GEF-8 PROJECT IDENTIFICATION FORM (PIF)

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General Project Information

Project Title	
Climate Resilient Seaweed Blue Economy in Madagascar (SeaBlue)	
Region	GEF Project ID
Africa	12311
Country(ies)	Type of Project
Madagascar	MSP
GEF Agency(ies):	GEF Agency ID
UNIDO	260109
Executing Partner	Executing Partner Type
Ministry of Environment and Sustainable Development	Government
GEF Focal Area (s)	Submission Date
Climate Change	3/27/2026
Project Sector (CCM Only)	
Climate Change Adaptation Sector	

Taxonomy

Coastal, International Waters, Focal Areas, Climate Change Adaptation, Climate Change, Livelihoods, National Adaptation Programme of Action, Biomes, Mangrove, Large Marine Ecosystems, Least Developed Countries, Community-based adaptation, Ecosystem-based Adaptation, Coastal and Marine Protected Areas, Protected Areas and Landscapes, Biodiversity, Community Based Natural Resource Mngt, Sustainable Development Goals, Land Degradation, Sustainable Livelihoods, Sustainable Land Management, Sustainable Agriculture, Land Productivity, Land Degradation Neutrality, Food Security, National Adaptation Plan, Mainstreaming adaptation, Private sector, Nationally Determined Contribution, United Nations Framework Convention on Climate Change, Paris Agreement, Enabling Activities, Capacity Building Initiative for Transparency, Agriculture and agrobiodiversity, Mainstreaming, Mangroves, Deploy innovative financial instruments, Influencing models, Demonstrate innovative approache, Convene multi-stakeholder alliances, Transform policy and regulatory environments, Strengthen institutional capacity and decision-making, Indigenous Peoples, Stakeholders, Public Campaigns, Communications, Education, Behavior change, Strategic Communications, Awareness Raising, Private Sector, SMEs, Local Communities, Non-Governmental Organization, Civil Society, Gender Mainstreaming, Gender Equality, Gender-sensitive indicators, Women groups, Sex-disaggregated indicators, Capacity Development, Gender results areas, Access to benefits and services, Participation and leadership, Food Value Chains, Sustainable Production Systems, Small and Medium Enterprises, Institutional and Social Fragility, Fragile and Conflict-Affected Situations, Adaptive management, Learning, Capacity, Knowledge and Research, Theory of change, Indicators to measure change, Peer-to-Peer, Knowledge Exchange, Conference, South-South, Professional Development, Knowledge Generation, Seminar, Training, Master Classes, Course, Workshop, Access and control over natural resources, Academia, Community Based Organization, Trade Unions and Workers Unions, Financial intermediaries and market facilitators, Capital providers, Type of Engagement, Participation, Information Dissemination, Consultation, Restoration and Rehabilitation of Degraded Lands

Type of Trust Fund	Project Duration (Months)
LDCF	60

GEF Project Grant: (a) 4,476,210.00	GEF Project Non-Grant: (b) 0.00
Agency Fee(s) Grant: (c) 425,240.00	Agency Fee(s) Non-Grant (d) 0.00
Total GEF Financing: (a+b+c+d) 4,901,450.00	Total Co-financing 10,350,000.00
PPG Amount: (e) 90,000.00	PPG Agency Fee(s): (f) 8,550.00
PPG total amount: (e+f) 98,550.00	Total GEF Resources: (a+b+c+d+e+f) 5,000,000.00
Project Tags CBIT: No NGI: No SGP: No Innovation: No Competitive Window: No	

Project Summary

Provide a brief summary description of the project, including: (i) what is the problem and issues to be addressed? (ii) what are the project objectives, and if the project is intended to be transformative, how will this be achieved? iii), how will this be achieved (approach to deliver on objectives), and (iv) what are the GEBs and/or adaptation benefits, and other key expected results. The purpose of the summary is to provide a short, coherent summary for readers. The explanation and justification of the project should be in section B “project description”.(max. 250 words, approximately 1/2 page)

With declining fish stocks and accelerating climate change, seaweed farming has become an important source for income diversification in coastal communities in Madagascar. While seaweed farming is recognized as an important “climate solutions”, the sector itself is highly exposed to current and anticipated climate hazards, requiring specific adaptation interventions to maintain its viability. Madagascar’s coastal communities in Analanjirofo, Diana, Melaky, Menabe, and Atsimo-Andrefana. Face quantifiable escalating climate risks: intensifying cyclones, storm surge, sea-level rise, and ocean variability that erode seaweed farms, damage coastal ecosystems, and drive environmentally harmful coping strategies such as mangrove cutting. The project specifically addresses these climate vulnerabilities through ecosystem-based adaptation (EbA) and climate-resilient production systems that enhance adaptive capacity to current and future climate shocks. Poverty and market volatility compound these risks, particularly for women and youth who rely on seaweed as an accessible livelihood. Emerging and future climate hazards including intensifying multi-stressor ocean conditions (higher temperatures, acidification) and more frequent extreme events are expected to result in declines in seaweed productivity, destruction of farming infrastructure and shifting habitats. If these anticipated risks are not addressed, coastal communities face cascading risks that amplify socio-economic vulnerability, with women expected to be disproportionally affected.

Objective: To transform seaweed-based livelihoods from a low-value, climate-sensitive, high-risk commodity into a diversified, climate-resilient driver of the blue economy, enhancing the resilience, sustainability, income and adaptive capacity of coastal communities in the face of current and future climate hazards.

Approach: The project will achieve this through a multi-faceted approach that directly strengthens the resilience and adaptive capacity of coastal communities, particularly women, youth, and vulnerable households, to current and anticipated climate hazards, including intensifying cyclones, storm surges, sea-level rise, marine heatwaves, and post-cycloon flooding.This is deliveredthrough five integrated components: (1) climate-resilient production and ecosystem protection, which strengthens coastal communities’ adaptive

capacity to withstand and recover from cyclones and marine heatwaves by improving last-mile connectivity to national EWS for local seaweed communities, digital climate services, restoration of 2,000–2,500 hectares of mangroves as natural buffers that reduce storm surge energy reaching farms and villages, and sustainable management of 3,500 hectares of marine ecosystems using climate-adaptive seaweed strains and integrated multi-trophic aquaculture to withstand marine heatwaves, thereby protecting livelihoods and coastal assets from climate shocks; (2) inclusive value-chain upgrading and market diversification, which strengthens economic adaptive capacity by establishing post-harvest facilities (solar drying to prevent losses during rainy seasons), introducing quality standards, and developing bio-stimulants, thereby reducing climate-related losses (20–40% post-harvest), diversifying income sources so households are not dependent on a single climate-sensitive product, and enhancing financial resilience to absorb shocks without distress asset sales; (3) enabling policy frameworks and community-based climate-risk finance, which builds financial resilience at the household level by piloting shock-triggered disbursement mechanisms for post-cyclone recovery (emergency funds and women-led savings groups aligned with seaweed income cycles), enabling people to repair productive assets and resume livelihoods immediately after extreme events without resorting to mangrove cutting for charcoal;; (4) knowledge management and South–South exchange, including platforms such as the UNGSI, which builds adaptive capacity by facilitating learning, innovation, and replication of climate-resilient blue economy practices across communities and targeted regions; and (5) robust monitoring, evaluation, and learning to ensure adaptive management, enabling communities and institutions to respond effectively to evolving climate risks and scale up successful interventions.

Site prioritization within the targeted regions will be finalized with national authorities during PPG to align with private sector presence and budget constraints ensuring practical, context-sensitive implementation.

Results and Benefits: Combining mangrove restoration with resilient seaweed farming and value chain development creates a powerful “blue” synergy that enhances coastal protection, biodiversity and climate resilient job creation. Adaptation benefits include reduced climate vulnerability through diversified incomes, early-warning access, and financial resilience. Capacity outcomes include training 3,000 people (60% women, 30% youth) and engaging 500–700 MSMEs. Global Environmental Benefits include restoration of 2,500 ha of mangroves and improved management of 3,500 ha of marine habitat, enhancing and protecting biodiversity through habitat creation, blue carbon sequestration, and coastal protection. The project is expected to directly benefit 60,000 people in coastal communities (60% women) and indirectly provide benefits to 2,5 million people in the targeted regions of Madagascar.

Indicative Project Overview

Project Objective

Enhancing the resilience, sustainability, income and adaptive capacity of coastal communities in the face of current and future climate hazards.

Project Components

Component 1: Climate-Resilient Seaweed Production and Ecosystem Protection

Component Type	Trust Fund
Technical Assistance	LDCF
GEF Project Financing ($)	Co-financing ($)
1,328,917.00	3,000,000.00
Outcome:	

Outcome 1.1: Seaweed producers adopt climate-resilient and gender responsive aquaculture practices, improving productivity, quality and resilience of farming systems under climate variability and shocks

Outcome 1.2: Critical coastal ecosystems (mangroves and seagrasses) are restored, sustainably managed, and protected, enhancing ecosystem services and community resilience.

