

PROJECT/PROGRAMME PROPOSAL TO THE ADAPTATION FUND

PART I: PROJECT/PROGRAMME INFORMATION

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|--------------------------------|--|
| Project/Programme Category: | Regular Project |
| Country/ies: | Union of the Comoros |
| Title of Project/Programme: | Ecosystem-based adaptation of the Comoros coastal zone |
| Type of Implementing Entity: | Multilateral Implementing Entity |
| Implementing Entity: | United Nations Environment Programme (UNEP) |
| Executing Entity/ies: | Ministry of Agriculture, Fisheries, Environment, Tourism and Handicrafts |
| Amount of Financing Requested: | USD 9,979,830 |

Project / Programme Background and Context:

Provide brief information on the problem the proposed project/programme is aiming to solve. Outline the economic social, development and environmental context in which the project would operate.

1. Context

The Comoros archipelago is located in the northern part of the Mozambique Channel, about 200 km northwest of Madagascar and 300 km from Mozambique. It is composed of four islands, three of which are under the administration of the Union of the Comoros¹, with a total surface area of 1,862 km² and a surrounding marine area, wherein the exclusive economic zone (EEZ) covers 900 Km² of continental shelf and 427 km of coastline²:

Map of Comoros³

- Ngazidja (Grande Comore), located in the North-West, where the capital Moroni is situated, is the largest of the archipelago with 1025 km².
- Mohéli, the southernmost island, covers an area of 211km².
- Anjouan, the easternmost island, has an area of 424km².



The Union of the Comoros belongs to the category of least developed countries and ranks 156th out of 189 countries in the world in terms of the Human Development Index (HDI). Furthermore, it ranks in the 5th and last group of countries in the Gender Development Index (GDI). The economy of the Comoros is poorly diversified and among the most food-import dependent in the world⁴. Agriculture is the leading sector in terms of number of jobs and a significant portion of GDP (31.6% compared to 23.7% on average in Sub-Saharan Africa). Approximately, 80% of the rural population is reliant on rainfed agriculture which is mainly subsistence agriculture, characterized by small family farms (mainly maize, cassava, bananas, taro, potatoes and coconuts)⁵. Commercial agriculture, based on three cash crops (vanilla, ylang ylang and cloves) produces the bulk of the country's exports.

Fishing is also an important component of the primary sector since it accounts for nearly a quarter of agricultural GDP (7.5% of national GDP) and directly employs around 5% of the active population.⁶ Some communities (in Mohéli in particular) depend exclusively on the resources offered by artisanal

¹ The island of Mayotte (374 km²) is currently under French administration.

² https://wedocs.unep.org/bitstream/handle/20.500.11822/25888/Comoros_MEDA.pdf?sequence=1

³ Source: Google maps

⁴ World Bank, Towards a more united and prosperous Union of the Comoros, 2019

⁵ Idem

⁶ (IOC/EU BIODIVERSITY Project), 2018

fishing in the reef for their subsistence. Despite providing 55% of the employment in the agricultural sector, seafood production does not cover the national demand.⁷ Finally, services remain largely underdeveloped and dominated by the informal economy and the public sector. In contrast to other countries in the south-western Indian Ocean, the tourism sector remains embryonic in Comoros, although it has considerable potential.

For the past two decades, the rate of economic growth has barely kept pace with that of population growth, resulting in a stagnation of GDP per capita, often at the cost of a degradation of natural capital (e.g. loss of 1% of forest cover every 4 years since the 1990s, strong erosion of very fertile soil).⁸

The almost complete absence of social safety nets and the low savings rate accentuate the social effects of structural economic volatility; only transfers from the diaspora, which are considerable (13% of GDP in 2017), can cushion economic crises and decouple national economic performance from the level of poverty of the inhabitants.⁸

Basic public services such as education, health and civil protection are chronically underfunded by a State that, despite rationalization efforts, is struggling to raise the tax revenue needed for their operation, which accentuates the vulnerability of communities to hazards and environmental and natural resource degradation.

Problems that affect the environment in Comoros are mainly ecological fragility, poor fishing practices and agriculture, high vulnerability to climate change and natural disasters, low capacity for response and management. These problems are also caused by the rapid degradation of ecosystems and the unregulated exploitation of forest resources, marine and coastal resources, increasing siltation of the water and the exploitation of coral reefs to extract building materials, including sand whose operation is prohibited.⁹

Nearly two thirds of the 832,000 inhabitants of the Comoros lives less than 2 km away from the sea.¹⁰ Key development infrastructure (ports, airports, power plants, water plants, oil and gas depots, and roads) are built near the sea, and 57 towns and villages in the coastal zone are located less than 6 meters above sea level.¹¹ On the island of Anjouan, for example, 50% of the primary road network is located at an altitude of less than 20 m above sea level¹².

Given that the population of the Comoros lives mainly along the coast, they are particularly at risk from flooding and sea level rise. Comoros is likely to experience direct losses reaching US\$2 million from flooding on average per year. This amounts to nearly 35% of the country's direct total annual losses from the combination of earthquakes, floods and tropical cyclones.¹³ Anjouan is at the greatest risk for flood loss (around \$1.3M/year). Coastal flood hazards are classified as high based on currently available information. This means that potentially damaging waves are expected to flood the coast at least once over the next 10 years.¹⁴

2. Baseline climate conditions

The tropical climate of the Comoros is characterized by a rainy season which lasts from mid-November to mid-April and a dry season which extends from June to October. Annual precipitation varies between 1000 and 5000 mm on the islands due to differences in altitude and winds, with the western

⁷ https://www.iotc.org/sites/default/files/documents/2017/11/IOTC-2017-SC20-NR03_-_Comoros.pdf

⁸ World Bank, Towards a more united and prosperous Union of the Comoros, 2019

⁹ https://wedocs.unep.org/bitstream/handle/20.500.11822/25888/Comoros_MEDA.pdf?sequence=1

¹⁰ Mamaty Isabelle, Bandar Ali Daniel, May 2018. Study of vulnerability to the effects of climate change in the Comoros.

¹¹ Kamardine Mohamed Sinane. The coasts of the Comoros, dynamics of an anthropized system: the case of the island of Anjouan. University of Reunion Island, 2013

¹² J. Courboules, Tests méthodologiques de cartographie des aléas érosion côtière, inondation et submersion marine aux Comores (AMCC Project), 2019

¹³ <https://www.preventionweb.net/publications/view/52379>

¹⁴ <https://thinkhazard.org/en/report/58-comoros/CF>

regions of the islands generally experiencing the highest rainfall totals due to greater exposure to monsoons. The average monthly precipitation ranges from 200 to 250mm (with an average annual precipitation of 1676.21 mm between 1901-2016). From June to October, the dry season's the average precipitation ranges between 50-100 mm per month during this time. The rainy season is also characterized with frequent storms, including tropical cyclones concentrated between January and April.

The average temperature in the Comoros gravitates around 27°C (with an average annual temperature of 25.59°C between 1901-2016). From June to October, the dry season brings lower humidity and the lowest temperatures of the year, between 18 and 28°C, with average temperatures around 24°C. The average precipitation during this period varies between 50 and 100 mm per month.

3. Visible and projected climate change

Sea level rise

Global sea level increases are caused by two phenomena: through the accumulation of heat-trapping greenhouse gases which are largely absorbed by the oceans causing ocean temperatures to rise and water to expand (rise) as well as with the melting of glaciers on land adding more water to Earth's oceans. In Comoros, the sea level is reported to have risen by 20- to 25 cm over the last 100 years already, contributing to increased damage to infrastructure, buildings and economic activities, in addition to human losses during natural disasters.¹⁵ This rise in sea level has also contributed to salinization of the water tables, especially on the eastern side of the islands, which is less watered.¹⁶

The sea level is expected to rise by about 4mm per year over the next fifty years, corresponding to an average potential rise of 20cm.^{17 18} While it is difficult to obtain national projections of sea level rise for Comoros, climate models for the region project sea-levels to rise by 0.13 to 0.43m by the 2090s, relative to 1980-1999 under SRES B1; 0.16 to 0.53m under SRES A1B; and 0.18 to 0.56m under SRES A2.^{19 20} The expected impacts are the intrusion of salt water into coastal aquifers²¹ and the destruction of 29% of the roads and works, by flooding.²² Sea level rise will affect each of the Comoros islands differently. For example, sea level rise on the west coast of Anjouan could cause the loss of 1204 ha under a 1-m rise in sea levels.²³ At the same time, the mining of sand, gravel, and coral is leading to extensive coastal erosion which is making the islands more vulnerable to SLR impacts. In the past 20 years, 90% of the beaches have disappeared on Ngazidja, increasing the island's vulnerability to sea-level rise and storm surges²⁴.

IPCC RCP projections for sea level rise for the Comoros are not readily available. Therefore, using Indian Ocean projection could help extrapolate similar scenarios to the region of Comoros. In the West Indian Ocean under a RCP4.5, annual change for 2081–2100 compared to 1986–2005 is projected to increase by 0.5-0.6 meters.²⁵ Another study has shown that sea level under RCP 2.6 may rise to 2.64 cm by 2030, 7.27 cm by 2050, and 12.7 cm by 2080 compared to 2015, whereas, in RCP 8.5 scenario, the sea level may rise to 5.23 cm by 2030, 9.37 cm by 2050, and 19.1 cm by 2080.²⁶

¹⁵ Kamardine Mohamed Sinane. The coasts of the Comoros, dynamics of an anthropized system: the case of the island of Anjouan. University of Reunion Island, 2013

¹⁶ Anli Bourhane, Méthodes d'investigation de l'intrusion marine dans les aquifères volcaniques (La Réunion et La Grande Comore), PhD thesis, 2014

¹⁷ https://thevcf.org/wp-content/uploads/2020/10/INDC_Comores_Version_Francaise.pdf

¹⁸ <https://sustainabledevelopment.un.org/content/documents/13692WWF2.pdf>

¹⁹ The IPCC developed different narrative storylines to describe the relationships between emission driving forces and different demo-graphic, social, economic, technological, and environmental developments. Each scenario represents a specific quantitative interpretation of one of four storylines. (<https://www.ipcc.ch/site/assets/uploads/2018/03/sres-en.pdf>)

²⁰ https://www.geog.ox.ac.uk/research/climate/projects/undp-cp/UNDP_reports/Comoros/Comoros_hires_report.pdf

²¹ Ibid

²² Ibid

²³ https://www.researchgate.net/publication/312213808_A_spatially_explicit_assessment_of_climate_change_vulnerability_in_the_agricultural_sector_of_the_Union_of_the_Comoros

²⁴ https://www.unclearn.org/wp-content/uploads/library/gef56_0.pdf

²⁵ https://www.ipcc.ch/site/assets/uploads/2018/02/WGIIAR5-Chap29_FINAL.pdf

²⁶ Paruthiyazhath Joshy Akhiljith, et al. (2019). "Climatic Projections of Indian Ocean During 2030, 2050, 2080 with Implications on Fisheries Sector," Journal of Coastal Research 86(sp1), 198-208, (7 November 2019). <https://doi.org/10.2112/SI86-030.1>

Globally, given the increases in ocean warming and loss of mass from glaciers and ice sheets, the mean sea level rise during the 21st century will exceed the rate observed during 1971–2010 for all Representative Concentration Pathways (RCP). Compared to 1986–2005, the period 2081–2100, global mean sea level rise is likely to be 0.26 to 0.55 m for RCP2.6, 0.32 to 0.63 m for RCP4.5, 0.33 to 0.63 m for RCP6.0, and 0.45 to 0.82 m for RCP8.5. For RCP8.5, the rise by 2100 is 0.52 to 0.98 m with a rate during 2081–2100 of 8 to 16 mm yr.²⁷

Precipitation

Climate change is also having impacts on rainfall amounts and distribution in the Comoros. Rainfall modifications have already been important: the rainy season has experienced increasing irregularity, but overall, it has shortened in duration from 6 months to around 3 months. More frequent episodes of severe rainfall events during the rainy season (march-may) have also occurred, and the frequency and intensity of floods and storms has also increased since 1960.²⁸

The IPCC's Representative Concentration Pathway (RCP) greenhouse gas concentration trajectories projects that monthly precipitations from 2080 to 2099 will likely decrease during the dry season (June to October) and increase during the rainy season (January and April) considering low to high emission scenarios.^{29 30}

There is however a large range of projections of mean annual rainfall from different models. They range from negative to positive changes (-15% to +39%). Seasonal projections offer a more coherent picture, with the projections tending towards rainfall decreases in JJA and SON, and increases in wet season rainfall in DJF³¹. Projected changes in JJA rainfall by the 2090s range from -47 to +21% with ensemble median values of -2 to -14% and in SON, -36 to +32%, with ensemble median values of -8 to -14%. Projected changes in DJF rainfall by the 2090s range from -17 to +45% with ensemble median values of +3 to +14%. The proportion of rainfall that falls in heavy events in projections tends towards increases, changing by -5 to +14% by the 2090s. Increases in DJF and MAM are partially offset by decreases in JJA. The models indicate increases in 1-and 5-day rainfall maxima by the 2090s under the higher emissions scenarios, with 1-day annual maxima changing by -7 to +34mm, and 5-day annual maxima by -11 to +64mm.³² Considering that there are several sources that project precipitation changes from different starting dates, Table 1 (below) uses a single source comparing from 1981-2010.

Table 1 : IPCC RCP pathway projections for Moroni, Grande Comore, Comoros

| IPCC | | | | | | | | | | | | | |
|----------------------|----------------------|----------------------|----------------------|----------------------|----------------------|----------------------|----------------------|----------------------|----------------------|----------------------|----------------------|--------------------------|--------------------------|
| Precipitation | | | | | | Temperature | | | | | | Sea Level Rise* | |
| RCP 4.5 2011-2040 | RCP 4.5 2041-2070 | RCP 4.5 2071-2100 | RCP 8.5 2011-2040 | RCP 8.5 2041-2070 | RCP 8.5 2071-2100 | RCP 4.5 2011-2040 | RCP 4.5 2041-2070 | RCP 4.5 2071-2100 | RCP 8.5 2011-2040 | RCP 8.5 2041-2070 | RCP 8.5 2071-2100 | RCP 4.5 2081-2100 | RCP 8.5 2081-2100 |
| Annual Median change | | | Annual Median change | | | Annual Median change | | | Annual Median change | | | Potential sea level rise | Potential sea level rise |
| 0.54% | 0.58% | -0.14% | -0.41% | -1.8% | -2% | 0.59°C | 1.1°C | 1.3°C | 0.71°C | 1.6°C | 2.8°C | 0.32 to 0.63 m | 0.45 to 0.82 m |

²⁷ https://www.ipcc.ch/site/assets/uploads/2018/02/WG1AR5_Chapter13_FINAL.pdf

²⁸ Data gathered from EM-DAT, CRED / UCLouvain, Brussels, Belgium: www.emdat.be (D. Guha-Sapir)

²⁹ <https://climateknowledgeportal.worldbank.org/country/comoros/climate-data-projections>

³⁰ RCP 2.6 (low emissions), RCP 4.5 (medium-low emissions), RCP 6.0 (medium-high emissions) and RCP 8.5 (high emissions). The dry season RCP 2.6: 27.29mm; RCP 4.5: 29.23mm; RCP 6.0: 25.63mm; and RCP 8.5: 25.83mm. The rainy season RCP 2.6: 123.63mm; RCP 4.5: 131.21mm; RCP 6.0: 129.77mm; and RCP 8.5: 145.19mm.

