders that work and rely on mangroves in Ouonck project villages	Teacher, ecologist, housewife	01/03/2024 29/03/2023 (CLD)	11 & 12/04/2021	scheduled for S2 2024	On progress (to be known on Q2 2024)		X
	Enampore	27.67		Teacher, entrepreneur, fisherman	27/09/2023 09/05/2023(CLD)		scheduled for S2 2024	On progress (to be known on Q2 2024)		X

Annex 3: Complaint form

This form must be completed in full

Name of complainant: Link to project:	Contact (phone number):

Physical address: Locality:	Date: Date you became aware of the event:
Date, time and place of the event giving rise to the complaint :	
Detailed description of the complaint including the names of other persons involved, if any*:*	
Complainant's expectations of the complaint:	
Complainant: File a copy of this form with Project XX staff and keep a copy for filing in the next step (see instructions on how to file with the steps). If you do not receive a response within 10 business days or if you do not agree with the action taken, you may file a copy of the grievance in the next step.	

Number	Complaints filed by :	Signature of complainant	Date
1			
2			
3			