Output:

Output 1.1.1: Climate-resilient and sustainable seaweed farming techniques demonstrated and adopted by at least 2,500 seaweed producers (50% women), including training on climate-adaptive cultivation methods, IMTA, seed banking, and post-harvest loss reduction.

Output 1.1.2. Digital climate information services established for seaweed farmers, including seasonal climate outlooks, storm alerts, guidance on planting and harvesting windows, and market price information through low-tech platforms (e.g. SMS/WhatsApp, community radio).

Output 1.1.3 Local adaptive capacity strengthened through the establishment of 30 community-managed disaster risk reduction committees equipped with contingency plans for climate shocks.

Output 1.2.1 Participatory mangrove restoration and conservation management plans developed and implemented for 2,000 hectares of degraded mangrove forests, with clear tenure agreements and community stewardship protocols.

Output 1.2.2 Mangrove nursery networks established and operationalized, capable of producing 500,000 seedlings annually, supported by community-based ecosystem monitoring systems.

Output 1.2.3 Nature-based jobs for climate adaptation created, including restoration teams trained in nursery management, ecosystem monitoring, and coastal planning, with pathways for transition into longer-term roles such as eco-guards, technicians, and enterprise managers (targeting 40% youth and 50% women employment in restoration activities).

Component 2: Inclusive Value Chain Development, Livelihoods, and Market Diversification

Component Type	Trust Fund
Technical Assistance	LDCF
GEF Project Financing ($)	Co-financing ($)
1,341,321.00	6,000,000.00

Outcome:

Outcome 2.1. Producer groups and women- and youth-led micro, small, and medium enterprises enhance their capacities in post-harvest handling, quality control, value addition, and enterprise development.

Outcome 2.2. Diversified seaweed-based products and strengthened market linkages contribute to resilient livelihoods and more stable producer incomes, and social benefits.

Output:

Output 2.1.1. Community-level seaweed processing and post-harvest facilities established or upgraded incorporating climate-resilient design and renewable energy sources.

Output 2.1.2 Product quality, safety, and grading standards developed and adopted by producer organizations aligned with international certification requirements (organic, fair trade).

Output 2.1.3. New livelihoods and MSMEs created along the seaweed value chain, with targeted training for Women- & youth-led “blue enterprises” in business management, financial literacy, and climate adaptation planning.

Output 2.2.1 Innovative seaweed-based products (e.g. bio-stimulants, organic fertilizers, and other climate-friendly products) developed, tested, and positioned for market entry providing income diversification against climate shocks.

Output 2.2.2 Market assessments conducted and business linkages facilitated for diversified seaweed-based products establishing contractual relationships between producer cooperatives and commercial buyers.

Component 3: Enabling Environment, Financial Resilience, and Policy Support

Component Type	Trust Fund
Investment	LDCF
GEF Project Financing ($)	Co-financing ($)
1,005,991.00	500,000.00

Outcome:

Outcome 3.1. Policy, regulatory, and financial frameworks increasingly enable inclusive, climate-resilient, and sustainable blue economy development.

Output:

Output 3.1.1. Policy notes and recommendations prepared to strengthen enabling regulatory frameworks including spatial, planning tools, and incentive frameworks for sustainable seaweed production and broader blue economy activities.

Output 3.1.2. Public–private partnerships and investment plans supported to advance sustainable seaweed enterprises and value chain development.

Output 3.1.3. Community-based climate risk finance mechanisms piloted, including emergency funds with transparent governance structures and shock-trigger disbursement rules women-led savings groups aligned with seaweed income cycles. Specific governance frameworks, fiduciary oversight mechanisms, and shock-trigger criteria will be developed during the PPG phase.

Output 3.1.4. Blue carbon co-benefits from mangrove restoration and seaweed farming assessed and documented to strengthen national MRV systems, inform policy development, and support future access to climate finance (without engaging in carbon credit sales).

Component 4: Knowledge Management, and Regional & Global Exchange

Component Type	Trust Fund
Technical Assistance	LDCF
GEF Project Financing ($)	Co-financing ($)
406,828.00	500,000.00

Outcome:

Outcome 4.1 Knowledge, evidence, and learning generated by the project inform policy, practice, and scaling of climate-resilient and gender-responsive blue economy interventions.

Output:

Output 4.1.1 A gender-responsive knowledge management and communication plan developed and implemented.

Output 4.1.2 Good practices, lessons learned, and knowledge products documented and disseminated to coastal communities, practitioners, and policymakers at local, national and regional levels.

Output 4.1.3 Knowledge exchange and learning partnerships facilitated with global and regional initiatives, including the United Nations Global Seaweed Initiative (UNGSI).

M&E

Component Type	Trust Fund
Technical Assistance	LDCF
GEF Project Financing ($)	Co-financing ($)
180,000.00	85,714.00

Outcome:

Outcome 5. 1 Project Monitoring, Evaluation and Learning system established

Output:

Output 5.1.1 Project monitoring, evaluation, and learning systems implemented to track results, support adaptive management, and inform scaling and replication.

Component Balances

Project Components	GEF Project Financing ($)	Co-financing ($)
Component 1: Climate-Resilient Seaweed Production and Ecosystem Protection	1,328,917.00	3,000,000.00
Component 2: Inclusive Value Chain Development, Livelihoods, and Market Diversification	1,341,321.00	6,000,000.00
Component 3: Enabling Environment, Financial Resilience, and Policy Support	1,005,991.00	500,000.00
Component 4: Knowledge Management, and Regional & Global Exchange	406,828.00	500,000.00
M&E	180,000.00	85,714.00
Subtotal	**4,263,057.00**	**10,085,714.00**
Project Management Cost	213,153.00	264,286.00
Total Project Cost ($)	**4,476,210.00**	**10,350,000.00**

Please provide justification

PROJECT OUTLINE

A. PROJECT RATIONALE

Briefly describe the current situation: the global environmental problems and/or climate vulnerabilities that the project will address, the key elements of the system, and underlying drivers of environmental change in the project context, such as population growth, economic development, climate change, sociocultural and political factors, including conflicts, or technological changes. Describe the objective of the project, and the justification for it. (Approximately 3-5 pages) see guidance here

Global Environmental Problems and Climate Vulnerabilities

Madagascar has the longest coastline in Africa, extending approximately 5,600 km along the Indian Ocean, and as a Least Developed Country (LDC) faces high climate vulnerability and limited adaptive capacity. The country ranks 178th out of 185 countries on the ND-GAIN Country Index, reflecting high exposure to climate hazards and low readiness to adapt (ND-GAIN, 2023). Observed climate trends indicate that Madagascar is already experiencing significant warming: average temperatures during 1991–2020 were approximately 0.53°C higher than the 1960–1990 baseline, accompanied by a steady increase in the frequency of hot days and tropical nights since the 1960s, intensifying heat stress for climate-sensitive livelihoods and ecosystems (IMF, 2022).

Climate-related hazards are frequent and economically damaging. Between 1980 and 2010, Madagascar experienced at least 53 major natural hazard events, primarily cyclones, floods, and droughts, resulting in more than USD 1 billion in cumulative damages (World Bank, 2023). Extreme events have become increasingly disruptive in recent years; in January–February 2022, four tropical cyclones struck the country in rapid succession, illustrating the growing risk of compound climate shocks that overwhelm recovery capacity and repeatedly damage coastal assets and livelihoods (World Bank, 2022). Coastal zones are particularly exposed, as communities depend heavily on marine ecosystems and climate-sensitive activities. Traditional off-bottom seaweed farming, an important livelihood for coastal households and a key source of income for women, is highly vulnerable to storm surges, wave action, and changing ocean conditions, leading to frequent loss of productive assets and income instability following extreme weather events.

The latest climate modeling for Madagascar foresees continued warming, increased rainfall variability, and more intense (though less frequent) cyclones. Future climate projections indicate that these risks will intensify.

In the western and southwestern regions of Menabe and Atsimo-Andrefana, climate risks are compounded by chronic drought, food insecurity, and increasing migration from inland areas toward coastal zones. This has intensified pressure on marine ecosystems, including overfishing and mangrove degradation, as households diversify into coastal livelihoods for survival. These dynamics reinforce the urgency of introducing climate-resilient, alternative income sources such as seaweed farming.