³¹ <https://research.fit.edu/media/site-specific/researchfit.edu/coast-climate-adaptation-library/asia-amp-indian-ocean/indian-ocean-islands/McSweeney-et-al.-Comoros-UNDP-CC-Profile.pdf>

³² <https://research.fit.edu/media/site-specific/researchfit.edu/coast-climate-adaptation-library/asia-amp-indian-ocean/indian-ocean-islands/McSweeney-et-al.-Comoros-UNDP-CC-Profile.pdf>

| Monthly mean change lies between | | | Monthly mean change lies between | | | Monthly mean change lies between | | | Monthly mean change lies between | | | | |
|----------------------------------|--------------|--------------|----------------------------------|--------------|--------------|----------------------------------|------------------|------------------|----------------------------------|------------------|-----------------|--|--|
| -34% and 31% | -46% and 42% | -42% and 38% | -46% and 46% | -53% and 34% | -61% and 61% | 0.23°C and 1.2°C | 0.56°C and 2.1°C | 0.69°C and 2.8°C | 0.33°C and 1.3°C | 0.74°C and 2.9°C | 1.5°C and 4.9°C | | |

Projections generated from Moroni, Grande Comore, Comoros. These projections will be extrapolated to the rest of the Comoros assuming similar projections for the country as a whole. The time period 2011–2040 is compared to 1981–2010 (RCP 4.5 and RCP 8.5), 2041–2070 is compared to 1981–2010 (RCP 4.5 and RCP 8.5), and 2071–2100 is compared to 1981–2010 (RCP 4.5 and RCP 8.5). Source: <https://climateinformation.org/create-report/>. *For sea level rise, the period is compared to 1986–2005.³³

We can see that over time and under both 4.5 and 8.5 RCP pathways, the level of precipitation will decrease in the Comoros. The annual median change is projected to be between -0.14% to + 0.54% under the RCP 4.5 (2011–2040), while under the RCP 8.5 scenario the change ranges from -0.41% (2011–2040) to -2% (by 2071–2100). However, considering the large disparity between monthly mean changes in precipitation of -42% and 38% and -61% and 61% under both RCP 4.5 and 8.5 respectively, it is likely that although precipitations will decrease overall throughout the year, heavy rainfall will increase and be produced by fewer more intense events. Corroborating this, are the projections for the Indian ocean, which will see no significant variations in the general pattern of rainfall over the seasons. However, variations will occur in the amount of precipitation or extreme precipitation events in 2030, 2050 and 2080.³⁴

Temperature

Annual temperature in Comoros has increased by at least 0.9°C (1991–2020), with frequent heat waves, particularly during March–May.³⁵ The rate of increase in mean surface water temperature in the tropical Indian Ocean is the fastest of all tropical ocean masses³⁶. It has increased by 0.7°C between 1951–2015 and could reach up to 2.7°C over the period 2070–2099 (compared to 1976–2005 in the pessimistic RCP 8.5 scenario).³⁷ In Comoros, the average annual temperature is expected to increase, with a range of estimates from 0.8 to 2.1°C in 2060 and by 1.2 to 3.6°C in 2090, considering averages of all scenarios.³⁸

Considering that there are several sources that project temperature changes from different starting dates, Table 1 (above) uses a single source comparing from 1981–2010. We can see that over time and under both 4.5 and 8.5 RCP pathways, the temperature levels will increase in Comoros, with increases under RCP 4.5 of 0.59°C (2011–2040) and at 1.3°C (2071–2100), or +0.71°C (2011–2040) and 2.8°C (2071–2100) under RCP 8.5.

Extreme Events

In addition, the Comoros is highly exposed to extreme weather events such as cyclones and droughts. Cyclone Kenneth caused damages estimated at US\$ 185.4 M in 2019 (i.e. between 12.5 and 16% of the GDP) and reduced GDP growth to 1.5% in 2019, half that in 2018.³⁹ Given the high probability of cyclone intensification and erratic regional cyclone routes, Comoros is expected to be affected more often by this type of extreme event in the future, despite being, for the most part, shielded by the

³³ https://www.ipcc.ch/site/assets/uploads/2018/02/WG1AR5_Chapter13_FINAL.pdf

³⁴ Paruthiyazhath Joshy Akhijith, et al. (2019). 'Climatic Projections of Indian Ocean During 2030, 2050, 2080 with Implications on Fisheries Sector'. Project: National Innovations on Climate Resilient Agriculture. Journal of Coastal Research 86 (sp1): 198

³⁵ <https://climateknowledgeportal.worldbank.org/country/comoros/climate-data-historical>

³⁶ Beal LM, Vialard J, Roxy MK et al., IndOOS-2: a roadmap to sustained observations of the Indian Ocean for 2020–2030. CLIVAR-4, 2019.

³⁷ Roxy et al. " Indian Ocean Warming ". In Assessment of Climate Change over the Indian Region: A Report of the Ministry of Earth Sciences (MoES), Government of India, Singapore, 2020.

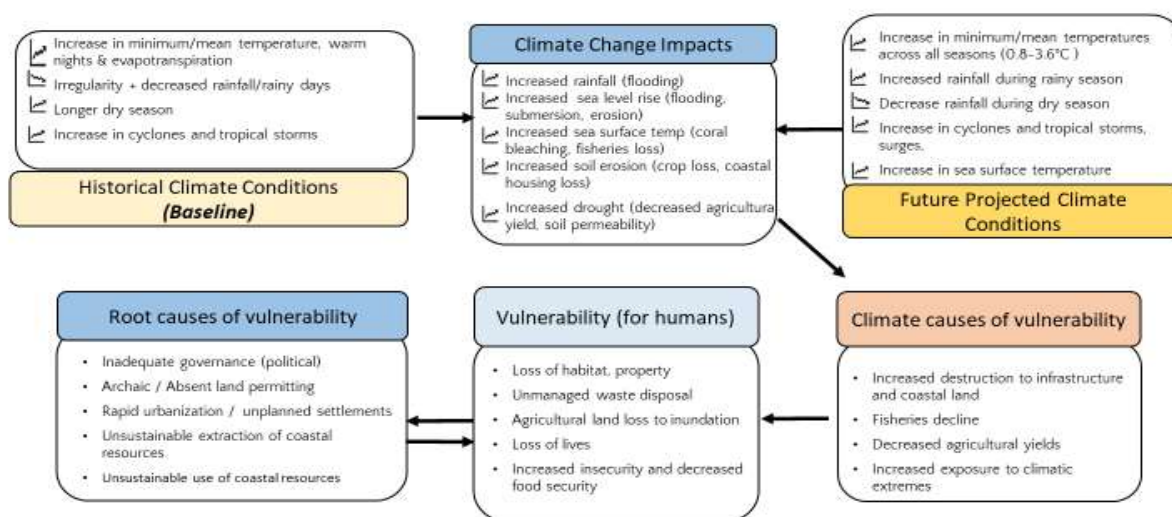
³⁸ <https://research.fit.edu/media/site-specific/researchfitedu/coast-climate-adaptation-library/asia-amp-indian-ocean/indian-ocean-islands/McSweeney-et-al.-Comoros-UNDP-CC-Profile.pdf>

³⁹ AfDB Comoros Economic Outlook, 2020

presence of Madagascar to the East.

The rising trend in sea level, combined with the increased frequency of exceptional storm surge phenomena (cyclonic swell), accelerates coastline erosion, reinforcing the recurrence of marine submersion on the surface and the intensity of the phenomenon of underground salinization of coastal aquifers. Storm swells and high wave action has been observed in Comoros, with some swells reaching over 7m. For all coastal countries, climate change exacerbates coastal flooding from storm surges.⁴⁰ In the long term, Comoros is likely to face coastal land loss, increased displacement of coastal communities, infrastructure loss, and decreases in agricultural productivity from the combined impacts of climate change on rainfall and temperatures.

Figure 1: Problem tree analysis



4. Climate change impacts

The combined pressures of land-and marine-based climate change effects are taking a toll on the already fragile Comorian economy, starting with the fragile buffering ecosystems in the coastal zone.

The Coastal areas in Comoros are covered by roughly 215 hectares of mangroves⁴¹ which provide essential ecological services to fisheries and protection of coastlines. Based on data provided by the FAO (2007) from to 1980–2005, the Comoros has lost about 8% of its mangroves at a rate of 0.3 ha per year.⁴² The remaining mangroves will be negatively impacted by sea level rise, frequent storm surges, and decreased salinity during high intensity rainfall events. Furthermore, other natural factors contributing to mangrove decline include pest infestation⁴³, El Niño events and climate change-associated factors such as sea level rise, excessive flooding and increased sedimentation from degraded upper watersheds.⁴⁴ In some cases, drought also impacts mangroves, by reducing the flow of freshwater and disturbing the saline balance.

Sea level rise combined with extreme weather events will particularly effect low-lying coastal areas

⁴⁰ <https://www.climatecouncil.org.au/uploads/56812f1261b168e02032126342619dad.pdf>

⁴¹ <https://unfccc.int/resource/docs/natc/comnc1e.pdf>

⁴² https://wedocs.unep.org/bitstream/handle/20.500.11822/11349/rsocr_printedition.compressed_Part5.pdf?sequence=6&isAllowed=y

⁴³ <https://unfccc.int/resource/docs/natc/comnc1e.pdf>

⁴⁴ https://wedocs.unep.org/bitstream/handle/20.500.11822/11349/rsocr_printedition.compressed_Part5.pdf?sequence=6&isAllowed=y

and their mangroves, as well as small-scale coastal fisheries in tropical countries, such as those found in Comoros. In the Initial National Communication (2002) it was estimated that sea level rise would flood 734 hectares of low-lying coastal areas on the islands. This will have implications for the majority of people employed in capture fisheries, wherein their food security is being eroded by smaller catches and lower incomes.⁴⁵

Healthy reefs provide protective ecological services by helping control against SLR and wave swells, but also significant productive services as support to fisheries. A recent study has shown that a healthy coral reef provides up to twice as much wave energy reduction as a degraded reef.⁴⁶ Coral reefs in Comoros have also been affected by mass coral bleaching and mortality, much like many sites in the western Indian Ocean. This was especially exacerbated during the extreme El-Niño Southern-Oscillation (ENSO) events in 1997–1998 and 2015–2016, and more recently in 2020 as observed by the Coastal Oceans Research and Development – Indian Ocean (CORDIO) institute.⁴⁷ Globally, coral bleaching events are occurring more often and in closer timespans from one another, giving the reef less time and a lowered capacity to regenerate. Furthermore, ocean acidification and greater thermal stress are also negatively impacting reefs in the West Indian Ocean as well as in parts of Comoros.⁴⁸ Although corals can recover from a single bleaching event over several years, limited stressors and a return to normal temperatures are needed. Unfortunately, the median time between pairs of intense bleaching events has gone from occurring, on average, every 27 years in the early 1980s to once almost every 6 years in 2016.⁴⁹ In turn, this disappearance favours coastal erosion and diminishes coastal fishing which leads to a decrease in fishing income. This results in a chronic deficit of fish in the market and a difficult access to it, especially for the most destitute populations.⁵⁰ Under high emissions trajectories of the Atlantic and Pacific Oceans (RCP 8.5), the sea surface temperature (SST) of the Western Indian Ocean is expected to rise an additional 0.67 to 0.83°C by 2040 and 2.66 and 3.14 °C by 2100. Even within moderate emissions scenarios (RCP 4.5), the SST in the major coral regions is expected to rise between 1.18 and 1.44°C by the end of the century.⁵¹ This rise in ocean temperatures results in the whitening of coral thus leading to a high coral mortality. Furthermore, ocean acidification has several deleterious impacts on coral species, impairing their development and other ecological and physiological functions. Both temperature and acidification stressors can occur simultaneously and will likely make coral recovery more difficult.⁵²

Combined with acidification, deoxygenation and rising average water temperature, rising sea levels and the increased frequency of heavy swell caused by extreme weather events tend to destabilize coastal ecosystems, primarily reef habitats, coastal wetlands, marine phanerogam beds, foreshore and backshore flora, and mangroves, all of which provide essential services to local populations (regeneration of fish stocks, tourist attraction, carbon storage, food and medicinal resources, etc.).⁵³ These degradations are a worrying factor in the amplification of the impacts of climate change on the coastline. Indeed, coastal ecosystems are the first (and sometimes the only) barrier to the phenomena of marine submersion during tropical storms and cyclones, by dissipating wave energy through friction

⁴⁵ https://www.ifad.org/documents/38714170/40321094/marine_advantage.pdf/09d7a693-c458-4967-a953-c02e7f573454

⁴⁶ <https://advances.sciencemag.org/content/4/2/eaao4350>

⁴⁷ Benjamin Cowburn, et al. (2018). 'The current status of coral reefs and their vulnerability to climate change and multiple human stresses in the Comoros Archipelago, Western Indian Ocean'. 2018 Marine Pollution Bulletin 133. DOI:10.1016/j.marpolbul.2018.04.065 and also <https://cordioea.net/coral-bleaching/io-coral-bleaching-alert/>

⁴⁸ Ibid

⁴⁹ Hughes et al., Spatial and temporal patterns of mass bleaching of corals in the Anthropocene *Science* 359, 80–83 (2018)

⁵⁰ https://www.preventionweb.net/files/8507_com01e.pdf

⁵¹ Hoegh-Guldberg, O., R. Cai, E.S. Poloczanska, P.G. Brewer, S. Sundby, K. Hilmi, V.J. Fabry, and S. Jung, 2014: The Ocean. In: *Climate Change 2014: Impacts, Adaptation, and Vulnerability. Part B: Regional Aspects. Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change* [Barros, V.R., C.B. Field, D.J. Dokken, M.D. Mastrandrea, K.J. Mach, T.E. Bilir, M. Chatterjee, K.L. Ebi, Y.O. Estrada, R.C. Genova, B. Girma, E.S. Kissel, A.N. Levy, S. MacCracken, P.R. Mastrandrea, and L.L. White (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, pp. 1655-1731.

⁵² Pendleton L, Comte A, Langdon C, Ekstrom JA, Cooley SR, Suatoni L, et al. (2016) Coral Reefs and People in a High-CO2 World: Where Can Science Make a Difference to People? *PLoS ONE* 11(11): e0164699. <https://doi.org/10.1371/journal.pone.0164699>

⁵³ For example, in 1998, the Indian Ocean Commission's Regional Environment Programme (PRE-COI 1995-2000) estimated the economic value of coral reef tourism services in the Moheli National Park area alone at 1.3% of Comorian GDP. ²⁹ Harris DL et al.,

and absorption.

Regarding land-based vulnerability to climate change, it is estimated that climate change will cause a loss of 734 ha of agricultural land and a displacement of around 10% of the population across the entire archipelago by 2050 if the sea level rises by 20 cm (Ministère du Développement Rural, de la Pêche, de l'Artisanat et de l'Environnement, 2006).⁵⁴ The majority of farmers have already observed a decline in fertility and yields over the past decade, as a result of more frequent droughts and increased soil erosion, which is being exacerbated by the increase in intense rainfall events.⁵⁵ Research shows that further change in climatic conditions will disrupt farming calendars and could lead to the emergence of new plant diseases, resulting in lower production and incomes and thus increased food insecurity.⁵⁶

Climate change also reduces access to drinking water for people dependent on coastal groundwater. All access wells to Comoros' drinking groundwater are located on the coast and most of them are affected by high permanent salinity. The increase in temperature, SLR, evapotranspiration, the prolonged dry periods and the overexploitation of the water table lead to a risk of diminishing water reserves on the three islands. Inland, the flow of many rivers and streams has already decreased significantly over the last two decades, leading to deterioration in water quality, supply difficulties and a reduction in hydropower potential, especially during the dry season⁵⁷. Deteriorating water quality and climate change are leading to a risk of an increase in diarrheal, infectious and parasitic diseases, which are among the main causes of child mortality.

Baseline stressors

Climate change impacts are further exacerbated by anthropogenic drivers contributing to ecosystem degradation.

Comorian mangroves are subject to human threats with varying degrees of intensity. They include overharvesting for firewood, timber and charcoal; clearing and conversion to other land uses such as agriculture, aquaculture, urban development, tourism and salt production; pollution; sedimentation and changes in river flow. Overharvesting, as well as the clearance for infrastructural development (for example, at Iconi on Grande Comore and Domoni on Anjouan), has resulted in considerable loss of mangroves in Comoros.⁵⁸ Specifically, the Comoros has lost about 8 per cent of its mangrove cover at a rate of 0.3 ha yr.⁵⁹ However, mangroves in Moheli still remain relatively pristine and are currently protected by the Moheli National Park, indicating a potential for positive impact from sustainable management practices.

Human pressures on reefs, be they direct or indirect, include fishing, pollution and sewage from towns, sand mining, and sedimentation as a result of deforestation and agriculture.⁶⁰ These pressures prevent reefs from restoring back to healthy resilient levels. Unsustainable reef fisheries and use are also accelerating reef degradation, for example through the continued practice of dynamite fishing, uncontrolled anchorage, walking on the coral at low tide (in search of fish and octopus trapped by the tides), and fishing pressure exerted by the fishermen on the reef fringe. Other unsustainable practices in the shelf area, including off-shore maritime oil pollution and soil deposits linked to land erosion, further destabilizing the nearshore seagrass and coral reef system.

⁵⁴ <https://onlinelibrary.wiley.com/doi/10.1111/1477-8947.12102>

⁵⁵ <https://www.thegef.org/news/challenge-climate-change-comoros>

⁵⁶ Second National Communication on Climate Change, 2012

⁵⁷ Document de projet FVC, Ensuring climate resilient water supplies in the Comoros Islands, accessible en ligne: <https://www.greenclimate.fund/sites/default/files/document/funding-proposal-fp094-undp-comoros.pdf>

⁵⁸ Rapport du projet SWIO-RAFI (South West Indian Ocean - Risk Assessment and Financing Initiative), 2017.