Madagascar`s Seaweed Sector and increasing climate vulnerability

Seaweed farming is a climate-sensitive livelihood activity that plays an important role in coastal household economies, particularly for women, due to its low capital requirements and accessibility in

nearshore environments. However, traditional off-bottom seaweed cultivation systems are highly exposed to climate hazards, including tropical cyclones, storm surges, increased wave energy, rising sea surface temperatures, and changing coastal water quality. Extreme weather events frequently damage or destroy cultivation infrastructure, such as lines, anchors, and seedlings, resulting in repeated asset losses and income disruption. Rising temperatures and changing ocean conditions can also reduce growth rates and increase disease incidence, further undermining productivity and reliability. Significant post-harvest losses occur during the rainy season due to inadequate drying infrastructure (FAO, 2024). Repeated cyclone events including Ana, Batsirai, Dumako, and Emnati in early 2022 demonstrate the high climate exposure (NASA Earth Observatory, 2022; ReliefWeb, 2022). Climate information services remain limited and financial resilience mechanisms such as savings, insurance, and emergency credit are largely inaccessible to small scale producers, particularly women and youth.

Women constitute approximately 60 percent of the seaweed workforce (Funk et al., 2022) but remain concentrated in lower value segments of the value chain, primarily production and post-harvest handling, while facing significant earnings gaps (World Bank, 2024). Youth under 25 represent nearly 60 percent of the population (CIA, 2024) and face limited access to stable employment opportunities (IMF, 2023). In the targeted areas of Analanjirofo, Diana, Melaky, Menabe, and Atsimo-Andrefana regions, seaweed farming is one of the few accessible income generating activities for women and youth yet remains highly vulnerable to climate variability and market volatility.

According to FAO (2024), Madagascar's aquaculture sector produced 16,396 tonnes in 2021, with seaweed accounting for 71.1 percent of total production by volume. However, this dominance in physical output contrasts sharply with economic returns, as seaweed generated only 5 percent of total aquaculture production value, underscoring significant structural constraints in domestic value capture. Within the sector, Eucheuma seaweed accounted for 11,658 tonnes of output, while giant tiger prawn—despite representing only 20.6 percent of total production volume—contributed 79.1 percent of total aquaculture value. This stark imbalance reflects the concentration of value in higher-value aquaculture segments. In contrast, global demand dynamics suggest substantial potential for seaweed upgrading: the World Bank (2023) estimates that new farmed seaweed markets could reach USD 11.8 billion by 2030. Together, these trends traps Madagascar in the raw material export model, supplying bulk carrageenan seaweed to Asian markets while importing carbon-intensive synthetic fertilizers. This creates a negative feedback loop: When climate shocks destroy farming assets, farmers are pushed away from sustainable practices; therefore, intensifying pressure on mangroves for charcoal production, the main cooking fuel for most coastal households. This coping strategy reflects the absence of resilient, higher-value livelihood alternatives, including the potential to increase value capture in seaweed through processing, diversification, and integration into higher-value markets. Madagascar's seaweed sector is characterized by weak domestic value addition, limited processing capacity, and high dependence on a small number of international buyers. Most seaweed is exported in raw or semi-processed form for carrageenan extraction, capturing only a small fraction of final market value. The absence of local processing, product diversification, quality standards, and market intelligence constrains income potential and limits resilience to price volatility. At the same time, global demand for diversified seaweed-based products, including bio-stimulants, organic fertilizers, animal feed additives, and climate-friendly inputs, is expanding rapidly, creating unrealized opportunities for domestic upgrading. The mismatch between Madagascar's production profile and global market trends reinforces a low-value, high-risk export model.

Despite these vulnerabilities, the seaweed sector represents a strategic entry point for climate adaptation in coastal zones, as it provides farming opportunities for livelihood diversification, reduces

dependence on overexploited fisheries, and can be combined with ecosystem-based adaptation approaches that strengthen coastal resilience.
Central to this transformation is the development of climate-resilient seaweed strains that can tolerate increased temperatures and environmental conditions, which involves applied research and tissue culture laboratory facilities. Equally important is the promotion of climate-adaptive and gender-responsive seaweed cultivation techniques, particularly Integrated Multi-Trophic Aquaculture (IMTA), which enhances resource efficiency and ecosystem resilience. Beyond its role as a cash crop, seaweed is naturally rich in iodine, calcium, protein, and iron—micronutrients critical for addressing malnutrition. The development of seaweed-based food supplements within the value chain can therefore deliver both climate resilience and nutritional security. Diversification of both seaweed species and value-added products, including food supplements, bio-stimulants, and organic fertilizers, strengthens income stability and market resilience against climate shocks.

With appropriate climate-resilient production practices, early warning and climate information services, post-shock recovery mechanisms, and value chain upgrading, seaweed farming can shift from a highly vulnerable livelihood to a more resilient and adaptive one. Focusing on the seaweed sector therefore enables integrated adaptation interventions that strengthen climate resilience, support women's economic participation, and reduce pressure on vulnerable coastal ecosystems.

Historical Climate Trends and Observed Impacts
Madagascar currently experiences three to four tropical cyclones annually, the highest cyclone risk in Africa—concentrated during the November–April season (World Bank, 2023). The compound event sequence of January–February 2022 demonstrated this escalating risk: four successive cyclones (Ana, Batsirai, Dumako, and Emnati) caused USD 657 million in economic losses and affected over 600,000 people (Global Facility for Disaster Reduction and Recovery, 2024; World Bank, 2022).

Cyclone Batsirai (February 5, 2022) generated a 2.6-meter storm surge and winds exceeding 230 km/h, resulting in 121 deaths, displacing 61,500 people, destroying 8,200 houses, and damaging 211 schools (African Risk Capacity, 2022; World Food Programme, 2022). Modelled exposure estimates indicated potential asset vulnerability of USD 2.1 billion across 6.1 million people in high-wind zones (African Risk Capacity, 2022). Just 18 days later, Cyclone Emnati generated a 1.9-meter storm surge in the same regions, compounding infrastructure destruction (African Risk Capacity, 2022). For seaweed production, these storm surges and associated wave action caused total infrastructure loss in exposed farms: off-bottom cultivation lines, bamboo rafts, and seedling stocks were physically torn away or buried in sediment. Cyclone Emnati generated a 1.9-meter storm surge in the same production areas, compounding the destruction before farmers could recover (African Risk Capacity, 2022).

The immediate production impact is devastating: when 2-meter storm surges inundate nearshore farms, farmers lose not only the current crop but also the productive infrastructure (lines, anchors, and seedlings) required for the next growing cycle. This forces households into distress asset sales or environmentally harmful coping strategies, specifically mangrove harvesting for charcoal production to replace lost income.

Secondary impacts compound the losses: the extended rainy periods associated with cyclones create significant post-harvest losses (up to 20% in regional analogs) when harvested seaweed cannot be dried properly, causing rotting or quality degradation that disqualifies product from export markets (World Bank, 2024). The 2022 cyclones also damaged 115,000 ha of cropland and reduced rice production by over 40% (World Food Programme, 2022), creating cascading food security crises that drive coastal

communities to exploit mangrove ecosystems for subsistence and fuelwood when both agricultural and aquaculture incomes collapse simultaneously.

Future Climate Scenarios and Anticipated Impacts
Modest Scenario (RCP2.6 – Low Emissions Pathway)
Compared to pre-industrial levels, median climate model temperature increases over Madagascar amount to approximately 1.6 °C in 2030 and 1.8 °C in both 2050 and 2080 under the low emissions scenario RCP2.6. Under the medium / high emissions scenario RCP6.0, median climate model temperature increases amount to 1.5 °C in 2030, 2.0 °C in 2050 and 2.8 °C in 2080. Sea level rise is also expected to significantly increase coastal exposure; median projections under higher-emissions scenarios indicate sea levels could rise by approximately 11 cm by 2030, 22 cm by 2050, and up to 43 cm by 2080 relative to year-2000 levels, amplifying risks of coastal erosion, saline intrusion, and storm surge impacts on settlements and production areas (GIZ, 2021). In parallel, ecosystem degradation is compounding climate vulnerability: Madagascar lost an estimated 230,000 hectares of natural forest in 2024, accelerating sedimentation, coastal erosion, and degradation of nearshore marine habitats that underpin coastal protection and livelihoods (Global Forest Watch, 2024). Together, climate change and ecosystem degradation are eroding the resilience of Madagascar's coastal zones, increasing exposure to climate shocks and threatening biodiversity, food security, and human well-being.

For seaweed farming, this scenario implies: (i) periodic marine heat stress exceeding 32°C threshold for ice-ice disease; (ii) increased post-harvest losses during intensified rainy seasons; (iii) gradual inundation of shallow intertidal farming zones. The sector faces moderate but manageable productivity declines of 15–25% by 2050 without adaptation.

High Scenario (2050 Projections under RCP6.0—Existential Threat to Coastal Production Systems)
By mid-century (2050), Madagascar-specific projections indicate warming of approximately 1.6–2.0°C (relative to year 2000 levels) under medium-to-high emissions scenarios (RCP6.0), with sea levels rising by 11 cm by 2030 and 22 cm by 2050 (range: up to 43 cm by 2080) relative to year 2000 levels (GIZ, 2021). The Intergovernmental Panel on Climate Change (2021) assesses with high confidence that the proportion of intense (Category 4–5) tropical cyclones will increase globally, alongside a median increase in cyclone-related rainfall rates of approximately 14% (range: 6–22%). Country-level modeling by the World Bank (2023) indicates that annual damages from tropical cyclones in Madagascar could increase almost fivefold by 2050, depending on exposure and adaptation pathways.