⁵⁹ Ibid

⁶⁰ https://wedocs.unep.org/bitstream/handle/20.500.11822/11349/rsocr_printedition.compressed_Part5.pdf?sequence=6&isAllowed=y

⁶⁰ Ibid

The impact of sea-level rise is also amplified by the widespread practice of sand extraction from beaches (and coastal zone riverbeds) for use in the construction sector. A study on the impact of this activity on the coastlines of the island of Anjouan was carried out in 2013 and concluded that these withdrawals had played a major role in the general retreat of the coastline over the last two decades⁶¹ (some studies mention beach retreats of up to 15-20m in two decades). Two-month estimates in 2008 and 2009 suggest that almost 170,000 m³ of sand were withdrawn annually during these two years.⁶² Aerial observations carried out as part of the Global Climate Change Alliance (GCCA) project in 2017 showed the large number of mining sites still existing on the three islands, despite a ban imposed by the public authorities in 1994.⁶³ Mining of sand from the beaches for construction purposes have led to the disappearance of an estimated 44% of the beaches of Grande Comore, 39% of the beaches of Anjouan and 54% of the beaches of Mohéli in about ten years.³⁴ As an example, a GCCA study cites the case of the coastal road that follows the village of Mouamoua in Anjouan: it is said to be on the verge of collapsing into the sea due to the illegal collection of sand and aggregates; sand collectors plunge into the water to continue their activity. This stretch of coast, which is not protected by a reef flat, has become extremely vulnerable and the road is in danger of being washed away during the next northern storm.⁶⁴

Ironically, this increase in sand extraction is linked to an increase in demand for "hard", weather resistant housing.⁶⁵ This is a maladaptation, since it leads to a loss of beach buffer functionality against wave energy and increases exposure and vulnerability. However, the socio-economic profile of sand extractors tends to prove that the activity is the effect of a lack of socio-economic alternative, often exercised as a complement to another livelihood activity and dictated by necessity. Women and illiterate people are said to be in the majority.⁶⁶

Another practice that can be considered as a potential source of maladaptation are attempts to halt coastline retreat by poorly planned coastal defense works, either as part of development, or sometimes spontaneously by communities and/or land users (riprap, small seawalls, use of macro-waste).⁶⁷ These structures, which are often poorly dimensioned and whose impact on upstream and downstream sedimentary dynamics is not studied, can also lead to increased erosion problems. In some cases, ill-designed protection infrastructure can trap sediment, leading to accumulation in some parts of the shore and depletion in other parts. The removal of vegetation cover on beaches accelerates the sand transfers from one site to another that would, under normal conditions, be naturally equalized.

Comoros seagrasses have been affected by sedimentation and climate change. High sediment influx into the lagoon from upland deforestation, for example, in Mohéli Marine Park, coupled with high rainfall, has destroyed seagrasses. Potential stressors are the reduction of light⁶⁸, nutrient enrichment, changes in sediment conditions, and strong water motion. Furthermore, filling and dredging, excess nutrient loading, industrial pollution, waste discharges, boats and harbour operations, and some fishing practices like trawling and digging are threats to seagrasses. Aquaculture practices may be

⁶¹ Kamardine Mohamed Sinane. The coasts of the Comoros, dynamics of an anthropized system: the case of the island of Anjouan. University of Reunion Island, 2013

⁶² Idem

⁶³ J. Courboulos, Tests méthodologiques de cartographie des aléas érosion côtière, inondation et submersion marine aux Comores (Projet AMCC), 2019 ³⁴ Malterre Pauline et al, op.cit.

⁶⁴ J. Courboulos, op. cit.

⁶⁵ Kamardine Sinane, et al, "Fragilization and modification of unconsolidated coastal formations on the island of Anjouan (Comoros): When human-induced erosion and climate change come together", Vertigo - the environmental science e-journal [Online], Volume 10 Number 3 | December 2010

⁶⁶ Kamardine Sinane, et al, op. cit

⁶⁷ Ratter, B.M et al. " Considering the locals: coastal construction and destruction in times of climate change on Anjouan, Comoros". Nat Resour Forum, 40: 112-126, 2016.

⁶⁸ In the tropics, light regimes are altered by pulsed sedimentation events, low nutrients in column water and grazing pressures.

negative to seagrasses due to organic overload, shading and trampling. Though sea grass (and mangroves) are important spawning and breeding grounds for fish and other marine resources the livelihood basis for many vulnerable coastal communities, damage to seagrass beds is rarely documented in the West Indian Ocean region, and in Comoros. As a result, the extent and severity of damage on most sea-grass beds are difficult to estimate in the region given the lack of data. Rehabilitation of seagrass is very difficult and costly once seagrasses have been destroyed, where recovery is slow (years/decades/centuries) and depending on the severity of the damage and on the species involved.⁶⁹

Waste management is poor in the three islands, with no systematized waste management practices in place. Effluent seepage affects the near shore reef and solid waste risks blocking urban drainage and water courses, and affects reef habitats. Waste already has a deleterious effect on coastal ecosystems in Comoros, such as those related to mangroves, reefs and corals as well as the underlying species living and maintaining these habitats. Inland, there is a proliferation of illegal dumping sites. Many villages in the upper watershed lack proper sanitation, leading to continued open defecation and use of rivers for hygiene and sanitation. This, combined with uncontrolled waste disposal, creates leachates that travel down the watershed through rivers and run-off, with impacts downstream.⁷⁰

The Comorian marine flora and fauna are also threatened by various types of pollution (waste, hydrocarbons, soil erosion, sand and coral extraction, human activities, upwelling, etc.). They are particularly affected by the garbage and oil spills (tankers passing through the Comorian waters) pollution.⁷¹ Furthermore, the discharge of wastewater promotes the excessive growth of seagrass beds which can cause an imbalance in the ecosystem, as those observed in Anjouan.⁷² Excessive growth of seagrasses cause eutrophication of coastal ecosystems (mangroves, estuaries, etc) by choking off oxygen and light, leading to fish mortality. In addition, runoff and household waste, among other anthropogenic stress factors, are reputed to have hastened a bleaching of the Comorian coral and coral death.⁷³ Waste volumes are difficult to quantify. Some studies estimate that Comoros has a mean rate of 0.32 kg waste generation per day per capita. As well, Ndzuwani produces around 0.4 kg per capita per day of house-hold waste, 80 percent of which is organic.⁷⁴ Ultimately, both gains and losses to seagrass resources will result from climate change. Productivity increases due to higher CO₂ levels are being buffered by the negative consequences of higher seawater temperatures and most additional anthropogenic factors such as “polluted” land runoff.⁷⁵

The Comoros has experienced high rates of deforestation in natural forests, of approximately 4.6% annually. In 2015, the total forest area including planted, naturally regenerated forest and natural forests was estimated at 37,000 ha compared to 40,000 ha in 1990.⁷⁶ The reduction of forest cover has occurred with the expansion of agriculture and urban centers within watersheds. Poor agricultural methods (slash and burn practices, total land clearing, absence of crop rotation, and planting on slopes without soil conservation measures) are leading to reduced soil fertility, land degradation and soil erosion. The degraded land in upper and middle watersheds have reduced capacity to naturally

⁶⁹ <https://www.diva-portal.org/smash/get/diva2:189345/FULLTEXT01.pdf>

⁷⁰ https://wedocs.unep.org/bitstream/handle/20.500.11822/25888/Comoros_MEDA.pdf?sequence=1

⁷¹ Ibid, <https://documents1.worldbank.org/curated/en/471791612255765765/pdf/Comoros-Urbanization-Review-Reimagining-Urbanization-in-Comoros.pdf>

⁷² ibid

⁷³ ibid

⁷⁴ <https://documents1.worldbank.org/curated/en/471791612255765765/pdf/Comoros-Urbanization-Review-Reimagining-Urbanization-in-Comoros.pdf>

⁷⁵ https://reliefweb.int/sites/reliefweb.int/files/resources/8_Seagrass.pdf

⁷⁶ FRA, 2015 for Comoros: <http://www.fao.org/3/a-az188f.pdf>

retain rainwater, thus increasing surface water flow, and at times of extreme rainfall events overflowing their natural channels, leading to flooding in coastal areas downstream.⁷⁷ Soil material transported down watersheds deposits on the near shore reef, further compromising the productivity and recovery capacity of the reefs.⁷⁸ Despite recent progress supported by the GEF/LDCF⁷⁹, and other partners, in supporting community-based watershed management committees to apply integrated watershed management approaches (see figures 2 and 3), it is not yet a commonly applied in all islands, and has yet to be scaled up to the level required to ensure coastal resilience.

Figure 2: Integrated watershed measures in upper watershed area in Anjouan Island (LDCF Project)



Figure 3: Agroforestry measures in upper watershed area in Anjouan Island (LDCF Project)



It should be noted that while all these baseline stressors are directly observable in the field (for example presence of waste deposits and sand mining pits), data on the extent of the problem is hard to come by. This is because these practices are illegal and therefore, conducted discretely, but also to the government's inability to practice observation and enforcement locally. Despite some attempts to control unsustainable practices such as the prohibition of collection of shells and coral mining as well as some limited monitoring of the socio-economic and ecological status of the country's coastal zones, the current governance system is weak, and there is a lack of ongoing monitoring and enforcement capacity.⁸⁰

Given that the population of the Comoros lives mainly along the coast, they are particularly at risk from flooding and sea level rise. According to the scenarios presented above, Comoros is likely to experience direct losses reaching USD \$2 million from flooding on average per year. This amounts to nearly 35% of the country's direct total annual losses from the combination of earthquakes, floods and tropical cyclones.⁸¹ Anjouan is at the greatest risk for flood loss (around \$1.3M/year). Coastal flood hazards are classified as high based on currently available information. This means that potentially

⁷⁷ <https://pubs.usgs.gov/wri/1984/4218/report.pdf>

⁷⁸

https://www.academia.edu/11841714/Towards_Reef_Resilience_and_Sustainable_Livelihoods_A_handbook_for_Caribbean_coral_reef_managers

⁷⁹ "Building Climate Resilience through Rehabilitated Watersheds, Forests and Adaptive Livelihoods (GEFID 5694)" executed by the Ministry of Agriculture, Fisheries, Environment, Tourism and Handicrafts and implemented by UNEP

⁸⁰ https://wedocs.unep.org/bitstream/handle/20.500.11822/25888/Comoros_MEDA.pdf?sequence=1

⁸¹ <https://www.preventionweb.net/publications/view/52379>

damaging waves are expected to flood the coast at least once over the next 10 years⁸².

Project / Programme Objectives:

The **main problem** that this project seeks to address is the vulnerability of the targeted coastal areas to the impacts of climate change in the near and long-term (such as storm surges, sea-level rise (SLR), and floods and droughts events) that threaten the existence, food security, livelihoods, and well-being of coastal populations. In an ideal scenario, the Comoros would manage its fragile coastal zone with climate change in mind, making sure that buffering ecosystems retain their ecological value and that livelihoods are deployed in climate-resilient pathways. However, there are a number of barriers that are preventing this situation from materializing, the main **barriers** that need to be addressed are:

Weak land use policies, regulatory and institutional capacity: Although a legal framework theoretically provides rules for use of the shoreline, the construction of buildings and infrastructure (public or private) still does not take into account the many risks associated with climate change and shoreline erosion. For example, the "*zone des pas géométriques*" (ZPG), with a width of about 80 m from the upper limit of the shoreline, is legally part of the maritime public non-transferable and inalienable domain of the State, and should be exempt from construction unless expressly authorized. It is, however, outside the real control of the public authorities, and has been progressively appropriated by the owners of the neighboring areas and by coastal settlements. The lack of ownership rights of the occupants even tends to complicate State interventions, insofar as the legitimacy of the occupation is in fact based exclusively on customary law. Today, for example, having escaped the control of the State, the ZPG of the island of Anjouan has lost its function as a buffer space in case of storms and a bulwark against wave action and sea level rise.⁸³

This reflects a conflict of norms between traditional and civil law and a lack of public participation in normative decision making and land use planning. Decentralization, a nascent public policy, is not complete, and many local leaders operate with insufficient resources for monitoring and enforcement and on the basis of limited knowledge. In the absence of a national land use plan or master plan, no coastal Comorian settlement has a development plan establishing rules for land use based on zoning that takes into account climatic risks. This lack of a framework to guide the location of buildings and infrastructure leads to a significant and unnecessary increase in the exposure of people, property and activities to climate risks.

Lack of sustainable economic alternatives fueling maladaptive ecosystem use practices: The baseline stressors listed above all share similar root causes. The Comorian economy is not diversified and there are high rates of unemployment, even among the educated young. The level of dependency on foreign remittances is at an all-time high, and it is expected that COVID 19 will have devastating consequences for the Comorian economy. However, some sectors of the economy have continuously shown signs of growth, in particular the construction and infrastructure sector which is partly fueled by foreign aid budgets, and partly by foreign Comorian citizens wishing to secure housing in country. This, combined with the high cost of imported construction material, contributes to fueling sand mining and coral mining and a rush for occupying land even in risky areas. On the other hand, the rural poor continue to practice slash and burn agriculture in the upper watersheds and in coastal areas in order to derive minimal food security. Even local production is insufficient to meet local food needs, however, and the high demand for food in turn drives the patterns of environmental degradation in the upland areas, and the unsustainable fisheries practices noted above.

⁸² <https://thinkhazard.org/en/report/58-comoros/CF>

⁸³ Kamardine Mohamed Sinane. The coasts of the Comoros, dynamics of an anthropized system: the case of the island of Anjouan. University of Reunion Island, 2013

Insufficient evidence-base to support resilient, sustainable development: Due to the weakness of public institutions and the lack of public funding for research and science, many normative and policy decisions are made on the basis of insufficient, inadequate or inaccurate data. For example, at the start of 2017, there was no comprehensive map of watersheds in the country (there are 3 watersheds maps in 2021); in terms of coastal observation, while it was possible to monitor salt levels in one well in Ngazidja in 2012, the experience has not been repeated. There is no recent data on the state of reefs or mangroves, and it is impossible to track uses (and misuses) of natural resources. AS a result of this lack of information, there are large gaps in the understanding of the coastal dynamics in all three islands, and local communities are unaware of the impacts of their actions on the environment – and as a result of this, on the long-term viability of their livelihoods.

The **solution** to this complex problem is to break the negative loop in which vulnerable people are adopting maladaptive practices that degrade ecosystems, erode the coastline, and increase the exposure of assets, infrastructure and activities, because of limited opportunities, poverty and low awareness. This will be done by acting along three main axes:

- Investing in the rehabilitation of natural coastal ecosystems so that they can continue to protect and provide for vulnerable communities;
- Actively reorienting livelihoods and economic activity towards resilient value chains, to replace deleterious practices; and,
- Improving local environmental governance to ensure proper consideration for coastal ecosystems and their protective and productive services and to enable sustainable socio-economic development pathways.

The project adopts an ecosystem-based adaptation (EbA) approach to tackle the multiple challenges posed by climate change. According to this approach, ecosystems will be restored to a state of health and resilience that will enable them to – under the right management – continue to provide productive, protective and regulating services. To ensure long-term viability and sustainability of this intervention, the project will work with local communities to strengthen local planning processes for resilience, and to actively remove non-climate pressures and barriers from the targeted ecosystems. Limiting anthropogenic pressures will partially offset the impacts of climate change as a destabilizing factor for coastal ecosystems and preserve their functionality in mitigating the risks of marine submersion of coastlines. In addition to these protective services, healthier coastal ecosystems will be restored to serve important provisioning functions: it is estimated that reefs alone produce 3,000 tons of reef fish per year; they represent a major asset for artisanal fishing, an important food and financial source that provides nearly 40% of animal protein to the population, the majority of whom live in a subsistence economy. A recent study undertaken by International Coral Reef Initiative showed that reef restoration should be conducted as a priority in countries where reefs are showing some level climate resilience already (as opposed to reefs that are significantly degraded), and Comoros appears to be one of those countries.

The preservation of these coastal ecosystems is a major strategic priority for the Union of the Comoros, which is seeking to make its still-preserved coastal sites a force of attraction for international tourism, which is currently very limited. The development of hotels and services based on ecotourism is therefore a key component of the Emerging Comoros 2030 Plan, and a cornerstone of the vision for a sustainable blue economy. A study conducted in 1998 estimated, for example, the economic value of coral reef tourism services in the Moheli National Park area alone at 1.3% of GDP, 15.2% of public investment and 10.7% of exports of goods and services.

The result of this project will be a reduction in vulnerability for the coastal zone through the combined action of healthy and resilient ecosystems and sustainable, climate-proof development pathways.