For seaweed production, these trends converge into existential compound hazards: when marine heatwaves coincide with cyclone seasons, farmers face simultaneous thermal crop mortality and physical infrastructure destruction. Heat-stressed seaweed exhibits increased 'ice-ice' fragmentation and tissue bleaching, meaning storm surges that caused partial damage in 2022 may cause greater biomass loss in 2050 as diseased thalli disintegrate upon physical impact. Without intervention, unprotected farms face severe production risks from compound thermal and physical stressors.

Mangrove ecosystem collapse amplifies farm vulnerability: Severe heatwaves cause mangroves to lose up to 50% of their carbon sequestration capacity (WWF, 2023), while increased cyclone intensity uproots canopy trees (as demonstrated when Cyclone Enawo devastated northeastern Madagascar forests in 2017 and Cyclone Freddy damaged western Madagascar forests in 2023; WWF, 2023). Historical precedent from the region shows that cyclones can cause massive mangrove loss—Cyclone Eline (2000) eliminated nearly 60% of mangroves in the Limpopo River estuary (Mozambique; UNEP, 2023), and Cyclone Idai (2019) caused 69% mangrove cover loss in the Buzi River delta (Frontiers in Forests and

Global Change, 2025). Loss of these natural barriers exposes seaweed farms to unattenuated wave energy, converting moderate surges into destructive impact forces at farm sites due to loss of frictional drag.

Economic tipping point: As production becomes structurally unviable in exposed areas, the seaweed farmers contract to survival-only operations, eliminating the income diversification that currently prevents mangrove exploitation. The sector collapses into pure extraction, farmers become charcoal producers not as a temporary coping strategy, but as a permanent livelihood replacement.

Climate Change Impacts on Coastal Communities and Livelihoods

Coastal communities in Madagascar are highly dependent on natural resources for their livelihoods, with household income and food security closely tied to climate-sensitive activities such as artisanal fisheries, small-scale aquaculture, coastal agriculture, and mangrove-based resource use. Climate change is already disrupting these livelihood systems through more frequent and intense cyclones, flooding, droughts, rising temperatures, and sea level rise, which damage productive assets, reduce natural resource productivity, and undermine household coping capacity. Extreme weather events regularly destroy fishing gear, boats, housing, and basic infrastructure, while prolonged dry periods reduce freshwater availability and agricultural yields, increasing pressure on marine resources as households seek alternative income and food sources.

Acute food insecurity and malnutrition present severe public health challenges. Following the worst drought in 40 years and recurring cyclones (World Bank, 2022), faces critical food insecurity affecting over 1.7 million people (WFP, 2024). Stunting rates among children under five reach 39.8% nationally—significantly higher than the Africa regional average of 30.7% (Global Nutrition Report, 2023; UNICEF, World Bank & Gates Foundation, 2024). While driven by multiple factors, including poverty and limited healthcare access, climate change exacerbates these nutritional vulnerabilities through reduced agricultural productivity and disrupted food systems (World Bank, 2022). simultaneously.

Within this context of heightened climate vulnerability in coastal communities, the seaweed sector offers a strategic entry point for adaptation interventions that link livelihood resilience with ecosystem-based approaches.

Non-climatic Drivers

1. Demographic Pressure: Madagascar faces intense demographic pressure with a population growth rate of 2.4% annually (2024) and a youthful demographic structure where approximately 60% of the population is under age 25, according to 2024 data from Statistics Times and the World Bank. This growth intensifies pressure on already-degraded coastal ecosystems, where over 75% of the local population depends on coastal resources for survival (UNEP, 2025) and an estimated 1.5 million people rely directly on fisheries and aquaculture (JNCC; World Bank, 2020).

Critically, significant migration to coastal zones is occurring as farmers and herders from drought-stricken inland areas (particularly in the Southwest) move to coastal villages to exploit marine resources for subsistence, as documented by research from Blue Ventures and IOM. This influx creates a paradox where traditional fishers simultaneously migrate away from their home villages due to resource depletion, while newcomers with no fishing tradition settle in coastal areas, increasing exploitation pressure (Blue Ventures/IOM). The result is a five-fold increase in fishing populations in some coastal areas since 1975, accelerating ecosystem degradation and reducing the resilience of coastal communities

to climate shocks (Blue Ventures/IOM). These dynamics are particularly pronounced in Atsimo-Andrefana, where recurrent drought conditions drive population movements toward coastal areas, and in Menabe, where increased settlement along coastal zones is accelerating ecosystem degradation and resource competition.

2. Socioeconomic marginality

Coastal communities face extreme multidimensional poverty, with 75.2 percent of the national population living below the poverty line, while rural poverty rates reach 79.9 percent and urban poverty has risen to 55.5 percent (World Bank, 2024). At the lower-middle-income poverty line ($3.65/day, 2017 PPP), poverty affects 92.6 percent of the population, reflecting widespread deprivation across multiple dimensions (World Bank, 2024).

Poverty is closely linked to the near-total informalization of employment. According to the IMF (2024) approximately 95 percent of total employment is informal, with women disproportionately represented: 97 percent of employed women work in informal production units compared to 94 percent of men. Despite a high female labor force participation rate of approximately 82 percent (World Bank, 2024), women remain concentrated in low-productivity activities, particularly subsistence agriculture, family labor, and micro-scale trading. Earnings disparities also persist: World Bank analysis of recent household survey data indicates a substantial gender wage gap, with women earning significantly less than men on average.

The predominance of informal, cash-based economic activity limits access to social protection, credit, and insurance mechanisms. In coastal regions where seaweed farming and small-scale fisheries are key livelihood sources, income volatility, climate shocks, and limited access to financial services heighten household vulnerability. During lean seasons, coping strategies may include asset depletion or increased pressure on natural resources, exacerbating environmental stress.

These vulnerabilities are stratified by gender and age. Women and youth, while forming a significant share of the labor force, typically control fewer productive assets, shoulder disproportionate unpaid care responsibilities, and face greater barriers to formal finance and safety nets. As a result, climate-related shocks and economic disruptions disproportionately affect them.

3. Ecosystem degradation

In coastal production systems, mangroves also play an important role in creating safer and more productive conditions for nearshore aquaculture activities, including seaweed cultivation, reducing storm impacts, and stabilizing shallow coastal environments where seaweed farms are typically located. Despite their importance, Madagascar's mangroves have experienced significant degradation over recent decades, with net losses recorded between the mid-1990s and 2016, driven primarily by unsustainable wood extraction for charcoal, fuelwood and timber, as well as conversion of mangrove areas for agriculture and other land uses (Erftemeijer & de Boer, 2022). While targeted restoration efforts since 2016 have resulted in localized recovery in some areas, ongoing pressures continue to undermine mangrove resilience, particularly in the context of sea level rise, increasing cyclone intensity, and altered sediment dynamics.

Mangrove degradation can negatively affect adjacent seaweed farming areas by increasing exposure to storm surge, altering nearshore water quality through increased sedimentation, and reducing overall coastal ecosystem health that supports stable seaweed growth. Degraded mangroves are less able to keep pace with sea level rise or provide effective buffering against extreme weather events, increasing

exposure of coastal communities to flooding and erosion. Strengthening mangrove protection, restoration, and community-based management is therefore essential for sustaining ecosystem-based adaptation and enhancing climate resilience and productivity of seaweed-based livelihoods.

4. Market concentration and monopsony pricing power
The seaweed export market is dominated by a handful of large trading companies that operate as monopsony buyers, dictating farm-gate prices without transparency or long-term contracts. Producers lack bargaining power or alternative buyers, forcing them to accept volatile spot prices that can drop 40–50% seasonally. This price instability drives overproduction during market highs (overburdening ecosystems) and desperation harvesting during price crashes, irrespective of climate conditions.

Key Barriers

1. High exposure to climate shocks and limited risk management mechanisms

Coastal seaweed farming communities face escalating cyclone intensity, ocean acidification, and unpredictable weather patterns that devastate production cycles, yet lack access to early warning systems, climate-adaptive techniques, or financial safety nets (insurance, savings) to buffer these shocks. This forces households into distress sales of assets or destructive coping strategies, such as mangrove cutting for quick income, during climate emergencies, perpetuating cycles of poverty and ecosystem degradation.