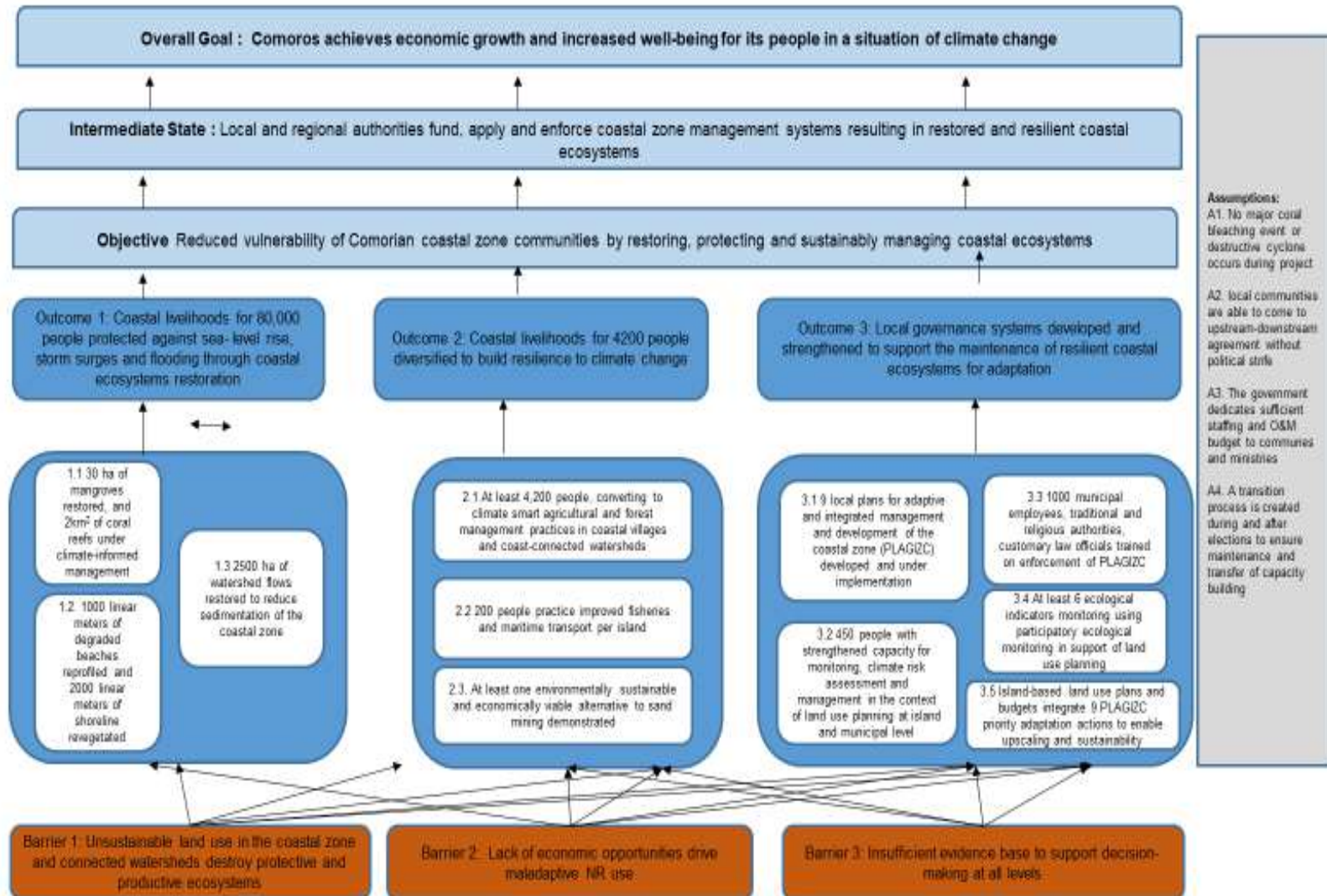
*The **theory of change** (Figure 4) of this proposed project* is premised on the fact that healthy coastal ecosystems can provide valuable protective, regulating and productive ecosystem services that can reinforce local climate resilience and reduce the vulnerability of communities (men and women) who rely on them. However, restoring and maintaining ecosystem health requires the reduction or removal of pressures that exacerbate ecosystem fragility and undermine their ability to recover from climate shocks. The overall **goal** of this project is the Comoros achieves economic growth and increased well-being for its people in a situation of climate change.

The **objective** of the project is to reduce the vulnerability of Comorian coastal zone communities by restoring, protecting and sustainably managing coastal ecosystems.

This will be achieved through a mix of interventions that will target identified vulnerable coastal ecosystems and the settlements that are directly dependent on them. To remove governance and management related barriers, the project will support enhanced planning and enforcement by working directly with communities and local authorities (ie at the village, commune and municipal levels) and leveraging the decentralization process that is underway in Comoros. The purpose of this approach is to reach beneficiaries directly and to involve those who are directly responsible for ecosystem management.

The project will be achieved through three interlinked outcomes with the first two focused on restoring the degraded ecosystems to a state of health and climate resilience through direct intervention as well as indirect action to remove human-induced pressures, thereby also addressing the barriers posed by unsustainable extraction and natural resource use in the coastal area. The third outcome seeks to create an enabling gender-sensitive environment for supportive land use planning, enforcement and management at municipal and communal levels, thereby lifting governance and policy barriers and also creating the stage for broader adoption and upscaling.

Figure 4: Theory of Change



Project / Programme Components and Financing:

Fill in the table presenting the relationships among project components, activities, expected concrete outputs, and the corresponding budgets. If necessary, please refer to the attached instructions for a detailed description of each term.

| Project/Programme Components | Expected Concrete Outputs | Expected Outcomes | Amount (US\$) |
|--|--|--|---------------|
| 1. Coastal ecosystems are restored and resilient | Output 1.1. 30 ha of mangroves restored, 2 km ² of coral reefs under climate-informed management Output 1.2. 1,000 meters of degraded beaches reprofiled and 2,000 meters of shoreline revegetated Output 1.3 2,500 ha of watersheds restored to reduce sedimentation flows to the coastal zone. | 1. Coastal livelihoods for 80,000 ⁸⁴ people protected against sea-level rise, storm surges and flooding through coastal ecosystems restoration. | 3,200,000 |
| 2. Local populations adopt sustainable economic of exploitation of coastal zone | Output 2.1 At least 4,200 people (at least 50% women) converting to climate smart agricultural and forest management practices in coastal villages and coast-connected watersheds Output 2.2 At least 200 people practice improved fisheries and maritime transport practices per island (at least 10% women) Output 2.3 At least one environmentally sustainable and economically viable alternative to sand mining demonstrated | 2. Coastal livelihoods for 4,200 people (at least 50% women) diversified to build resilience to climate change. | 3,200,000 |
| 3. Local governance systems support the maintenance of resilient coastal ecosystems | Output 3.1 Nine Municipal integrated, and adaptive coastal zone management plans (PLAGIZC) adopted and under implementation Output 3.2 450 people (at least 50% women) with strengthened capacity for monitoring, climate risk assessment and management in the context of land use planning at island and municipal level Output 3.3 1,000 municipal employees (at least 50% women), traditional and religious authorities, customary law officials, trained on enforcement of PLAGIZC Output 3.4 At least 6 local level participatory monitoring initiatives in support of land use planning and monitoring. Output 3.5 3 Island-based land use plans and budgets integrate 9 PLAGIZC priority adaptation actions to enable upscaling and sustainability | 3. Local governance systems developed and strengthened to support the maintenance of resilient coastal ecosystems for adaptation | 2,000,000 |
| 6. Project/Programme Execution cost | | | 798,000 |
| 7. Total Project/Programme Cost | | | 9,198,000 |
| 8. Project/Programme Cycle Management Fee charged by the Implementing Entity (if applicable) | | | 781,830 |
| Amount of Financing Requested | | | 9,979,830 |

⁸⁴ 38,800 men and 41,200 women

Projected Calendar:

Indicate the dates of the following milestones for the proposed project/programme

| Milestones | Expected Dates |
|---|-----------------------|
| Start of Project/Programme Implementation | January 2023 |
| Mid-term Review (if planned) | June 2026 |
| Project/Programme Closing | December 2028 |
| Terminal Evaluation | December 2028 |

PART II: PROJECT / PROGRAMME JUSTIFICATION

A. Describe the project / programme components, particularly focusing on the concrete adaptation activities of the project, and how these activities contribute to climate resilience. For the case of a programme, show how the combination of individual projects will contribute to the overall increase in resilience.

The project comprises of three interlinked Outcomes. Activities will be implemented in 3 sites on the island of Ngazidja, 2 sites on the island of Anjouan and 1 site on the island of Mohéli, comprising 14 municipalities or villages grouped in 9 Communes, which are themselves in 7 Prefectures. The total population in these areas is approximately 80,000 people (38,800 men and 41,200 women), who all stand to benefit directly from project interventions. (See Annex 1 for site description)

Outcome 1: Coastal livelihoods for 80,000⁸⁵ people protected against sea-level rise, storm surges and flooding through coastal ecosystems restoration.

This component seeks the implementation of urgent and necessary ecosystem-based adaptation measures that will reduce ecosystem and communities' vulnerability in the short and long term. Activities in this component will take place in the 6 selected priority sites listed above (Refer Annex 1) and will be implemented through a partnership with IUCN, under the supervision of Ministry of Environment, Agriculture and Fisheries. Activities under this outcome are supported by the activities under Component 2, aimed at reducing human pressures on vulnerable ecosystems and component 3, that aim at enabling better governance for ecosystem-based resilience and adaptation (e.g. Output 3.1). For example, priority ecosystem restoration activities will be co-designed with local communities and inscribed in local participatory development plans for adaptation and integrated management of the coastal zone (PLAGIZC) which will be supported under Component 3, and local communities and CSOs will also be invited to participate in ecological monitoring to support a feedback loop into planning and enforcement processes.

All interventions will be complementary with those programmed within the framework of other ongoing projects (e.g. Agence Française de Développement, Green Climate Fund, GEF / LDCF, African Development Bank and World Bank) and complement actions carried out by civil society organisations. Given the number of sites and the budget, investments will need to be carefully targeted. During the project document formulation GIS images and maps will be consulted to finetune vulnerability hotspots within the project sites. The outputs are as follows:

Output 1.1: 30 ha of mangroves restored, and 2 km² of coral reefs under sustainable, climate-informed management, that support both protective services against sea level rise, surges, swells and wave action, and productive services for fisheries reproduction and ecotourism.

According to the World Map of Mangroves, Comoros still has over 100 ha of mangroves, most of which are located on Moheli, whose restoration and sustainable management would bring tremendous long term value in terms of commercial fisheries⁸⁶ and flood control

⁸⁵ 38,800 men and 41,200 women

⁸⁶ <https://maps.oceanwealth.org/mangrove-restoration/>

or prevention⁸⁷. The sites of Orovéni, Mitsamiouli and Bimbini have mangroves protecting the coast, which need urgent restoration and management intervention lest they be destroyed, but other mangrove sites may also be explored during the project preparation phase. Mangrove restoration helps with protection against sea level rise, coastal erosion through wave action, storm swells and cyclones (Figure 5), in addition to providing avenues for fisheries to regenerate. Attempts had already been made to restore a mangrove in front of the village of Bimbini in order to limit the strength of the swell during storm events, but the lack of technical assistance and local consensus did not allow this operation to succeed. This project will draw upon the growing body of evidence and science on mangrove restoration, including that emerging from Coastal EBA projects in Tanzania, Djibouti and other neighbouring countries, such as those participating in the Mangroves for the Future Initiative (MFF), implemented by IUCN.

Figure 5 : Small scale mangrove restoration in Hamavouna, Moheli by LDCF Project



The purpose of improving reef management in the context of this project will be to enable the removal of climate and non-climate drivers of reef degradation that prevent reef resilience and hinder the delivery of reef ecosystem services⁸⁸. The project will first conduct a full scientific diagnostic of coral reefs and seagrass beds and threats within and outside protected areas. This will be used to determine restoration potential and to select the most locally appropriate reef and seagrass rehabilitation or restoration approach taking into account local capacity, cost effectiveness and the existing state of reef degradation. For example, if found feasible, the project will select and pilot small-scale restoration activities such as seagrass bed restoration and coral farming techniques and colony transplantation, natural or artificial substrates, or any other (no more than 1 site, 100m²). Training will be conducted for scientific organizations and CSOs who may take part in restoration and management. Further training of local institutions will be undertaken to enable them to engage with incoming funding opportunities such as the forthcoming GCF investments and the Global Fund for Coral Reefs, training for private sector and reef users on appropriate management, sustainable use and economic growth opportunities leveraging reefs.

Reef conservation and sustainable management will also be included in participatory integrated coastal adaptation management plans foreseen under this project (PLAGIZC⁸⁹) and other drivers of reef degradation such as land-based pollution, sedimentation, and unsustainable fisheries, will be addressed under Outcome 2. Impacts of various management practices on reef health will also be monitored under Outcome 3.

Indicative activities to be implemented under Output 1.1 will include:

- 1.1.1 Conduct a baseline study of all six project sites and diagnostic of coastal vegetation and of coral reefs and seagrass beds, and determine the most locally appropriate reef rehabilitation and sustainable management approaches.
- 1.1.2 Establish community-managed nurseries to produce

⁸⁷ This report lists Comoros as one of the 10 countries who would stand to benefit the most from mangrove restoration for flood risk reduction. <https://conservationgateway.org/ConservationPractices/Marine/crr/library/Documents/GlobalMangrovesRiskReductionSummaryReport10.7291/V9930RBC.pdf>

⁸⁸ Hein MY1,2, McLeod IM2, Shaver EC3, Vardi T4, Pioch S5, Boström M, Tharsson L2,6, Ahmed M7, Grimsditch G7(2020) Coral Reef Restoration as a strategy to improve ecosystem services – A guide to coral restoration methods. United Nations Environment Program, Nairobi, Kenya

⁸⁹ Plans locaux d'adaptation et de gestion intégrée de la zone côtière (PLAGIZC)

mangrove and upper watershed tree and agroforestry seedlings for reforestation.

- 1.1.3 Undertake feasibility study on small-scale reef and seagrass restoration and assessment of local capacities for piloting small-scale reef restoration.

Output 1.2: 1,000 linear meters of degraded beaches reprofiled and 2,000 linear meters of shoreline revegetated

A combination of interventions in the coastal terrestrial zone will be implemented to limit the phenomenon of sedimentary leakage and conserve or even reinforce the buffer role of existing beaches in project sites (notably the beaches of Outsoha to the north of Ouani and Mbachile in Grande Comore) and/or to limit the silting up of ports (in particular Mutsamudu).

The aim will be to limit the impact of sedimentary transfer, including waste, from upstream watercourses, and to promote the recharging of sites by reprofiling the current obstacles to coastal drift (coastal protection works, port facilities). Reprofiling involves moving sand (usually with mechanised machinery) that has piled up in some parts of the beach and equalizing, either bringing it back down towards the water line, or by reshaping the natural curves around obstacles such as wave breaks, rocky outcrops and piers. This creates a gentler profile in which the beach ensures an optimal protective gradient against wave action. The herbaceous foreshore vegetation plays a significant role in the preservation of the sand stock of Comoros' beaches, and its restoration combined with the reprofiling action, will create an effective buffer against wave and swell action. All reprofiling actions will be subject to extensive environmental impact assessments in their design and monitoring during and after implementation (linked to Output 3.4)

A creeping plant species, *Ipomoea-pes-caprae brasiliensis* (locally called "pumpu"), colonizing the backshore, helps dissipate the energy of the swell at the top of the foreshore and plays a role in stabilizing this part of the beach against waves and wind. Other, more recessed strata also play a similar role (high foreshore supra-littoral thicket, supra-littoral shrub belt). This vegetation is now fragmented due to anthropic pressures and the generalised retreat of the coastline. Efforts will be made to increase this vegetal cover to reduce the frequency of repeated beach maintenance. In places where it is possible to restore coastal vegetation by simple measures (installation of cranks, replanting etc.), interventions will also be envisaged. While it is recognized that beach reprofiling is an activity that requires periodical repetition, it remains the most cost-effective form of maintenance, and when combined with restoration of natural vegetation, it can provide effective protection against SLR and erosion.

Indicative activities to be implemented under Output 1.2 will include:

- 1.2.1 Undertake revegetation of 2,000 meters of shoreline using creeping plant species.
- 1.2.2 Undertake reprofiling of 1,000 meters of degraded beaches subject to environmental impact assessment findings and associated recommendations.

Output 1.3: 2,500 ha of watershed flows restored to reduce sedimentation of the coastal zone.

This will include watersheds that are known to have a direct impact on the health of the coastal and marine ecosystems targeted for rehabilitation. The purpose of this rehabilitation, which will be mainly conducted through assisted natural regeneration, the implementation of anti-erosive measures such as stone barriers, terracing and live fencing, as well as targeted reforestation, is to slow down sediment transfer and siltation through improved vegetative cover. These measures will build on from the approach applied by the Department of Environment and Forests executed GEF project in integrated watershed

management EbA project. This is particularly effective also to prevent downstream flooding during severe rainfall events, and will therefore serve the dual function of reducing flood risk in lower lying coastal settlements. The project will leverage the best practices demonstrated by the Integrated Watershed management EBA project in Comoros (GEF Project ID 5694) and will also leverage the mapping of watersheds conducted by the DGEF to target interventions.

In order to reduce pollution of coastal zones by domestic waste and effluents, the project will also implement a series of gender-sensitive awareness raising activities targeted towards the resident of watersheds. These will seek to build on community structures and associations, such as Ulangas, and women's groups, to strengthen waste collection and appropriate waste disposal. These efforts, targeted towards the general public, will also be paired with support for communes to institute their own waste management systems, such as plastic bag bans, household composting, and domestic waste collection systems. These processes, while nascent in Comoros, are of high interest to the national government and there are currently plans underway to explore public private-partnerships and climate finance towards the creation of waste-to-energy systems for each island.

Indicative activities to be implemented under Output 1.3 include:

1.3.1 Establish community-based watershed management committees and elaboration of watershed management plans.

1.3.2 Reforestation and watershed protection measures in 2,500 ha of watersheds.

1.3.3 Awareness raising and training of watershed residents to strengthen waste collection and appropriate waste disposal and waste management.

Table 1 provides a summary of interventions by site under Outcome 1. Refer to Annex 1 for a more detailed site-by-site description.

Table 1: Summary of interventions by project site include:

| Site name | Type of ecosystem-based adaptation intervention | Climate impacts addressed | Scope of expected benefits |
|--|---|--|---|
| <i>Bangoua Kouni, Ivoini, Mistamiouli (Ngazidja)</i> | <i>Mangroves management and reforestation, coral reef management or protection. Upper watershed anti-erosive measures and reforestation. Revegetation of road reserves, shorelines and adjacent areas</i> | <i>marine intrusion on roads sea level rise, flooding and coastal erosion extreme storm swells</i> | <i>12,000 inhabitants protected, 2 National Roads protected Fisheries and ecotourism potential</i> |
| <i>Malé, Orovéni, Chidini (Ngazidja)</i> | <i>Restoration of mangroves and reef management or protection Upper watershed anti-erosive measures and reforestation Revegetation of shores</i> | <i>Risk of submersion due to SLR, storm surges, increased coastal erosion</i> | <i>4,000 inhabitants protected Roads protected 1 informal harbour protected 1 national park protected fisheries restore</i> |
| <i>Iconi, Mbachile (Ngazidja)</i> | <i>Coral Reef management beach reprofiling (Mbachile) Upper watershed anti-erosive measures and reforestation</i> | <i>Marine submersion, flooding</i> | <i>9670 inhabitants Fisheries, secondary road, housing protected</i> |
| <i>Pajé, Mutsamudu-Mirontsi, Ouani (Anjouan)</i> | <i>Coral reef management and protection Beach reprofiling (Ouani) Upper watershed anti-erosive measures and reforestation Shoreline revegetation</i> | <i>Marine submersion, flooding, storm swells, 22</i> | <i>36,000 inhabitants Island airport, Harbour and national roads protected, marine</i> |

| | | | |
|-------------------------------------|--|---|---|
| <i>Bimbini (Anjouan)</i> | <i>Mangroves management and reforestation, coral reef management and protection Upper watershed anti-erosive measures and reforestation Beach reprofiling and revegetation</i> | <i>submersion and flooding, coastal retreat</i> | <i>2,000 inhabitants protected 1 protected area secured Ecotourism and fisheries potential restored</i> |
| <i>Fomboni-Djoiezi (Moheli)</i> | <i>Fringing reef protection/management Upper watershed anti-erosive measures and reforestation Mangrove restoration to be determined</i> | <i>storm swells, flooding, erosion and submersion</i> | <i>21,000 inhabitants fisheries restored, roads and airport protected</i> |

Outcome 2: Coastal livelihoods for 4,200 people (at least 50% women) diversified to build resilience to climate change

Component 2 is aimed at addressing inappropriate, maladapted and unsustainable natural resource use practices. The main purpose of the outcome is to ensure long-term viability of the ecosystem-based adaptation measures by providing alternatives to unsustainable practices. The result of the activities will be that communities adopt more sustainable modes of exploitation of coastal territories in and around the 6 sites. Activities under this component will directly contribute to, and be undertaken in conjunction with, activities under Outcome 1 and Outcome 3 (Output 3.1).

As noted earlier, there are a suite of unsustainable practices that create harmful conditions to the fragile ecosystems this project is seeking to restore. The project will work with local communities to develop suitable, resilient and economically viable alternatives to unsustainable practices. This output will build on the various investments in and around project sites focusing on climate smart agriculture, rural finance, private sector development and infrastructure building that are currently ongoing. The project will pay particular attention to providing opportunities for youth and women as two groups who are particularly susceptible to economic disenfranchisement and will take a business-oriented approach to ensure sustainability of all interventions. The outputs are as follows:

Output 2.1: 4,200 people (at least 50% women), converting to climate smart agricultural and forest management practices in coastal villages and coast-connected watersheds.

This output will serve as a support to the rehabilitation and sustainable management of upper watersheds with coastal connection in the 6 sites. The farmers and households who are exploiting the watershed will be trained in the gender-sensitive application of climate smart agriculture and forest management practices. This will include gender-sensitive capacity building on the non-erosive land management practices (upscaling the lessons of the GEF-Integrated Watershed management EBA project), installation of natural anti-erosion and anti-flooding barriers, and agroforestry practices to maintain soil cover. This will help reduce sediment transfer to lower parts of the watershed. To further reduce pressure on sloped farmland while increasing food availability, the project will reintroduce the practice of household gardening and vegetable production at village level in lower lying areas, with a particular focus on vulnerable groups such as women, elderly or persons living with disabilities. This will be conducted in coordination and with cooperation from local authorities in all communes and villages and will build on results and methods implemented in other projects such as the GCF Water Adaptation project.

In addition, the project will explore the development potential of "biosaline" agriculture in

coastal areas, based on the cultivation of halophytic plants and their integration into food systems, notably as fodder plants for livestock breeding or organic fertiliser for crops. International actors such as the International Centre for Biosaline Agriculture (ICBA) are promoting the implementation of integrated agricultural models based on the cultivation of halophytic plants in coastal areas, in order to adapt coastal agriculture to the salinisation of aquifers and rising sea levels. ICBA is currently conducting a four year project (RESADE, "Improving agricultural REsilience to SALinity through Development and promotion of pro-poor technologies and management strategies in selected countries of sub-Saharan Africa" 2019-2022) funded by IFAD that supports the introduction of crop varieties that are tolerant to high salinity levels in the coastal regions of seven sub-Saharan African countries. The results of this project could help inform selection of salt-resilient plant species for the Comores. Moreover, the presence of halophyte plants on the sandy barrier beach often has an interesting anti-erosion effect, which could add to the economic benefit of developing a previously unused area. Among the species already present on the shores of the Indian Ocean, *Atriplex Halimus* or *Scaevola Taccada* could prove to be potential candidates. The project, on the basis of feedback from projects developing biosaline farming practices, common in certain arid regions of the Middle East and Central Asia, will therefore assess the opportunity for experimentation and, if necessary, provide support on the model detailed above for the development of a halophyte cultivation chain in the Comoros.

Other options for sustainable coastal agriculture that will be explored include:

- Saliculture: first experiments have been carried out on individual initiative in Bambao and on the islet of La Selle. Today, the Comoros imports almost all its salt, while the 350 km of coastline and climate are largely conducive to the development of local salt production sector.
- Aquaculture: No aquaculture activity exists today in Comoros. Apart from the cultivation of shellfish and other seafood products in the coastal zone, the cultivation of seaweed, developed in many countries in this region of the Indian Ocean, could also be experimented.

To monitor the impacts of these activities and feed into public education, communities in both upstream and downstream localities will be engaged in participatory ecological monitoring (Outcome 3), with support from the NGOs engaged in other EbA projects such as the ones financed by the CEPF and AFD/GCF.

Indicative activities to be implemented under Output 2.1. will include"

2.1.1 Train local communities and watershed committees in agroforestry and climate-resilient smart agriculture and in coastal climate-smart agriculture.

2.1.2 Provide agriculture inputs to support adoption of climate-smart agriculture.

Output 2.2: 200 people (at least 10% women) practice improved fisheries and maritime transport per island

In order to remove the pressures on reefs and mangroves, the project will work with local fishing communities to support fishing practices that are not destructive and that allow sufficient time for ecosystems and fish species to recover. A first objective will be to take fishing away from reefs (including foot fishing) and mangroves as much as possible, by diversifying fish species catch, training and the provision of suitable fishing materials such as, fishing concentration devices, appropriate nets that limit catches to fish of a certain size, embarkations to limit foot fishing, and processing or conservation equipment. This will be accompanied by training and awareness raising, and efforts will be made to ensure that all persons currently practicing unsustainable fishing have a decent economically viable alternative.

The project will also support training and awareness raising for maritime transporters and fishermen on suitable mooring and anchoring practices, and where necessary will provide equipment that will enable safer navigation away from fragile ecosystems. This will also include working with the Directorates responsible for maritime transport and the National Meteorology Agency (ANACM) to update navigation maps.

Indicative activities to be implemented under Output 2.2 will include:

2.2.1 Train 200 people in sustainable fisheries and reef management practices that reduce pressure on reef resources and damage to reefs.

2.2.2 Provide small scale fishing materials that support sustainable fisheries and reef management (e.g. fishing nets, embarkations and fish processing and preservation equipment).

2.2.3 Raise awareness and training for maritime transporters and fisherman on best practices for suitable mooring, beach morning and safer navigation away from fragile coastal ecosystems.

Output 2.3: At least one environmentally sustainable and economically viable alternative to sand mining demonstrated. This output would leverage private sector oriented approaches to develop alternatives to sand mining in coastal areas. An alternative to sand in concrete, the crushing of volcanic rock is already practiced in various parts of the territory, in particular on Ngazidja, but its use is far from being generalized, and the levers that could lead to widespread use need to be better identified. Several promising avenues for the use of other mineral resources are also regularly mentioned in the grey literature of development projects but have not been the subject of in-depth studies, notably pozzolanic rocks, which are abundant in the island, and clays.

A 2001 study carried out by a French research organization (BRGM, Bureau de Recherches Géologiques et Minières) drew up an initial inventory of the natural resources available for construction, but limited itself to suggesting a few lines of research that have not been explored since then. Lessons should also be drawn from the UN Habitat project initiated in 2006, which advocated the use of clay bricks for construction, but which did not result in wider replication and scale-up. The project will therefore support a thorough research and feasibility assessment to examine the potential of different construction techniques using alternative materials, taking into account the geology, technology, regulatory framework and market potential as well as socio-economic and environmental considerations. An evaluation of the suitability, perception and economic performance of alternative materials will be carried out, in order to assess the main risk factors relating to the social acceptability of alternative techniques. On this basis, a strategy to stimulate demand will be developed in collaboration with the Bureau of Geology and other relevant stakeholders (role of public procurement in certain sectors; differentiated promotion of materials according to the islands; tax incentives etc.).

The project will identify one or more programmed construction initiatives for which funding is already secured. This could be a public or a private building, for example those being reconstructed with WB support through the post-Kenneth Recovery project, a Mosque, or any other initiative. In order to increase the 'demonstration' effect, it will be necessary that the use of alternative construction techniques is focused on buildings of high symbolic value, decided and/or financed directly by the communities, and erected close to sites where resilient economic activities (3.1.2) have been established as an alternative livelihood to beach sand extraction. The project will cover the additional costs incurred by the use of innovative materials, additional engineering or architectural designs and tests required, additional training for craftsmen and the communication and promotional expense needed to ensure the visibility of the initiative.

In addition, a technical training program for enterprises and workers in the construction sector (material extraction and production, private contractors in construction and public works) and a capacity building programme for the island's main public contracting authorities and their partners will be deployed, in order to strengthen their understanding of the issues related to the exploitation of natural resources, and of the opportunities for the development of the sector. The project will also work with the Ministry of public works, MAPE and other relevant government agencies to support the development of regulations limiting the use of sand in construction material.

Indicative activities to be implemented under Output 2.3 will include:

2.3.1 Feasibility assessment of potential alternative construction techniques using alternative materials to sea sand, taking into account the geology, technology, regulatory framework and market potential as well as socio-economic and environmental considerations. It will also include an evaluation of the suitability, perception and economic performance of alternative materials will be carried out, in order to assess the main risk factors relating to the social acceptability of alternative techniques.

2.3.2 A pilot demonstration project will be established in partnership with a local authority and private sector entity to demonstrate the use of alternative construction approaches and materials other than sea sand.

2.3.3 A strategy will be elaborated with key stakeholders on stimulating demand for, and supply of, alternative construction materials.

2.3.4 A technical training programme for enterprises and workers in the construction to strengthen their understanding of unsustainable sand extraction and opportunities for alternatives and development of the construction sector.

Outcome 3 - Local governance systems developed and strengthened to support the maintenance of resilient coastal ecosystems for adaptation

A lasting change in governance systems is necessary if ecosystems are to be managed in a way that maximizes their value in terms of resilience and sustainable modes of exploitation and management are going to be adopted and replicated. However, as noted earlier, there are currently significant gaps in the coastal management governance systems in Comoros, notably the absence of coastal land use plans at any level, and gaps or inconsistencies in the legal and regulatory apparatus and enforcement capacity governing natural resource use and urbanization in coastal areas. The project will therefore work with authorities at national, regional and communal levels to address these gaps, using a bottom up approach. This will be achieved through introduction of integrated and adaptive coastal zone management planning at municipal (commune) level, and the strengthening of institutional, regulatory and technical capacity for management and enforcement of coastal management. Efforts to plan adaptation and integrate climate change adaptation issues into sectoral policies have so far been undertaken mainly at the national level of public decision-making (e.g. ANCAR I and II project). The governorate (island level), the prefecture (grouping of communes/municipalities) and the municipality or *commune* (grouping of several villages) are, however, equally relevant levels of public action and, closer to the population, for strengthening the territory's adaptation to climate change. However, vertical devolution is a relatively recent phenomenon in the Comoros and this project will support efforts to consolidate these local institutions and strengthen national research and training institutions to deliver training on improved governance systems. For instance, drawing on and supporting the National Documentation and Scientific Research Center, National Research Institute on Agriculture, Fisheries, and Environment, and the University of the Comoros

The project "Capacity building for multisectoral, coordinated and decentralized

environmental management to achieve the objectives of the Rio Conventions in the Union of Comoros", co-financed by the Comorian Government, the Global Environment Facility and the UNDP, is currently setting up consultation mechanisms at the national and island levels, in order to achieve better representation of all stakeholders and thus greater legitimacy of the decisions adopted. Similarly, the project "Building Climate Resilience through Rehabilitated Watersheds, Forests and Adaptive Livelihoods (GEFID 5694)" executed by the Ministry of Agriculture, Fisheries, Environment, Tourism and Handicrafts and implemented by UNEP, has established community watershed coordination committees that have elaborated fifteen management plans that are currently being implemented using reforestation and agro-forestry measures (See figure 1 and 2). Although the fifteen watersheds are located outside the proposed project's 6 sites, the process and consultation mechanism modalities applied by the present GEF/ LDCF project serves as an example of good practice which the proposed AF project will be able to draw on.

Output 3.1: 450 people (at least 50% women) with strengthened capacity for monitoring, climate risk assessment and management in the context of land use planning at island and municipal level

The proposed AF project will support the creation of evidence based and participatory coordination and decision-making frameworks for adaptive and integrated co-management of the coastal zone. This will require strengthening the capacity of all local stakeholders, through stronger information, decision-making tools, and governance mechanisms.

The project will carry out gender-sensitive risk and vulnerability assessments in each project site in order to pinpoint the areas of high vulnerability of populations and their livelihoods, assets and economic activities to climate risk. The assessments will be informed by the use of the high definition aerial photography library taken as part of the Global Climate Change Alliance (GCCA) project which will enable the cross-referencing of altimetry and building distribution data in order to identify the fine-scale exposure of coastal zone populations and activities in the short (2030), medium (2050) and long term (2100). Demographic projections and analysis of available land resources will also be carried out to identify coastal conurbations likely to experience population growth in areas at risk of major flooding.

Based on these data, participatory and gender-sensitive risk and vulnerability assessments will be conducted with local communities and key stakeholders. These community level risk and vulnerability assessments will identify, at a precise scale (of the order of the municipality and adjacent areas), the built-up and buildable areas and agricultural areas on the coastal zone with a high climate risk by 2030, 2050 and 2100, according to parameters linked to emission scenarios, the state of conservation of coastal ecosystems and the pressures related to the use and extraction of natural resources, including of sand resources. These risks and vulnerability assessments will be produced using a basic, easy-to-use mapping tool that can be later updated with new data, which will enable the production of cartographic syntheses of the risks which will be used during information and awareness raising campaigns for the general public. The risk and vulnerability assessments will identify adaptation measures and options for application under Outcomes 1 and 2.

Furthermore, the project will work with each of the three island-level environment directorates (*Directions Regionales de l'Environnement*) of the Ministry of Agriculture, Fisheries, Environment, Tourism and Handicrafts and national research institutions (e.g. National Documentation and Scientific Research Center; National Research Institute on Agriculture, Fisheries, and Environment; and University of the Comoros) to: 1) train up to

450 people in climate risk and vulnerability assessments and adaptation planning and monitoring; 2) collate information on adaptation planning tools (including decision support tools), and best practices on adaptation measures; 3) analyze and enforce national policies, law and regulations concerning coastal zone management; and 4) prepare and then annually update coastal monitoring systems at the level of the Prefecture including:

- An inventory of the most pressing, locally-relevant issues, challenges and opportunities for the integrated implementation of the orientations of the National Adaptation Plan, the SNGIZC (National Strategy for Integrated Coastal Zone Management) and the PCE 2030/PDI (Plan Comores Emergent / Plan de Développement Intermédiaire)
- An inventory and mapping of current and programmed programmes and projects, as well as any other expected changes likely to reduce or increase the vulnerability of the areas (including private and community projects).
- A SWOT-like analysis of the assets, needs unaddressed and the risks of failure to achieve the locally-relevant objectives of national plans, policies and regulations.