2. Limited access to finance, processing infrastructure, and markets

Small-scale producers, particularly women and youth, are excluded from formal financial services due to lack of collateral and remoteness. The absence of basic cold chain infrastructure, inadequate drying facilities, and rudimentary processing techniques result in 30–40% post-harvest losses that are entirely preventable through better technology, not climate adaptation. These losses represent wasted income that could otherwise buffer households against shocks, but the capital requirements for solar dryers or storage facilities are prohibitive under current credit constraints, locking communities into low-efficiency production systems, dependent on volatile international spot markets with no bargaining power or stable offtake agreements.

3. Weak domestic value addition and quality standards

The seaweed sector operates almost exclusively in raw dried biomass exports with minimal processing, capturing very minimal of final product value and missing high-growth markets for bio-stimulants, hydrocolloids, and climate-friendly fertilizers. Absence of recognized quality, safety, and traceability standards (organic, fair-trade) excludes producers from premium markets.

4. Fragmented governance and limited cross-sector coordination

Responsibility for coastal zones is split across ministries (Fisheries, Environment, Land Use, Finance) with often overlapping regulations, mandates, and no integrated spatial planning tools, resulting in unclear tenure rights and ad-hoc coastal development.

5. Insufficient data, learning, and evidence to inform policy and scaling

Critical knowledge gaps exist regarding blue carbon sequestration potential of mangrove restoration, cost-effectiveness of ecosystem-based adaptation versus hard infrastructure, and gender-differentiated climate impacts in seaweed value chains. Without systematic monitoring, documented business cases, or knowledge exchange platforms, successful interventions cannot be effectively replicated, adaptive management is challenging, and Madagascar lacks the evidence base to access additional climate finance or update NDC/NAP commitments effectively.

6. Gendered structural barriers

Women constitute the majority of seaweed farmers and post-harvest workers yet remain concentrated in the lowest-value segments of the value chain, excluded from decision-making in producer organizations, and denied access to credit due to lack of collateral and legal barriers to asset ownership. Their disproportionate burden of unpaid care work limits mobility and time for training, while restrictive social norms and safety concerns constrain their participation in market transactions and leadership roles. This structural exclusion prevents women from upgrading to higher-value processing and trading activities, leaving them disproportionately exposed to climate and price shocks with fewer adaptive resources.

Rationale for Selected Adaptation Solutions

The following solutions have been selected specifically to address the climate hazards and trends identified above:

Addressing the Modest Scenario (Current Climate Emergency)

Component 1: Climate-Resilient Production and Ecosystem-Based Adaptation
The 2.6-meter storm surges documented during Cyclone Batsirai (2022) physically destroy off-bottom cultivation infrastructure, lines, anchors, and seedling stocks, causing total crop loss and preventing recovery for subsequent growing cycles. To address this, Output 1.1.1 (Climate-resilient techniques) demonstrates and adopts deep-water cultivation lines and Integrated Multi-Trophic Aquaculture (IMTA) systems that are mechanically secured against wave action and positioned to reduce surge exposure. These techniques target 3,000 producers (60% women), directly addressing the gender-differentiated asset loss documented in the 2022 events, where women producers lacking secure infrastructure experienced disproportionate recovery delays.

The 48-72 hour early warning gap currently prevents harvest-timing adjustments that could save crops from impending storm surges. Output 1.1.2 (Digital climate information services) establishes SMS/WhatsApp and community radio systems providing seasonal outlooks, 48-hour storm alerts, and guidance on planting/harvesting windows. This directly addresses the '18-day gap' between Batsirai and Emnati in 2022, when farmers had no mechanism to harvest vulnerable crops before the second surge hit.
The 115,000 ha of cyclone-damaged cropland in 2022 created immediate food security crises that drove mangrove charcoal production as a coping mechanism. Output 1.2.3 (Nature-based jobs) creates alternative income streams through restoration teams (60% women, 40% youth) trained in nursery management and ecosystem monitoring, providing immediate livelihood replacement that prevents mangrove exploitation during recovery periods.

Component 2: Inclusive Value Chain Development
The 20% post-harvest losses during rainy seasons (World Bank, 2024) represent wasted income that could buffer households against cyclone shocks. Component 2 establishes community-level processing

facilities with solar drying infrastructure and climate-resilient design (Output 2.1.1), directly addressing the 'inadequate drying infrastructure' cited in FAO (2024). By reducing these losses, households retain asset value for reinvestment rather than distress sales during recovery.

Component 3: Enabling Environment and Financial Resilience
The USD 657 million economic losses from the 2022 cyclone series demonstrated that current financial systems cannot absorb climate shocks. Output 3.1.3 (Community-based climate risk finance) pilots emergency funds with transparent governance and shock-trigger disbursement rules synchronized with seaweed harvest cycles. This specifically prevents the 'asset depletion cycle' where farmers sell productive capital (or cut mangroves for charcoal) to finance recovery, ensuring the 400–600 targeted MSMEs can resume operations within one growing season rather than collapsing permanently.

Component 5: Monitoring, Evaluation and Learning (MEL)
Given that current climate variability already exceeds adaptation thresholds (Modest Scenario), and 2050 projections suggest existential threats (High Scenario), static project designs will rapidly become obsolete. Component 5 institutionalizes adaptive management through real-time monitoring of Core Indicators (60,000 beneficiaries, 6,000 ha managed, 3,000 trained) and qualitative resilience metrics (shock recovery times, mangrove survival rates under heat stress, climate information service usage rates).

Output 5.1.1 (MEL systems) enables course correction: if early-warning systems show low adoption among women producers (threatening the 60% target), Component 4 adjusts knowledge products; if mangrove nurseries show 50% mortality during marine heatwaves (threatening Output 1.2.1), Component 1 adjusts species selection. This iterative learning is essential for maintaining project relevance as the Modest Scenario intensifies toward High Scenario conditions during the project lifespan (2026–2031).

Addressing the High Scenario (2050 Existential Threats)

Marine Heatwave Adaptation (Component 1)
The 30–60 fold increase in marine heatwave likelihood and lethal temperatures of 36–40°C for Kappaphycus alvarezii (PMC, 2020) threaten total species failure in traditional growing areas. While Output 1.1.1 includes climate-resilient strain development (tissue culture for heat-tolerant genotypes), the project recognizes that long-term biological adaptation requires complementary physical protection. The 2,500 ha mangrove restoration (Output 1.2.1) provides shading and evaporative cooling that can reduce intertidal water temperatures by 2–3°C during peak heat events, potentially keeping thermal stress below the 32°C 'ice-ice' disease threshold.

Storm Surge Amplification (Components 1 & 3)
The projection of routine 3+ meter surges by 2050 (versus 2.6m in 2022) combined with 22 cm sea-level rise eliminates the safety margin of current coastal protection. The 2,500 ha mangrove restoration is explicitly designed to address this amplification: mangroves reduce surge height by 4–16.5 cm per 50 m–2 km width of forest and can prevent months of lost productivity (World Bank, 2019). At scale, this creates a 'surge attenuation buffer' that maintains the 2.6-meter effective impact level even as open-ocean surges increase to 3+ meters.

The Compound Event Cascade (Components 1–4)

The most dangerous High Scenario outcome—simultaneous thermal stress and physical destruction—requires integrated responses. When heat-stressed thalli (above 32°C) encounter storm surges, the structural weakening causes total biomass loss rather than recoverable damage. The project addresses this through:
Component 1: Heat-tolerant strains + mangrove shading (reducing thermal stress)
Component 2: Diversified bio-stimulant products (Output 2.2.1) providing income streams when carrageenan seaweed fails, preventing total income collapse

Component 3: Shock-responsive finance (Output 3.1.3) enabling immediate replanting with resilient materials rather than asset liquidation

Component 4: Knowledge exchange with UNGSI (Output 4.1.3) accessing global innovations in heat-adaptive aquaculture from comparable Indian Ocean contexts

Component 5: Real-time tracking of compound event impacts to trigger adaptive management before total system collapse

Ecosystem-Based Adaptation as Climate Infrastructure (Component 1)
The 50% carbon sequestration loss and root integrity degradation in mangroves during severe heatwaves (WWF, 2023) creates a dangerous feedback loop: degraded buffers expose farms to unattenuated wave energy, converting moderate surges into destructive forces. The 2,500 ha restoration (Output 1.2.1) is designed as 'climate infrastructure' that functions under both Modest and High Scenarios—maintaining protective function even as individual trees experience heat stress, through diversified age structures and species mixes that ensure continuous canopy coverage.

Knowledge, Scaling and Systemic Resilience (Components 4 & 5)
The fivefold increase in cyclone damages projected by 2050 (World Bank, 2023) exceeds the absorptive capacity of any single project. Component 4 (Output 4.1.2) documents the cost-effectiveness of EbA-Value Chain integration, while Component 5 provides the evidence base (Output 5.1.1) to demonstrate which interventions work under which climate conditions. The blue carbon assessment (Output 3.1.4) strengthens national MRV systems to support Madagascar's NDC2 commitment to 170,000 ha mangrove restoration, positioning the 2,500 ha project as a scalable model.