Indicative activities to be implemented under Output 3.1 will include:

3.1.1 Conduct participatory and gender-sensitive risk and vulnerability assessments with local communities and key stakeholders to identify the built-up and buildable areas and agricultural areas on the coastal zone with a high climate risk by 2030, 2050 and 2100.

3.1.2 Identify adaptation options to respond to the climate risks and vulnerabilities to inform actions under Outcomes 1 and 2.

3.1.3 Engage with three island-level environment directorates (Directions Regionales de l'Environnement) of the Ministry of Agriculture, Fisheries, Environment, Tourism and Handicrafts and national research institutions to: 1) train up to 450 people (at least 50% women) in climate risk and vulnerability assessments and adaptation planning and monitoring; 2) collate information on adaptation planning tools (including decision support tools), and best practices on adaptation measures; 3) analyze and enforce national policies, law and regulations concerning coastal zone management; and 4) prepare and then annually update coastal monitoring systems at the level of the Prefecture.

Output 3.2: 9 local plans for adaptive and integrated management and development of the coastal zone (PLAGIZC) developed and under implementation

On the basis of evidence and scientific findings emerging from Output 3.1, the proposed AF project will support the creation of local coordination and decision-making mechanisms for adaptive and integrated co-management of the coastal zone, in order to contribute to the effective development and implementation of local plans for adaptive and integrated management and development of the coastal zone within the context of existing and forthcoming national and Prefecture level development and adaptation plans. It will strengthen the last link in the chain of national efforts to integrate stakeholders into public decision-making, ensuring both vertical (between scales of action, from the national to the municipal/commune level) and horizontal (multi-sectoral, allowing the interests and concerns of different types of stakeholders, issues and sectors of activity to be taken into account) integration.

The participants in these gender-sensitive coordination mechanisms will be the primary targets of information, awareness-raising and capacity building actions. During the five-year project period, a minimum of 2 coordination meetings per year per Commune (9 Communes across 6 sites) will be held to continuously inform governance. The coordination meetings will be inclusive, and attention will be paid to ensure active participation of CSO partners who are supported through other ongoing EBA projects (e.g. AFD, GCF and GEF). The first meeting will validate procedures and objectives of the coordination mechanism. The coordination meetings will also serve as a vehicle by which

to strengthen the population's awareness, understanding and ownership of adaptation issues and to integrate these considerations more fully into local decision-making.

With the support of these mechanisms and groups, and through the facilitation of island-level Environment directorates, a local participatory plan for integrated and adaptive coastal zone management and development (PLAGIZC) will be developed in each Commune. The gender-sensitive plans will build on from the climate risks and vulnerability assessments (Output 3.1) and fill the gaps left by the National Strategy for Integrated Coastal Zone Management (2010) and the National Adaptation Plan of Action (NAPA, 2006) in terms of area specific adaptation measures, and will serve as a mechanism to inform and implement the forthcoming National Adaptation Plan (NAP, 2022). The PLAGIZC will therefore provide a framework for coherent and coordinated approach to local planning and implementing effective and cost-efficient adaptation measures in the coastal zone.

These plans will include:

- Findings and recommendations from available downscaled scenarios and the climate change risk and vulnerability assessment for the prefecture and commune.
- An overview of actions already planned and their expected impacts, and of remaining needs and gaps to be addressed
- An analysis of major barriers to resilient livelihoods, and adaptation, including non-climate threats such as waste mismanagement and unsustainable extractive uses, along with options to mitigate or abate them.
- An assessment of the funds and means of implementation to be mobilized, which will include public sector, private and community funds, expected subsidies, resources under component 2 of this proposed project for the 6 project sites, future international climate funding, and resources mobilized by partners such as CSOs through other ongoing EBA activities.

The monitoring and enforcement of the plans will be ensured by Island level Environment Directorates in close collaboration with Planning directorates and authorities at commune and island levels, using participatory processes under outputs 3.3 and 3.4 below. The Island level Environment Directorates will also be supported by drawing on the technical capacities of national research institutions (e.g. National Documentation and Scientific Research Center; National Research Institute on Agriculture, Fisheries, and Environment; and University of the Comoros)

Indicative activities to be implemented under Output 3.2 will include:

3.2.1 Establish gender-sensitive commune level multi-stakeholder coordination and decision-making mechanisms in 9 communes (9 communes in six project sites) and hold 2 meetings per year per commune during the project duration.

3.2.2 Gender-sensitive awareness raising and training of members on multi-stakeholder coordination and decision-making mechanisms on adaptive and integrated management and development of coastal zone.

3.2.3 Elaborate 9 participatory and gender-sensitive plans for integrated and adaptive coastal zone management and development (PLAGIZC).

Output 3.3: 1,000 municipal employees (at least 50% women), traditional and religious authorities, customary law officials, trained on enforcement of PLAGIZC

In order to create lasting conditions for coastal resilience, local stakeholders must be empowered to enforce agreed policies and plans. On the basis of the PLAGIZC developed under Output 3.2, the project will support efforts to build local public and civil society capacity to manage, enforce and monitor coastal zone management plans. This will be achieved through the following:

Local public officials, including sectoral officers (at least 50% women) at island-level directorates, and officials from Prefecture, Commune and Municipality administrations will benefit from a continuous capacity building programme supported by the project and delivered by service providers (e.g. national research institutions) on:⁹⁰

- Monitoring and evaluation of the adaptation of a coastal territory to climate change (indicators, data collection, monitoring methodology)
- Key principles of integrated and adaptive coastal zone management
- Advanced notions of Comorian environmental law
- Use of the decision support tools and mapping tools created by the project (Output 3.1)
- Techniques for facilitating and mediating territorial consultation processes
- Implementation and monitoring of adaptation projects, in particular ecosystem-based adaptation projects, both on a technical and general project management perspective.

The island-level planning directorates (*Directions Régionales de l'Aménagement*) will verify the compliance with the gender-sensitive regulations and policies set out in the island-level land-use plans. They will be provided with capacity building support and material resources to enable them to carry out field missions to obtain information, undertaking monitoring and reporting on non-compliance with the regulations set within the framework of the island-level regulation. They will work in close collaboration with the local authorities in charge of implementing these schemes. In particular, they will ensure compliance with regulatory procedures, and notably the implementation of impact assessments required by the law before any development on the coastal zone that could have a negative impact on ecosystems and communities.

They will draw up an annual report to be sent jointly to the Ministry of Agriculture, Fisheries and the Environment and the Ministry of Land Use Planning in order to report on their actions and to point out areas where significant shortcomings are found.

Indicative activities to be implemented under Output 3.3 will include:

3.3.1 Elaborate a capacity building programme to manage, enforce and monitor coastal zone management plans (PLAGIZC) and deliver six monthly training programmes for the local public officials.

3.3.2 Capacity building support and provision of material resources for island-level planning directorates of the Ministry of Land Use Planning and the Ministry of Agriculture, Fisheries and Environment on monitoring compliance with regulations and policies set out in the island-level land-use plans.

Output 3.4: At least 6 local level participatory monitoring initiatives in support of adaptative land use planning

In further support to the enforcement capacity of communal and prefecture authorities, and to feed into the PLAGIZC as well as to increase awareness among coastal communities, the project will partner with local environmental NGOs and national research institutions to support the deployment of a participatory ecological, social and economic monitoring initiative. This participatory monitoring could be coupled with eco-tourism and nature-based leisure activities to enlist participation from youth, students or schoolchildren, and could rely on a network of volunteer observers, as well as observation from administrations. The purpose of this monitoring would be to detect the changes in status of coastal zone

⁹⁰ Both at individual level (tools, techniques etc.) and organisational level (managerial and functional capacities).

resources (e.g. vegetation, erosion, biodiversity) but also to enlist direct observation of the socio-economic costs and benefits of adaptation measures implemented.

Monitoring will be undertaken on the basis of a set of indicators and processes to which both Regional Environment Directorates, the local communities and national research institutions will contribute. Indicators will include:

- Evidence of sea level rise or coastal erosion
- Extent of vegetative cover, encroachment,
- Extent of sand mining or beach degradation
- Presence of waste and water quality
- Fisheries productivity
- Presence of certain species (plants, birds, fish)
- Information from the various economic activities taking place in the coastal zone, including those supported by the project (e.g. estimate of women and men engagement (hours), yields, catches, income).

Indicative activities to be implemented under Output 3.4 will include:

3.4.1 Elaborate a local level participatory monitoring programme for adaptive and integrated management and development of the coastal zone (PLAGIZC) in close collaboration with local communities, civil society institutions and national research institutions, and train local level stakeholders in its application.

3.4.2 Regular (e.g. six monthly) periodic monitoring of, and reporting on, PLAGIZC implementation and changes resulting from adaptation measures and benefits received by local communities (gender disaggregated).

Output 3.5: 3 Island-based land use plans and budgets integrate 9 PLAGIZC priority adaptation actions to enable upscaling and sustainability

In order to set the stage for broader adoption of project lessons learned, and results, the project will engage with policy makers at all levels (commune, prefecture, island and Union officials) to develop a solid set of gender-sensitive arguments for the upscaling of activities. In particular, the project will conduct gender-sensitive awareness raising and training for policy makers to enable stronger enforcement of laws and regulations, as well as the development of the “economic case” for ecosystem-based adaptation and sustainable management. This will serve the dual purpose of demonstrating direct economic benefits to Comoros (both in terms of gains and averted losses) and to make the case for integrating ecosystem-based adaptation priorities contained in the 9 PLAGIZC into each of the island land use plans and budgets. This will enable upscaling and sustainability of coastal adaptation measures into island development and land use plans and budgets led by the Island Regional Planning Directorates.

A key condition for the sustained success of the various activities in this project is an increased awareness and level of public understanding of the value of coastal ecosystems to island resilience and the need to act urgently to redress their degradation. The project will therefore support an extensive campaign of awareness raising on each of its activities and outputs targeted to various gender-sensitive audiences.

In the project sites, the inhabitants whose livelihoods depend on the natural resources of the coastal area (e.g. artisanal fishers, “on foot” fishers, i.e. fishers practicing sea-food harvesting on the beach, sand extractors, coastal farmers, maritime transporters, and eco-tourism actors) will benefit from information on the impacts and risks of climate change and adaptation solutions that could be assimilated in the conduct of their livelihood activities.

Specific awareness campaigns and public education activities will also be organized for the duration of the project to enlist and maintain gender-balanced public participation in the elaboration of participatory coastal zone land use plans (PLAGIZC, output 3.2) and towards sustaining the project outcomes. The project will draw on the expertise from national research and training institutions to provide trainers and communicators to support awareness campaigns.

Upstream, communities will be sensitized to the impacts of their use of natural resources on downstream ecosystems and communities. This will also include a suite of gender-sensitive messages targeted towards pollution control, plastic waste reduction, and wastewater management. On the coast, areas that will be identified as particularly at risk of submersion or flooding under Output 3.1 will be identified by public notices and pictorial panels, to discourage settlement. Key messaging will be developed for communicating legal frameworks to local populations, including zones where construction is barred by law and any other illegal uses (e.g. sand mining).

The project, in collaboration with national research institutions, will also work with local authorities and traditional leadership (muftis, cadis, women groups, etc.), including religious leaders, through a gender-sensitive "training of trainers" programme, with regular sessions and close support to enable them to respond to the questions of their audience and to relay the awareness raising messages. The experience, resources and networks of the "Faith For Earth" programme coordinated by UNEP will be used to raise awareness of religious leaders on environmental and climate issues. One of the objectives will also be to identify opportunities for the implementation of the alternative construction demonstration programme, as religious buildings and Koranic schools are examples of buildings that benefit most from community-funded construction programmes. This Output will also support the activities under this Outcome designed to build capacity of communal administration and elected leaders to effectively plan, implement and monitor sustainable integrated coastal management plans.

The project will build on the sensitised local authorities and traditional leadership, and expertise of national research institutions, to promote island-based and national gender-sensitive amendments to policies and regulations to incorporate adaptation priorities contained in the PLAGIZC into local development planning and budgeting processes. These changes to local and national policies and regulations will contribute towards sustaining the project adaptation outcomes.

Indicative activities to be implemented under Output 3.5 will include:

3.5.1 Gender-sensitive awareness programme designed and implemented during duration of the project targeting gender-sensitive audiences and target groups. Production and dissemination of audio-visual products via public television and radio, of printed materials and via community-based communication road shows.

3.5.2 Design and implement a gender-sensitive "Training of Trainers" programme, in close collaboration with national research institutions, with six monthly sessions targeting local authorities and tradition leaders.

3.5.3 Hold information sessions with local authorities to present PLAGIZC and sharing of monitoring reports to promote the integration of key PLAGIZC land use priority actions into local development plans and budgets and regulations.

3.5.4 Prepare amendments to local and national policies and regulations to strengthen the integration of coastal zone adaptation measures and strategies into local development processes.

B. Describe how the project / programme provides economic, social and environmental benefits, with particular reference to the most vulnerable communities, and vulnerable groups within communities, including gender considerations. Describe how the project / programme will avoid or mitigate negative impacts, in compliance with the Environmental and Social Policy and Gender Policy of the Adaptation Fund.

Economic, Social and Environmental benefits

This project will create a large array of environmental benefits, starting with the renewal of coastal ecological services (beaches, shorelines, mangroves, reefs, seagrasses, and fisheries), improvements in watershed management and soil/forest cover, improvements in coastal and marine biodiversity, and reductions in flooding and erosion. These and other ecological services will be carefully monitored through output 3.4.

In terms of socio-economic benefits, the project will generate direct benefits in terms of food security for the coastal zone inhabitants from interventions focusing on sustainable fisheries, reef and mangrove restoration, as well as those focusing on improved watershed management (through agroforestry and other sustainable land use approaches). An estimated 4,400 people will benefit directly from such food production benefits, with indirect impacts on household food security and income for an estimated 88,000 people.

It is also expected that the project would lead to enterprise and job creation in various sustainable value chains, including potentially sustainable construction methods/material extraction, alternative livelihoods and the engagement of private sector.

Gender

Gender issues in Comoros are complex and closely tied to socioeconomic class. Although the Comorian society is matrilineal and women traditionally inherit land and houses, they do not always have usufruct rights, and decision over the use of the land, capital and resources tend to be taken by their husbands or close male relatives.

Women are generally less educated (70% against 90% rate of primary school completion), more often jobless (twice than men) and considerably less represented in politics and in the civil service. Ensuring a gender-balanced representation into the local stakeholders coordination mechanisms will be a key objective and a challenge, which needs to be tackled not only to advance the fair participation of women to decisions in the country but also because many coastal economic activities rely heavily on female labor.

Women in the coastal zone often tend to have less sustainable and more vulnerable livelihoods than men. They fish on foot (while men tend to fish with nets at sea), which is physically harder and often detrimental to the fringing reef ecosystem. They are also over-represented in such activities as sand extraction (an estimate by Dr Kamardine Sinane put the rate at two-thirds of women), responsible for coastal erosion. This high percentage of women in sand extraction is indicative both of women's vulnerability to poverty and of their economic role in households in difficulty, in an economy where female salaried jobs are very rare. This very strenuous and unprofitable activity is never chosen, but is due to the lack of alternatives for poor women inhabiting in the coastal zone of the Comoros.

Some of the economic practices that need to be transformed to ensure better adaptation of the coastal zone to climate change are therefore undertaken by women with no other choice, attempting to bring a modest additional income to their economically vulnerable households. This reality will need to be taken into account when designing the project during project document formulation, and during its implementation. Women cooperatives and associations promoting the economic role of women in society will therefore play a central role in the design of the support program offered to promote alternative economic activities. The project will specifically ensure that value chains that benefit women are

supported, and that women are recipients of trainings, and included in pilots that promote resilient approaches and planning. Indicators from the project will be disaggregated by gender. During the project preparation, a gender gap analysis to determine the main climate change vulnerabilities relating to men and women and the main solutions that will benefit both men and women. The gender gap analysis will also analyse the role of women are part of decision-making processes at all levels. The gender gap analysis will specifically look to answer the following questions: 1) Who does what? When? Where?; 2) Who has what or has access to what?; 3) Who decides and how?; and 4) Who gains? Who might lose (even if unintended)? The aim of the analysis will be to inform the development of specific outputs, indicators and activities with budget allocations in support of women and other vulnerable groups with focused results that contribute towards effective adaptation.

C. Describe or provide an analysis of the cost-effectiveness of the proposed project / programme.

Various options were analyzed and compared during the development of this concept, in order to select the interventions that offered the most promise in terms of efficiency and effectiveness. Under outcome 1, options for reef and sea grass restoration were discussed and tested against feasibility and cost criteria. Because of high costs and low results potential, it was agreed that the project would test various low-cost methods for reef restoration and would also focus on those reefs and seagrass beds that show the most promise for resilience. This effort will also be made in collaboration with the Global Fund for Coral Reefs currently being set up and which received GCF equity investment of USD 125 Million in October 2021, which is proposing to undertake direct investment into the removal of stressors on reefs in Comoros and other countries. Similarly, a rapid feasibility assessment was undertaken for mangrove rehabilitation and a conservative target was adopted, that can be upscaled once the best approaches have been found, and once the benefits have been demonstrated locally.