Resilience Outcome
Together, these interventions create adaptive capacity rather than fixed defenses: producers adjust techniques as temperatures rise (Component 1), financial mechanisms absorb shock without asset depletion (Component 3), ecosystem-based adaptation maintains protective function across scenarios (Component 1), knowledge systems enable scaling (Component 4), and MEL ensures continuous calibration to evolving climate hazards (Component 5). This ensures project outcomes remain effective under uncertainty, transforming the baseline from a trajectory toward collapse (High Scenario without intervention) to managed resilience (High Scenario with project support).

Describe the objective of the project, and the justification
The project will target priority coastal districts within Analanjirofo, Diana, Melaky, Menabe, and Atsimo-Andrefana regions—areas selected in consultation with the BNCCC for their concentration of acute climate vulnerability, including exposure to cyclones, storm surges and changing ocean conditions, and private seaweed operators. These regions form Madagascar's principal seaweed producing coastal belt and include nearshore production areas. Mangrove ecosystems in these districts provide essential

coastal protection and fisheries nursery functions, yet face increasing pressure from fuelwood harvesting and charcoal production, particularly during periods of income shortfall following climate shocks. Specific communes will be prioritized during the PPG phase to ensure the fixed GEF budget delivers meaningful, concentrated impact.

Project Objective
The objective of the project is to reduce climate vulnerability and strengthen adaptive capacity of coastal communities in Analanjirofo, Diana, Melaky, Menabe, and Atsimo-Andrefana regions by promoting climate resilient seaweed production systems, ecosystem-based adaptation through mangrove restoration, and diversified livelihood pathways.

Justification
Madagascar's coastal communities operate within a highly climate-sensitive socio-ecological system characterized by widespread poverty, limited livelihood diversification, weak value addition, and accelerating ecosystem degradation. While seaweed farming represents the dominant aquaculture activity by volume, its concentration in raw material exports generates low economic returns and leaves producers highly exposed to climate shocks, market volatility, and environmental stress. When climate events damage seaweed farms and fisheries, households often resort to environmentally harmful coping strategies, particularly mangrove harvesting for charcoal, further weakening natural coastal defenses and increasing long-term vulnerability.

Climate change acts as a threat multiplier in this context, intensifying cyclones, marine heat stress, and coastal erosion, while institutional, financial, and technological constraints limit adaptive capacity. At the same time, global demand for diversified and climate-friendly seaweed-based products is expanding rapidly, presenting a strategic opportunity to increase domestic value capture, create resilient livelihoods, and align economic incentives with ecosystem protection.

To this end, addressing coastal vulnerability requires an integrated, system-level approach that simultaneously strengthens climate-resilient production, restores and protects coastal ecosystems, upgrades value chains, and improves the enabling policy and financial environment. By combining ecosystem-based adaptation with inclusive enterprise development, financial resilience mechanisms, and knowledge and policy support, the project targets the root drivers of environmental degradation rather than their symptoms. This integrated approach is expected to generate durable climate, biodiversity, and socioeconomic benefits, while providing a scalable model for sustainable blue economy development in Madagascar and other climate-vulnerable coastal contexts.

Narrative 1: Business-as-Usual

Under a business-as-usual trajectory, population growth, climate change, and limited economic diversification continue to place increasing pressure on Madagascar's coastal systems. Seaweed production remains concentrated in low-value raw material exports, with little investment in climate-resilient practices, local processing, or market diversification. Although seaweed dominates aquaculture production by volume, weak domestic value addition limits income gains for producers and discourages reinvestment and innovation, particularly among small-scale producers, including women and youth engaged in primary production and post-harvest activities.

Private sector engagement in the coastal economy remains low and largely transactional. High exposure to climate shocks, uncertain supply volumes, weak infrastructure, and limited access to climate and market

information reduce incentives for long-term investment in production, processing, and downstream products. These constraints are more pronounced for small and emerging enterprises, including those led by women and youth, reinforcing the persistence of low-value export models.

As climate shocks such as cyclones, storm surges, and marine heat stress events become more frequent and severe, seaweed farms and coastal infrastructure suffer repeated damage. Without access to savings, insurance, or recovery finance, households are unable to repair assets or invest in improved production practices. Vulnerable households, including poorer families and youth with limited employment alternatives, tend to experience the greatest and most persistent income losses following shocks.

Governance and institutional constraints further entrench this trajectory. Responsibilities for aquaculture, fisheries, forestry, land use, and environmental protection are spread across multiple institutions with limited coordination and enforcement capacity. Community-based management initiatives exist but are often under-resourced and weakly linked to market incentives or sustainable financing, limiting inclusive participation in coastal resource governance.

As ecosystem services decline, climate impacts intensify further, reinforcing a negative feedback loop in which environmental degradation, livelihood insecurity, and climate vulnerability mutually reinforce one another. Over time, coastal livelihoods become increasingly precarious, private investment remains deterred, and the scope for adaptive and inclusive responses narrows.

Narrative 2: Partial Adaptation

In a partial adaptation scenario, incremental improvements are introduced in seaweed production and coastal ecosystem management, but key structural constraints remain unresolved. Some seaweed farmers adopt improved farming practices and benefit from localized restoration efforts, which temporarily reduce climate-related losses in targeted areas. Access to basic climate information improves short-term decision-making, helping producers adjust planting and harvesting cycles.

However, seaweed value chains remain largely unchanged. Limited investment in processing, product diversification, and quality upgrading means that most production continues to be exported as low-value raw material. Private sector engagement remains cautious, constrained by climate risk, uneven supply, and weak enabling conditions. As a result, income gains are modest and uneven, and many small-scale producers—particularly those with limited assets—remain vulnerable to market and climate shocks.

Ecosystem restoration and management efforts deliver localized benefits but are not sufficiently scaled or sustained to reverse broader trends of ecosystem degradation. Mangrove pressure declines in some locations but persists elsewhere as households continue to rely on charcoal and fuelwood during periods of economic stress. Governance improvements occur in pockets, but coordination across sectors and levels remains limited.

Overall, this scenario delivers incremental resilience gains but does not fundamentally alter the underlying development pathway. Coastal livelihoods are somewhat more stable than under a business-as-usual trajectory, yet the system remains fragile. Future climate shocks or market disruptions risk eroding progress, highlighting the limits of partial adaptation in the absence of deeper value chain transformation, financial resilience, and enabling policy reforms.

Narrative 3: Transformational Pathway

In a transformational scenario, coordinated interventions address multiple, interlinked drivers of vulnerability across production systems, ecosystems, markets, and governance. Seaweed producers progressively adopt climate-resilient farming practices supported by accessible digital climate information services, improved extension support, and demonstration of adaptive techniques. These measures reduce sensitivity to climate variability, stabilize production, and improve planning at the farm and community levels.

At the same time, ecosystem-based adaptation restores and protects mangroves and other coastal ecosystems, strengthening natural coastal defenses against storm surges and erosion while enhancing ecosystem services such as nursery habitats and water quality. By linking restoration efforts with livelihood incentives and community-based management, ecosystem recovery becomes both environmentally and economically sustainable.

Value chain upgrading shifts the sector away from exclusive reliance on low-value raw material exports toward diversified, higher-value seaweed-based products. Investments in post-harvest handling, processing, quality standards, and market linkages increase domestic value capture and create more stable employment and enterprise opportunities, including for small-scale producers and emerging entrepreneurs. As incomes become less volatile and more predictable, households are better positioned to invest in improved production and sustainable practices.

Improved access to savings, emergency recovery finance, and risk management mechanisms strengthen financial resilience at household and enterprise levels. Following climate shocks, producers are able to repair assets and resume production without resorting to environmentally damaging coping strategies such as mangrove harvesting. This financial stability reduces risk aversion and encourages longer-term planning and private investment.

Governance, policy coherence, and investment planning improve as evidence on ecosystem services and blue carbon co-benefits informs decision-making. Strengthened coordination across aquaculture, fisheries, forestry, and environmental institutions reduces fragmentation and supports an enabling environment for responsible private sector engagement. Over time, these conditions attract increased investment in climate-resilient coastal value chains and facilitate scaling beyond pilot interventions.

As livelihoods stabilize and ecosystems recover, pressure on mangroves declines, reinforcing positive feedback loops between economic security, ecosystem health, and climate resilience. Over time, the coastal system transitions toward a sustainable blue economy pathway characterized by adaptive capacity, inclusive growth, and reduced vulnerability to climate shocks. This pathway enhances the ability of coastal communities and ecosystems to absorb disturbances and adapt to an uncertain climate future.