Some activities, although rating lower on the cost-effectiveness scale, were maintained in the project, as they appeared necessary in order to enable higher-order results. This is the case for the reprofiling of beaches, which prevents the use of beaches to their intended ecological and cultural purposes, and whose current state of degradation prevents the integrated coastal management that is required to adapt to climate change.

Finally, some activities that were initially suggested were repurposed for cost-effectiveness reasons, including for example the work on sustainable alternatives to coral and sand mining. Whereas the original intention was to support the full development of value chains in this sector, the lack of able private sector partners, the low level of technical capacity and the type of financing instrument required prevented the inclusion of these activities in the project. Instead, the project will focus on establishing the technical feasibility, demonstrating the viability of such approaches, and setting the stage for future private sector participation at a larger scale.

A full cost-effectiveness analysis will be provided at full proposal stage.

D. Describe how the project / programme is consistent with national or sub-national sustainable development strategies, including, where appropriate, national adaptation plan (NAP), national or sub-national development plans, poverty reduction strategies, national communications, or national adaptation programs of action, or other relevant instruments, where they exist.

The following table highlights the consistency of the proposed project with national priorities listed in 5 key national sustainable development strategies :

Annex 5 to OPG Amended in October 2017

| Name of the Plan | Coherence between the objectives | Shared priority climate change impacts addressed | Shared priority zones of interventions | Actions called for by the strategy, consistent with the proposed AF project - Governance and capacity building | Actions called for by the strategy, consistent with the proposed AF project |
|--|--|---|---|---|--|
| National Adaptation Plan of Action (NAPA) (2006) | The project will contribute to achieve the overall objective of the NAPA: Reduce the adverse effects of climate change on the livelihoods of the most vulnerable populations and areas and thereby increase their resilience to climate change and variability. | Increase in marine temperature, sea-level rise, coastal erosion, threats to coastal ecosystem, cyclones | Coastal zone identified as the most vulnerable part of the Comoros "Most of the major cities and towns, road, port and airport infrastructures, tourist facilities, oil tanks, power plants, and historical monuments located near the sea will be threatened with extinction". | Efforts to mainstream adaptation issues into all sectors, through a cross-sectoral, multi-stakeholders coordination mechanism | Promotion of sustainable fishing practices ; promotion of alternative materials for construction |
| Plan National Gestion Intègre de la Zone Côtière (GIZC) (2010) | The project will contribute to achieve the overall objective of the national integrated coastal zone management (ICZM) plan : "Support the development of effective interventions that will reduce or eliminate damage and degradation of coastal zones and promote the protection of this fragile environment, socio-economic development and institutional | Threats to coastal ecosystems ; coastal erosion | No priority zones defined | Establish the mapping of degraded coastlines; Elaborate and implement an anti-erosion development plan ; Reinvigorate the validation and monitoring structure for impact studies ; Complementing existing legislation and improving its dissemination; Formalize through legal instruments (agreements, charters, conventions, etc.) the involvement of local communities in ICZM | Reinforce the capacities of the actors in terms of enhancement of the tourist sites. |

Annex 5 to OPG Amended in October 2017

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| | development of the country." | | | actions. Create an environmental police force ; | |
| Secondes Communications Nationales sur les changements climatiques (2012) | The project will contribute to achieve the specific adaptation objectives regarding the coastal zone, listed under section 4.7.e | Impacts on the coastal zone detailed as such: Coastal erosion, heavy rains and flooding, marine submersion (which may affect several coastal villages) will have direct consequences such as socio-economic infrastructures submerged by sea level rise ; loss of beaches; flooding of coastal villages leading to population displacement; loss of income and activities for operators; Insecurity of coastal navigation ; destruction of coastal ecosystems ; difficulties in the fishing sector | 5 projects sites out of 6 are mentioned as top priority sites for the adaptation of the coastal zone (the exception is site 5: Bimbini) | Awareness-raising in the coastal zone ; support to land-use planning efforts discouraging construction in the most-at risk areas ; integrated management of the coastal zone ; reinforcement of the national regulatory framework ; Creation of a structure in charge of coastal management to oversee land-use and infrastructure development works; Carry out regular vulnerability studies in the 3 Comoros islands. | Rehabilitation of beach and dunes ecosystems ; promotion of natural restoration methods for marine ecosystems and watersheds ; protection of areas vulnerable to sea-level rise by building appropriate coastal protection structures adapted to the environment. Encourage the use of crushed materials for the construction of permanent structures to replace traditional housing made of straw or mud; |
| Politique, stratégie et plan d'action sur le changement climatique (2015) | The project will contribute to achieve the objectives II, III, IV, V, VI and VIII of the national climate change strategy and action plan | Sea level rise, decrease in coastal fishing, loss of biodiversity, increase in marine temperature, cyclones, coastal erosion | High priority zones for coastal protection against sea level rise include 5 out of 6 project sites (the exception is site 2 : Chindini-Male) | Adaptation integrated into land-use planning ; awareness-raising and dissemination of climate change knowledge | Promotion of sustainable fishing practices ; promotion of alternative materials for construction ; construction of coastal defense works |

Annex 5 to OPG Amended in October 2017

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|---|---|--|---------------------------|---|---|
| Plan Comores Emergent (PCE) 2030/ Plan de Développement Intermédiaire (PDI) (2019-2020) | The project will contribute to achieve the objectives of the "Plan Comores Emergent" (National Development Plan) related to climate change : (i) strengthen actions and capacities for adaptation to climate hazards and climate-related natural disasters taking into account the real needs of the country, (ii) implement mitigation and resilience actions for the benefit of the country's socio-economic development, and (iii) integrate the concepts of climate change at all levels. | Sea-level rise, cyclones, coastal erosion, livelihoods vulnerability | No priority zones defined | <p>2 components of the Plan de Développement Intermédiaire, as an operational declination of the Plan Comores Emergent 2030 :</p> <p>10.1 II. Sustainable management of the environment to achieve emergence is ensured</p> <p>10.2 I. The regulatory and institutional framework for land use planning and urban development is established</p> <p>Sectorial project included into the Plan Comores Emergent : Integrated Management of the Coastal Zone including the design of a land-use plan</p> | <p>Sectorial projects included into the Plan Comores Emergent :</p> <p>- "Integrated Management of the Coastal Zone" including the search for alternative materials to the use of marine aggregates in construction</p> <p>- "Artisanal Fishing" including technical trainings and support to the local fishermen, support to the creation of value chains.</p> |
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E. Describe how the project / programme meets relevant national technical standards, where applicable, such as standards for environmental assessment, building codes, etc., and complies with the Environmental and Social Policy of the Adaptation Fund.

An initial screening has been conducted, which will be finalized during project preparation. Standards and norms that are applicable to the construction and installation of infrastructure in the coastal area will be revised during the project in line with climate scenarios and adaptation requirements. The project will align with all relevant building codes, production codes, and policies in terms of natural resources management, extraction, and fisheries. Cooperation with various national normative entities, including ministry of energy and mines, national geological bureau, national meteorological agency and maritime transport agency will be pursued to ensure alignment with policies, or where needed revision of policies, standards and norms that require revising due to climate change.

F. Describe if there is duplication of project / programme with other funding sources, if any.

There is no duplication of project with other funding sources. Comoros may be among the countries benefiting from investment in coastal adaptation activities through the Global Fund for Coral Reefs, though such an investment would be channeled to private sector entities, and is not likely to materialize before 2023. Similarly, the GCF is funding NGOs/civil society institutions in coastal EbA through the Agence Française de Développement (AFD) and the Critical Ecosystem Partnership Fund (CEPF) which could provide additional financing in the implementation of adaptation measures contained in the 9 PLAGZICs.

G. If applicable, describe the learning and knowledge management component to capture and disseminate lessons learned.

The project's knowledge management strategy is critical to the achievement of the overall project objectives and is delivered in the following two ways.

Capitalizing the knowledge generated by other projects for decision making on the Comorian coastline.

One of the expected results of the project is a strengthening of the coherence of ongoing or future interventions in the coastal zone, in order to make possible the simultaneous and synergistic achievement of national adaptation and economic development objectives. This requires the capitalization and operationalization of the knowledge already acquired during past projects, and the knowledge that will be generated by the implementation of the planned projects.

This capitalization will be carried out within the framework of the project thanks to two main actions.

The development of local coastal vulnerability assessments: all the available knowledge, in various fields, allowing a local assessment of climate risks and vulnerabilities will be mobilized. The synthesis of this knowledge will lead to the publication of multiple studies but also to the spatialized visualization of the impacts of climate change through a mapping tool. This tool is an essential part of the knowledge management strategy, which has several objectives:

- Decision-making support, particularly for regional environment and planning departments and for municipalities
- Raising awareness, targeting in particular participants to the local coordination mechanisms under

which the PLAGIZCs (Local Plan for Adaptive and Integrated Management of the Coastal Zone) will be designed

- Strengthening coherence, by allowing for better identification of areas where current or future project interventions are not sufficiently coordinated.

Using demonstration approaches to change the scale of the experimental systems

A sustainable adaptation of the Comorian coastline to climate change is only possible if the inhabitants, as economic actors, sustainably change some of their practices that are most detrimental to the natural capital on which their activity is based.

The first level of response consists of mobilizing part of the project's resources to carry out actions to sensitize communities and to strengthen their technical capacity. A second level of response consists in using a demonstrative approach: by giving the communities the possibility to carry out innovative actions on pilot sites (EbA for the protection of urban areas against SLR and coastal erosion; new economic activities that enhance the value of the beach area; construction in alternative materials), knowledge that was previously theoretical on ecosystem benefits or construction techniques is directly made visible and concrete for the communities. The demonstration of the economic feasibility, viability and opportunity that these new approaches represent should allow for a more massive change in practices in the coastal economy. In order to make this change in scale of practices work, the project intends to employ several strategies:

- Making the replication potential in other sectors of the coastline one of the priority criteria in the choice of the funded adaptation actions.
- Dedicating a significant budget to the dissemination of lessons learned, the valorization of the actions carried out and to the successful implementation of an efficient communication strategy.
- Mobilizing local figures such as mayors and religious authorities as the main relays for awareness-raising and dissemination at a subnational scope (ie. in the surrounding towns and villages for example) to enable a progressive dissemination and consolidation, through multiple exchanges of local knowledge, anchored into the existing network of daily social relationships.
- Putting the community that carries out the adaptation action at the center of the valorization and dissemination process. Choosing symbolic, highly-valued objects and events (eg.: community and/or sacred buildings; well-known beach; festive events) should help to make the experimental action a source of local pride and a factor of emulation towards other localities on each island. Setting up a science-society dialogue platform in each project site, facilitated by local researchers, will help the execution partner integrating *ex-ante* these considerations in the very design of the action.

H. Describe the consultative process, including the list of stakeholders consulted, undertaken during project preparation, with particular reference to vulnerable groups, including gender considerations, in compliance with the Environmental and Social Policy and Gender Policy of the Adaptation Fund.

This project concept is the result of a consultative process that has included public and private stakeholders, coastal dwellers and enterprises. Site selection and intervention selection was conducted through a participatory mission conducted by UNEP consultants. A thorough consultation plan and stakeholder analysis will be undertaken during project document formulation.

I. Provide justification for funding requested, focusing on the full cost of adaptation reasoning.

In the Business as usual scenario, development actions in the coastal zone (funded by international donors, the State and communities) are not well coordinated, and take little account of long-term resilience issues. There are practically no governance structures and mechanisms for monitoring and coordinating actions for adaptation, management and development of the coastal zone, and the knowledge base is weak and dispersed. In particular, because devolvement and decentralization are so nascent in Comoros, local public authorities do not have the technical and financial means to implement a policy of adaptation and integrated management of the coastal zone. The weakness of the municipalities' resources undermines their legitimacy and deprives Comoros of the specific potential contributions of local regulatory authorities.

Without intervention, project sites will be increasingly exposed to climate change impacts, and some of them will experience permanent land loss due coastal erosion and sea level rise. The coastline is retreating, beaches are disappearing, coastal roads may be cut by local collapses, and some built-up areas will have to be abandoned in the medium term. During climatic episodes with rapid return rates (<10 years), marine submersion will damage to dwellings, buildings and infrastructure at low altitude, whereas severe rainfall events will accelerate erosion of upper watersheds. During exceptional episodes, cyclonic swells will increasing cause human losses and inflict heavy damage to buildings.

Spontaneous dykes and retaining walls have been erected by communities not only do they fail to limit coastal erosion, in some cases they may aggravate it, as they are based on an insufficiently detailed knowledge of local hydro-sedimentary dynamics and climatic risks. Even the other coastal defense actions undertaken in the framework of projects financed by international donors are insufficient to offset the increased risks, as they do not address all the issues, and they take ecosystem integrity for granted.

The livelihoods of people living in coastal areas are under serious threat from the degradation of coastal ecosystems. The salinization of coastal aquifers and the decline in reef fisheries, linked to the poor state of the ecosystems, are increasingly limiting the productivity of the primary sector. Unsustainable agricultural and fishing practices are adding to the pressures already exerted on the environment by climate change. The continued removal of coral sand from beaches for construction accelerates erosion, the degradation of coastal ecosystems, and the potential for coastal development through eco-tourism is greatly reduced.

The basis of the coastal economy is still based on the sale of raw materials, mostly unprocessed. Communities, especially their most vulnerable members, derive little income from these primary production activities that degrade natural capital, and are therefore becoming less and less able to be resilient to the impacts of climate change. Alternative livelihoods are lacking and climate events are creating severe economic hardship. Despite visible climate impacts, communities are often aware of the consequences of unsustainable practices, but have few alternatives and limited support for changing practices.

With AF intervention and support, participatory governance mechanisms and adaptation and integrated coastal zone management plans can be set up at local level. Based on up to date local vulnerability studies local public administrations will gain a better knowledge of the risks specific to their territory and of the adaptation options available. Importantly, for the first time, they will be able to directly access climate finance resources to implement adaptation interventions and fill the gaps left by development projects.

With this project, adaptation actions based on ecosystems will significantly reduce the exposure and vulnerability of more than 80,000 inhabitants (38,800 men and 41,200 women) in the coastal zone and 970 ha of dense built-up area, as well as key buffering, protecting and productive ecosystems, with co-benefits in terms of biodiversity, land degradation, local economy and climate mitigation. Restored coastal ecosystems will dissipate marine energy during heavy swells (coral reefs, mangroves, supra-littoral vegetation), avoiding or limiting the submersion of low-lying built-up areas.

National and local authorities will gain a better understanding of the complex coastal dynamics, and will come to value ecosystem services in terms of protection and economic value. Planning will be undertaken in collaboration with local communities and on the basis of improved knowledge, while plans will be better enforced through participatory mechanisms. People whose livelihoods depend on the natural resources of the coastal zone will be made aware of the value and potential of more sustainable practices and capacitated in their use. Enhanced technical skills will enable producers to reduce their pressure on ecosystems while continuing to derive beneficial livelihoods. Awareness-raising on these issues will be relayed by the public authorities but also by customary and religious leaders, who will benefit from an advanced training programme.

The law prohibiting the extraction of beach sand will be enforced and respected by the communities, as attractive alternatives will be demonstrated for the extractors but also for companies in the construction sector. The adoption of alternative materials to coral sand by the construction industry will strongly supported through R&D studies and technical and financial support.

J. Describe how the sustainability of the project/programme outcomes has been taken into account when designing the project / programme.

Each project component has been designed with the long-term sustainability of the expected results as a priority. The long-term vision of this project is that after the end of the project, local public authorities and communities continue to have sufficient resources and skills to ensure the coherence of the long-term adaptation, development and integrated management interventions in the coastal zone. By 2050, protected/restored ecosystems will continue to effectively protect built-up low-lying coastal areas from marine submersion and to generate productive services that can be leveraged for a sustainable blue economy, without interference from unsustainable extractive and management practices. This will be achieved by

- Strengthening community governance systems;
- strengthening of the technical and management capacities of municipal staff (decision support tool created, technical and administrative training) and island-level staff (adaptation observatories).
- Improving the capacity of municipalities to attract international funding by demonstrating the potential of the Comorian decentralised public level as an efficient and legitimate actor for adaptation
- Taking into account the medium- and long-term impacts of climate change in the design and dimensioning of ecological and civil engineering works, and in the recommended maintenance solutions
- Long-term deterrence of urbanisation in high-risk areas (taking into account the foreseeable impacts of climate change) through the creation of adaptation plans and regulatory zoning and the strengthening of enforcement capacity.
- Support for investment directed towards perennial activity sectors whose business model is viable in the long term (feasibility studies: taking into account operating costs, social

- acceptability and CC impacts)
- Technical training of communities in alternative economic practices and activities that are economically viable and environmentally sustainable.
- Training, demonstration and awareness raising of construction industry players in the production and use of alternative materials, supported by disincentives/incentives in the construction sector to stop sand removal and use of alternative materials (regulatory, institutional, fiscal)

Potential for scaling up

Although the bulk of the investments will target the six project sites, the project has been designed to produce benefits on a national scale (and beyond, on the scale of the South West Indian Ocean). The improvement of localised knowledge of the impacts of CC, the monitoring of coastal adaptation, local planning and land-use management can be upscaled to the entire coastal zone of Comoros. Awareness raising, training and capacity building of public actors will be carried out on a national scale. The coordination mechanisms will enable the sharing and dissemination of information on the results obtained, the lessons learned and the good practices during the life of the project.