Alignment with National and Global Priorities

National Policy/Framework	Key national Priorities/Objectives	Project Contribution/Alignment	Relevant Component (s)

Nationally Determined Contribution (NDC2) (Updated Jan 2024)	• Reduce GHG emissions by 28% by 2030 • Restore 170,000 ha degraded mangroves Triple marine protected areas • Blue Economy as priority sector • Strengthen land-based carbon sinks	• 2,500 ha mangrove restoration (contributing to 170k target) • 3,500 ha marine habitat under improved management • Climate-resilient seaweed aquaculture (Blue Economy priority) • Blue carbon assessment strengthening MRV for NDC reporting	1, 2, 3
National Adaptation Plan (NAP) *May 2022*	• Prioritize ecosystem-based adaptation in coastal zones • Climate-resilient fisheries and aquaculture • Strengthen adaptive capacity of vulnerable communities	• EbA through 2,500 ha mangrove restoration • Climate-resilient seaweed • aquaculture • Coastal community • resilience and disaster risk reduction • Integration of adaptation • into sectoral planning	1, 2, 3
Blue Economy Strategy	• Sustainable blue economy development • Marine resource valorization and private sector engagement • Sustainable aquaculture and fisheries value chains • Conservation and sustainable use of marine ecosystems	• Seaweed value chain transformation and diversification • Blue enterprises and MSME development • Sustainable aquaculture practices (IMTA) • Ecosystem protection linked to economic incentives	1,2,3

The National Strategy for Aquaculture Development in Madagascar (SNDAM) 2024-2030	• Promote sustainable aquaculture as economic pillar • Create Zones *d'Émergence Piscicoles (Create Fish Farming Development Zones)* • Align with Initiative *pour l'Émergence de Madagascar (Align with the Madagascar Emergence Initiative)* • Sustainable seaweed/shrimp farming	• Climate-resilient seaweed farming techniques • *Blue enterprises* and MSME creation • Quality standards and certification • Integration with fisheries zones	1, 2
Politique Générale de l'État 2024-2028 (PGE 2024-2028)	• Accelerate sustainable economic growth and structural transformation • Strengthen resilience to climate change and environmental sustainability • Promote inclusive development and decent employment • Enhance private sector competitiveness and MSME development • Develop blue economy and sustainable aquaculture	• Value chain transformation and industrialization of seaweed sector • Climate-resilient livelihoods and ecosystem-based adaptation • Blue enterprises and MSME development (women/youth-led) • Sustainable aquaculture contributing to economic diversification	2, 3
Fisheries and Aquaculture Code *(Law No. 2015-053)* *Code de la Pêche et de l'Aquaculture* *(Loi n° 2015-053)*	• Sustainable management of fisheries • Aquaculture regulation and zoning • Environmental protection in coastal areas	• Regulatory framework for seaweed aquaculture licensing • Spatial planning for sustainable production • Compliance with environmental standards	3

Kunming-Montreal GBF Targets *(Global Biodiversity Framework)*	• Target 2: Restore 30% degraded areas • Target 3: Protect 30% of planet • Target 19: Mobilize financial resources • Target 23: Gender equality	• 2,500 ha restoration (Target 2) • 3,500 ha improved management (Target 3) • Innovative finance mechanisms (Target 19) • 60% women beneficiaries (Target 23)	All
SDG Alignment *(Madagascar SDG Priorities)*	• SDG 1: No Poverty • SDG 5: Gender Equality • SDG 8: Decent Work • SDG 13: Climate Action • SDG 14: Life Below Water	• Income stabilization and diversification (SDG 1, 8) • Women's economic empowerment (SDG 5) • Climate resilience (SDG 13) • Ecosystem restoration (SDG 14.2)	All
Sendai Framework for Disaster Risk Reduction 2015-2030 Global Framework	• Priority 1: Understanding disaster risk • Priority 2: Strengthening governance • Priority 4: Enhancing disaster preparedness • 'Build Back Better' in recovery	• Climate risk finance mechanisms (emergency funds) • Digital early warning systems for climate shocks • Ecosystem-based DRR (mangroves as natural barriers)	1, 3

NAP (2022): Madagascar's National Adaptation Plan (submitted May 29, 2022) prioritizes ecosystem-based adaptation in coastal zones and climate-resilient fisheries. This project's EbA approach through mangrove restoration and climate-adaptive aquaculture aligns with the NAP's priority sectoral actions.

NBSAP Update: Madagascar is currently updating its NBSAP to align with the Kunming-Montreal Global Biodiversity Framework (GBF). The project contributes to GBF Target 2 (Restoration), Target 3 (Conservation), Target 10 (Sustainable Aquaculture), and Target 23 (Gender Equality).

Blue Economy Policy: The National Blue Economy Policy and National Blue Economy Strategy establishe the foundation for Madagascar's blue economy development, emphasizing ecosystem preservation as prerequisite to exploitation. This project's integration of mangrove conservation with seaweed value chain development operationalizes this policy directives.

Justification for Project Choice and Enduring Impact

This project has been selected because it addresses the key drivers of environmental degradation and climate vulnerability in Madagascar's coastal zones in an integrated manner. Other potential options were considered but assessed as insufficient to deliver lasting change. Stand-alone ecosystem restoration would improve coastal habitats but would not reduce livelihood vulnerability or the economic drivers that lead households to exploit mangroves during climate and income shocks. Short-term livelihood or cash-based support could temporarily stabilize incomes but would not build adaptive capacity or address exposure to climate risks. Production-focused interventions alone, such as improving seaweed farming techniques without value chain upgrading or financial resilience, would leave producers vulnerable to market volatility and climate shocks. Market or private-sector-led approaches without ecosystem and governance support would risk increasing environmental pressure and exclude small-scale and vulnerable producers.

This project was therefore selected because it combines climate-resilient seaweed production, ecosystem-based adaptation, value chain diversification, financial resilience, and enabling policy support to address the interacting drivers of degradation and vulnerability simultaneously. Seaweed-based livelihoods provide an appropriate entry point because they are widely practiced, climate-exposed, and closely linked to coastal ecosystem health.

The project's outcomes are designed to endure under future uncertainty by strengthening adaptive capacity rather than relying on fixed solutions. Climate-resilient practices and climate information services enable producers to adjust to changing conditions. Ecosystem-based adaptation strengthens natural coastal defenses that continue to function under a range of climate scenarios. Value chain diversification reduces dependence on a single product or market, increasing economic flexibility. Financial resilience mechanisms support recovery from shocks without environmentally damaging coping strategies. Strengthened policy, governance, and knowledge systems enable continued learning, investment, and scaling, ensuring that project outcomes remain effective as climate, market, and demographic drivers evolve.