Project scope: 9 communes and 80,000 people (38,800 men and 41,200 women)

Potential upscale in the 3 islands: 54 communes and 886,000 people (429,710 men and 456,290 women).

The key element of the scale-up strategy will be the PLAGIZC which will set the stage for a bottom up approach to coastal zone management that can be replicated in all Comoros communes. Lessons learned from the process of developing PLAGIZC will be extracted and engagement with national and island government authorities will ensure these are continuously applied in other planning frameworks, including any future interactions of the National ICZM plan.

A second pathway for upscaling will be explored by working with local communities and private sector entities to identify viable alternatives to unsustainable reef use, fisheries and sand mining that, if proven successful, will contain an economic pathway for broader adoption. With UNEP support, emerging viable initiatives by local communities and private sector entities will be submitted to potential funding entities for support such as the Global Fund for Coral Reefs.

Furthermore, with UNEP support, Comoros is currently preparing a GCF project concept proposal that will address the full scope of policy barriers remaining to ensure that integrated watershed management and coastal zone management are harmonized and fully leveraged for adaptation. This larger initiative will build on the current GCF investments in the country and will also leverage significant private sector participation in the development of green and blue economy activities.

K. Provide an overview of the environmental and social impacts and risks identified as being relevant to the project / programme.

A preliminary screening of the project's impacts on the AF's Environmental and Social Principles is presented below. It will be subject to further consideration and elaboration during the project document formulation.

| Checklist of environmental and social principles | No further assessment required for compliance | Potential impacts and risks – further assessment and management required for compliance |
|---|---|--|
| <i>Compliance with the Law</i> | . | This project will comply with all existing laws and regulations, including those pertaining to labor and working conditions, pollution and the environment and gender equity. A full analysis will be undertaken during the project document formulation. |
| <i>Access and Equity</i> | | This project may have repercussions in terms of limiting access to natural resources and/or creating benefits for which sharing protocols will need to be established. A full analysis to be provided and factor in to the project document formulation. |
| <i>Marginalized and Vulnerable Groups</i> | | The risk is that marginalized and vulnerable groups are excluded from project benefits and are negatively impacted on by the project. The project will ensure effective participation of marginalized and vulnerable groups, including women and people living with disabilities located in the coastal zones. This will be through a detailed stakeholder assessment during the project document formulation and integrated in the stakeholder engagement plan. |
| <i>Human Rights</i> | No activities are or will be included in the design of the proposed project that are not in line with established international human rights. Moreover, the proposed project will promote the basic human rights of access to food, water, a healthy environment and information. | |
| <i>Gender Equality and Women's Empowerment</i> | | The project targeting communities and working with national and island-based institutions where men occupy positions of leadership. There is the risk that women will not sufficiently benefit from capacity building and EbA interventions. The project will adopt gender equality and women's empowerment principles in its design and implementation. A detailed |

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| | | gender action plan and budget will be prepared in the project document formulation. |
| <i>Core Labour Rights</i> | . | There is the risk that project executing partners engaged in site-level adaptation measures that do not respect core labour rights. The project adopt the respected of labour rights and considered it in project design and implementation. National and regional stakeholders will be involved in the design of project activities to ensure that labour legislation is adhered to. |
| <i>Indigenous Peoples</i> | No indigenous peoples present in project sites. | |
| <i>Involuntary Resettlement</i> | . | The risk is that the participatory integrated and adaptive coastal zone management and development plans (PLAGIZC), agreed by stakeholders, might include resettlement of some households from areas at risk of extreme climate events. During the project document formulation, safeguard measures will be built into the project design and implementation to ensure that any resettlement factors in mitigation (e.g. compensation), provision of new location) and are voluntary. It will also feature as part of the project monitoring plan. |
| <i>Protection of Natural Habitats</i> | | The project will help restore natural coastal and near shore reef habitats and aim to create locally managed protected zones or buffer zones. Detailed assessment to be provided in the project document formulation. |
| <i>Conservation of Biological Diversity</i> | | The project efforts to restore natural coastal habitats and ecosystems will contribute to conserve biodiversity in the coastal zone and near shore reefs. Detailed assessment to be provided in the project document formulation. |
| <i>Climate Change</i> | | The risk is that the project applies maladaptation strategies and measures. During the development of the project proposal formulation, climate change risks and vulnerabilities will be further assessed, and proposed adaptation interventions will be tailored. |
| <i>Pollution Prevention and Resource Efficiency</i> | | All efforts will be made to reduce pollution. The sustainable |

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| | | construction alternatives to sand mining will be the object of a detailed feasibility assessment that will also include potential pollution trade-offs. |
| <i>Public Health</i> | | All efforts will be made to ensure that there are no negative effect on public health. During the development of the project proposal formulation, assessment of proposed project activities against public health risks will be considered and mitigated against if necessary. Public health indicators will feature in the monitoring plan and be monitored during implementation. |
| <i>Physical and Cultural Heritage</i> | | There is a low risk that adaptation interventions could result in negative impacts on physical and cultural heritage. The participatory approach of elaborating local coastal zone management plans will mitigate any risk of affecting physical and cultural heritage in the project sites. |
| <i>Lands and Soil Conservation</i> | Project activities will promote land and soil conservation across the project sites as part of EbA approaches | |

Because the proposed project will be undertaking on-the-ground activities, some environmental and social impacts are expected, however not significant and can be mitigated. Therefore, the proposed project is classified as a Category B project as its potential impacts are “less adverse than Category A projects, because for example they are fewer in number, smaller in scale, less widespread, reversible or easily mitigated”.

The project proposal will include the principles and standard operating procedures for a grievance mechanism that the Department of Environment and Forests will put in place to enable members of the public to raise concerns and complaints concerning the project. The project documentation and safeguard information will be disclosed in www.open.unep.org in addition the Ministry website site and also the GEF site.

PART III: IMPLEMENTATION ARRANGEMENTS

The United Nations Environment Programme (UNEP), through its Climate Change Adaptation Unit (CCAU), will be implementing the five-year project and will be responsible for project supervision to ensure consistency with AF and UNEP policies and producers. The Ministry of Agriculture, Fisheries and Environment will execute the project with delegated execution arrangements with Ministry of Land Use Planning and Ministry of Local Government) and island-based institutions. During the project document formulation, partnerships with technical executing partners, such as IUCN, will be explored to provide specific execution support for specific project outcomes (e.g. coastal and near shore reef ecosystem management).

A full-time, dedicated Project Manager will be hired to lead a Project Management Unit (PMU) and execute the day-to-day management and delivery of the project. The PMU will also comprise of full-time administrative officer and a finance officer.

The institutional structure of the project will include a Project Steering Committee (PSC), with a mandate to oversee and guide project implementation, and to review annual workplans and budgets, and project reports. The project will include a wide partnership of various ministries, as well as local administration representatives from the three islands on the Project Steering Committee. This cross-government oversight will allow greater accountability and coordination among institutions and promote a multisectoral approach in support of local level adaptation strategies and measures.

The project will follow UNEP standard monitoring, reporting and evaluation processes and procedures. An M&E plan consistent with the AF Results-based Management and Evaluation policies will be developed during project document formulation. The Project Results Framework to be developed will include SMART indicators and targets for each expected outcome as well as mid-term and end-of-project targets. These indicators will be the main tools for assessing project implementation progress and whether project results are being achieved. Day to day project monitoring will be the responsibility of the project management unit particularly the Project Manager and supported by monitoring and reporting (M&R) specialist. In addition, other project partners will be responsible to collect information to track assigned indicators.

PART IV: ENDORSEMENT BY GOVERNMENT AND CERTIFICATION BY THE IMPLEMENTING ENTITY


A. Record of endorsement on behalf of the government²

Provide the name and position of the government official and indicate date of endorsement. If this is a regional project/programme, list the endorsing officials all the participating countries. The endorsement letter(s) should be attached as an annex to the project/programme proposal. Please attach the endorsement letter(s) with this template; add as many participating governments if a regional project/programme:

| <i>(Enter Name, Position, Ministry)</i> | <i>Date: (Month, day, year)</i> |
|--|---------------------------------|
| Fawaz Mohamed Moumini AF Focal Point Ministry of Agriculture, Fisheries, Environment, Tourism and Handicrafts | (12/28/2021) |

B. Implementing Entity certification *Provide the name and signature of the Implementing Entity Coordinator and the date of signature. Provide also the project/programme contact person's name, telephone number and email address*

⁶ Each Party shall designate and communicate to the secretariat the authority that will endorse on behalf of the national government the projects and programmes proposed by the implementing entities.

| | |
|---|--|
| <p><i>Name & Signature</i></p>  <p>Ms Mirey Atallah Deputy Director Ecosystems Division UNEP</p> | |
| <p>Date: <i>(Month, Day, Year)</i></p> <p>10/01/2022</p> | <p>Tel. and email:</p> <p>mirey.atallah@un.org</p> |
| <p>Project Contact Person:</p> <p>Mr. Alex Forbes</p> | |
| <p>Tel. And Email:</p> <p>Tel: [254] 20 762 4903 Mobile: [254] 780 441998 E: Alex.Forbes@un.org</p> | |

Point Focal Fonds Adaptation,

Réf. N°021 - 04/ MAPETA/DGEF



Moroni, le 29 / 11 / 2021

TO: The Adaptation Fund Board
c/o Adaptation Fund Board Secretariat
Email : Secretariat@Adaptation-Fund.org
Fax : 202 522 3240/5

Subject: Endorsement for project "Ecosystem-based Adaptation of the Comoros Coastal Zone"

In my capacity as Designated Authority for the Adaptation Fund for the Union of the Comoros, I confirm that the above national project proposal is in accordance with my government's national priorities in implementing adaptation activities to reduce adverse impacts of, and risks, posed by climate change in the Union of the Comoros.

Accordingly, I am pleased to endorse the above project/programme proposal with support from the Adaptation Fund. If approved, the project/programme will be implemented by the United Nations Environment Programme and executed by the Directorate for Environment and Forests of the Ministry of Agriculture, Fisheries, Environment, Tourism and Handicrafts.

Sincerely,

Fawaz Mohamed Moumini
Adaptation Fund Designated Authority
Focal Point INDC

Copy: Convention Focal point for UNFCCC
Convention Focal point for UNCCD
Convention Focal point for CBD
GEF Focal Point

FAWAZ MOHAMED MOUMINI



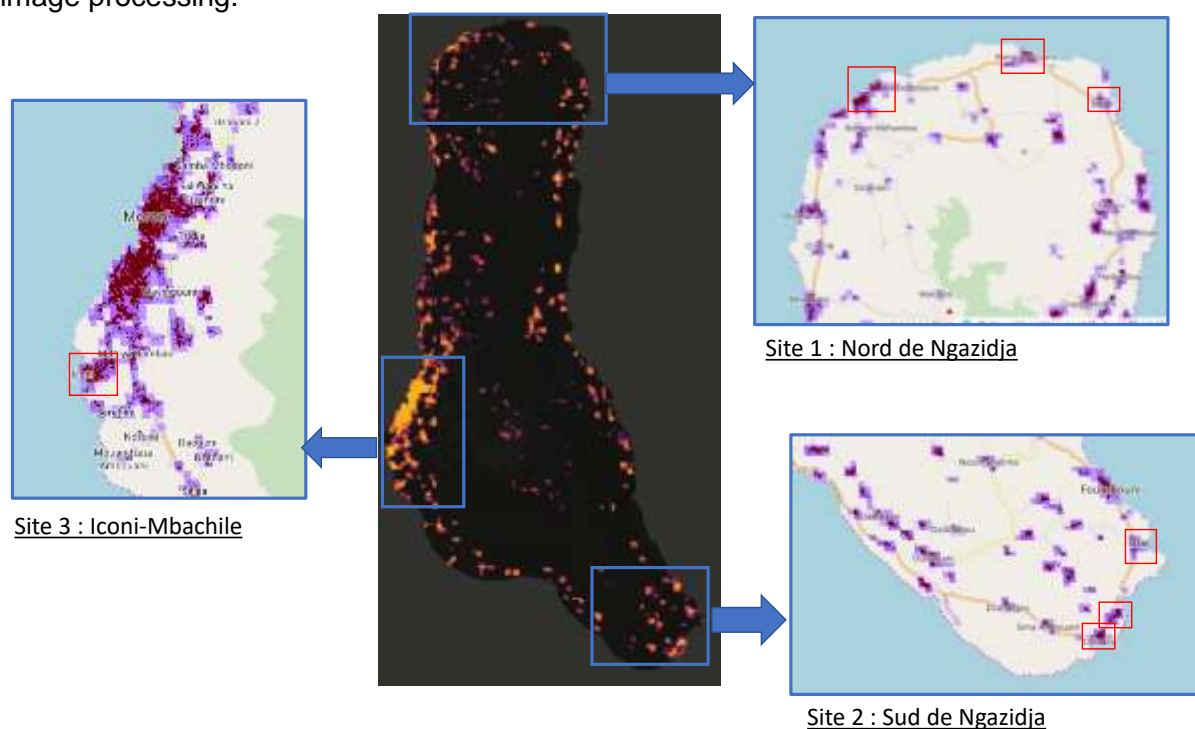
Annex 1: Description of the Six coastal sites facing major climate risks and vulnerabilities targeted by the project

The project will be implemented in 3 sites on the island of Ngazidja, 2 sites on the island of Anjouan and 1 site on the island of Mohéli. These 6 sites comprise of 14 municipalities or villages grouped in 9 Communes, which are themselves in 7 Prefectures.

Island of Ngazidja (Grande Comore)

On the main island of the archipelago, housing almost half of the population, three sites were selected for the project as priorities in terms of the impact of climate change on the coastal zone.

The maps below show the location of the three project sites, with regard to the population density (central map) and of the built-up area (detail maps) on the island, estimated via satellite image processing.⁹¹



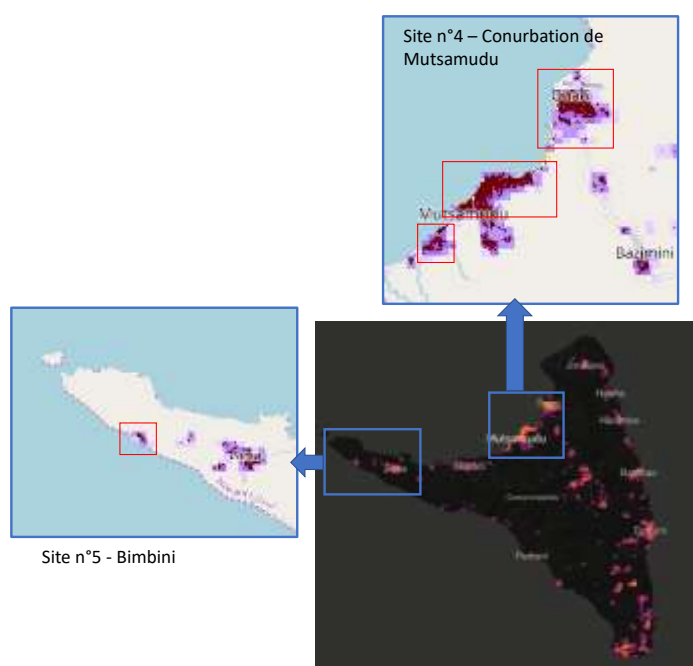
Island of Anjouan

On the island of Anjouan, two sites have been selected for the project as priority sites with regard to the impact of climate change on the coastal zone.

The site of Bimbini is inscribed within the perimeter of the future Shisiwani protected area, while the second corresponds to the area of the urban conurbation of Mutsamudu (Pajé-Mutsamudu-Mirontsi-Ouani).

The maps below show the location of the project sites, with regard to density of population (central map) and of the built-up area (detail maps) on the island, estimated via satellite image processing.

⁹¹ Based on the Global Human Settlement Layer developed by the Joint Research Centre (JRC) and the DG for Regional and Urban Policy (DG REGIO) of the European Commission, together with the international partnership GEO Human Planet Initiative. Residential population estimates for target years 2015 provided by CIESIN GPWv4.10 disaggregated from census or administrative units to grid cells, informed by the distribution and density of built-up as mapped in the Global Human Settlement Layer (GHSL) global layer per corresponding epoch.



Island of Mohéli

On the island of Mohéli, the Fomboni-Djoiezi site was selected for the project as a priority site regarding the forecasted impacts of climate change on the coastal zone.

The maps below show the location of the project site in terms of the density of population and built-up areas on the island, estimated using satellite image processing.