B. PROJECT DESCRIPTION

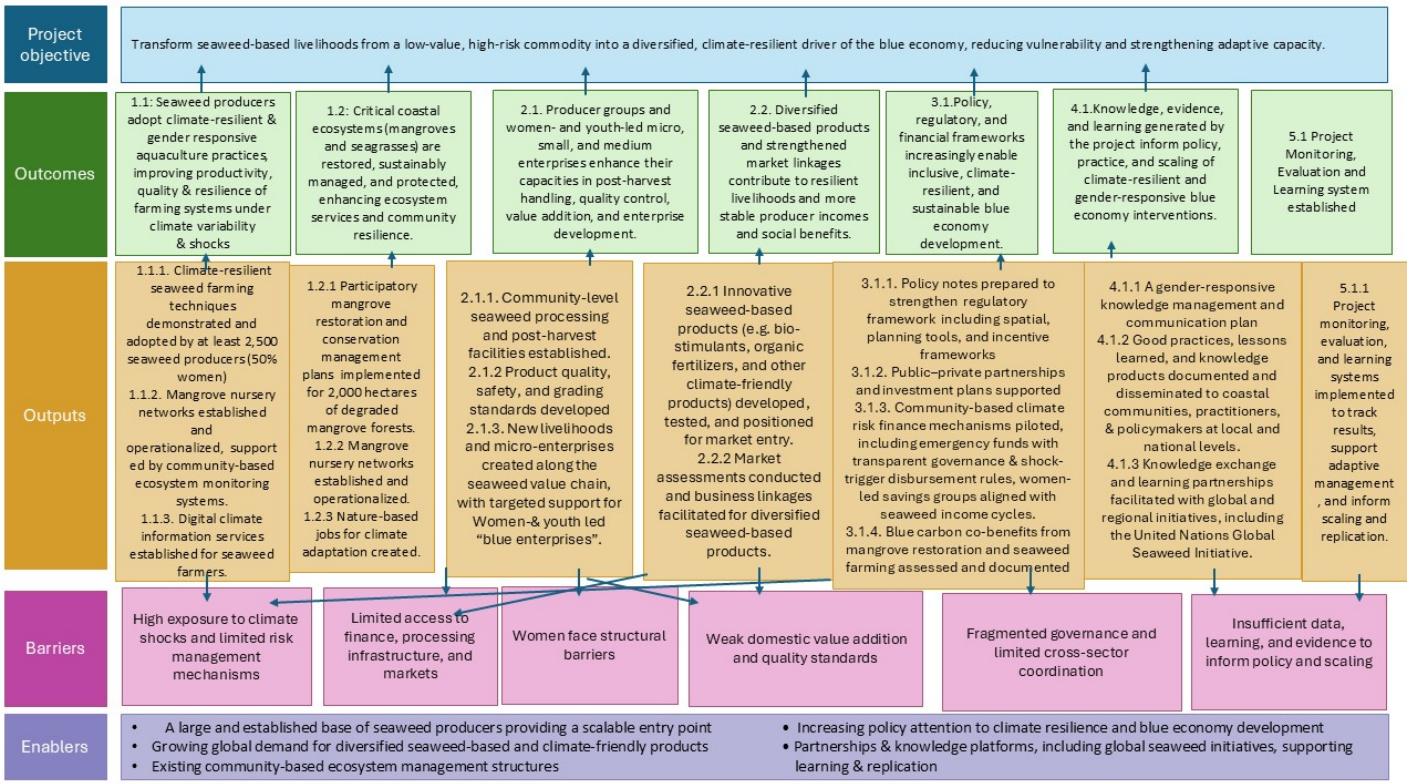
Project description

This section asks for a theory of change as part of a joined-up description of the project as a whole. The project description is expected to cover the key elements of good project design in an integrated way. It is also expected to meet the GEF's policy requirements on gender, stakeholders, private sector, and knowledge management and learning (see section D). This section should be a narrative that reads like a joined-up story and not independent elements that answer the guiding questions contained in the PIF guidance document. (Approximately 3-5 pages) see guidance here

The theory of change is grounded in the premise that coastal communities in Analanjirofo, Diana, Melaky, Menabe, and Atsimo-Andrefana regions face escalating climate risks including cyclones, storm surges, and ocean variability that undermine seaweed production systems, damage coastal ecosystems, and erode household resilience. Specific districts and communes within these regions will be prioritized during the PPG phase jointly with national counterparts, and selected based on climate risk exposure, level of ecosystem degradation, tenure readiness and existence of private operators working in the seaweed sector. If climate change exposed livelihood systems are strengthened through adaptive production practices, ecosystem based coastal protection, diversified income streams, and accessible financial risk mechanisms, then household sensitivity to climate shocks will decrease and long-term adaptive capacity will increase.

If the project strengthens the adaptive capacity of 60,000 coastal community members—particularly women and youth—through climate-resilient farming techniques, digital climate information services, and restored mangrove buffers (Component 1); informed by traditional ecological knowledge and customary governance systems that enhance local legitimacy and effectiveness of adaptation measures; and if it simultaneously upgrades post-harvest infrastructure, establishes quality standards, and diversifies into higher-value seaweed-based products that stabilize incomes against climate and price shocks (Component 2); and if it embeds these economic gains within coherent policy frameworks and community-based financial resilience mechanisms that prevent distress sales of natural capital during emergencies (Component 3); and if knowledge and evidence generated are systematically captured and exchanged to inform adaptive management and national policy (Component 4); then the project will achieve a shift from environmentally degrading coping strategies toward sustainable blue economy pathways.

This shift delivers Global Environmental Benefits through the restoration and sustainable management of 2,500 hectares of mangrove ecosystems (enhancing biodiversity, fisheries nurseries, and blue carbon sequestration) and improved management of 3,500 hectares of marine habitat (Core Indicator 2: Area of land and coastal ecosystems managed for climate resilience), while enhancing biodiversity, fisheries nurseries, and blue carbon sequestration. Adaptation benefits manifest as reduced climate vulnerability for 60,000 direct beneficiaries (Core Indicator 1) (60% women) coastal households who can anticipate shocks, recover without depleting natural capital, and capture greater value from sustainable production. The project strengthens systemic resilience by informing 5–7 national and sub-national policies, plans, and regulatory instruments to strengthen climate adaptation (Core Indicator 3), while building human capacity through training 3,000 people trained in climate-resilient practices (Core Indicator 4) (60% women, 30% youth). By engaging 400–600 private sector enterprises engaged in climate change adaptation and resilience actions (Core Indicator 5), including MSMEs, cooperatives, and women-led 'blue enterprises', the project ensures outcomes remain effective under uncertain future climate scenarios, creating a replicable model for coastal resilience across the Western Indian Ocean.



Achieving Outcome 1.1 will reduce the sensitivity of seaweed production systems to climate variability through improved practices, access to climate information, and demonstration of adaptive techniques. Achieving Outcome 1.2 will restore and protect mangroves, strengthen natural defenses and reduce reliance on environmentally damaging coping strategies. Through Outcome 2.1 and Outcome 2.2, value chain upgrading, diversification, and market linkages will increase domestic value capture and income stability, reducing vulnerability to climate and price shocks. Outcome 3.1 will improve the enabling environment by strengthening policy coherence, investment planning, and financial resilience mechanisms, allowing households and enterprises to recover from shocks without depleting natural capital and encouraging responsible private sector engagement. Outcome 4.1 will ensure that lessons learned and evidence inform adaptive management, policy development, and scaling beyond the project. Together, these outcomes shift the baseline from a low-value, high-risk, and environmentally degrading pathway toward a more resilient, inclusive, and investable coastal development trajectory.

Description of Components

Component 1: Climate-Resilient Seaweed Production and Ecosystem-Based Adaptation

Barrier Addressed:
High exposure to climate shocks and limited risk management mechanisms; limited coastal ecosystem monitoring and management capacity at the local level; and weak integration between livelihood systems and natural resource management.

Outcome: 1.1: Seaweed producers adopt climate-resilient and gender responsive aquaculture practices, improving productivity, quality and resilience of farming systems under climate variability and shocks. (targeting 3,500 ha of marine habitat under improved practices).

Outcome 1.2: Critical coastal ecosystems (mangroves and seagrasses) are restored, sustainably managed, and protected, enhancing ecosystem services and community resilience. (2,500 hectares of mangrove ecosystems)

Description of Interventions:
This component addresses the foundational vulnerabilities of Madagascar's coastal zones by integrating climate-resilient production with ecosystem-based adaptation (EbA). Recognizing that seaweed farmers operate at the frontline of climate impacts—facing intensifying cyclones, ocean acidification, and unpredictable weather patterns—the component establishes a dual-track approach that simultaneously fortifies livelihood assets and the natural capital upon which they depend.

The intervention logic follows a sequenced approach: first, demonstrating and disseminating climate-resilient seaweed farming techniques (including improved hatchery management, diversified seed stock, and climate-adaptive post-harvest handling) to reduce production sensitivity as well as testing the application of sustainable cultivation materials including biodegradable materials and natural fibres (e.g. bamboo) to reduce potential (micro)plastic pollution; second, establishing community-based climate information services that bridge the gap between meteorological data and local decision-making, establishing last-mile connectivity to national EWS, ensuring that cyclone alerts and extreme weather warnings from national meteorological services reach remote seaweed farming communities through low-tech digital platforms (SMS/WhatsApp, community radio) and community-managed relay systems; and third, linking these production improvements to mangrove restoration initiatives that provide physical protection against storm surges while generating alternative nature-based income streams. By embedding ecosystem

restoration within livelihood programming, the component ensures that mangrove conservation is not viewed as a restriction on resource use but as an investment in climate resilience that provides tangible economic returns through blue carbon potential, fisheries enhancement, and nature-based employment.

This component explicitly integrates Indigenous Peoples' and local communities' traditional ecological knowledge into climate adaptation interventions. Output 1.1.1 will incorporate traditional knowledge regarding seasonal planting calendars, lunar cycle indicators, wind pattern predictions, and traditional seed stock selection into climate-resilient farming demonstrations and training materials. Output 1.2.2 will establish community-based ecosystem monitoring systems that utilize traditional indicators of mangrove health (e.g., specific bird/fish species presence, traditional water quality indicators) alongside scientific metrics. Output 1.2.1 will recognize and map customary marine tenure areas (tanety or traditional fishing zones) within the 2,500ha restoration area to ensure mangrove restoration plans respect and strengthen traditional resource governance rather than override them.

Key Outputs: Under Outcome 1.1

Output 1.1.1: Climate-resilient and sustainable seaweed farming techniques demonstrated and adopted by at least 3,000 seaweed producers (60% women), including training on climate-adaptive cultivation methods, IMTA, seed banking, and post-harvest loss reduction.

Output 1.1.2: Digital climate information services established for seaweed farmers, including seasonal climate outlooks, storm alerts, guidance on planting and harvesting windows, and market price information through low-tech platforms (e.g. SMS/WhatsApp, community radio).

Output 1.1.3: Local adaptive capacity strengthened through the establishment of 30 community-managed disaster risk reduction committees equipped with contingency plans for climate shocks.

Key Outputs Under Outcome 1.2

Output 1.2.1: Participatory mangrove restoration and conservation management plans developed and implemented for 2,500 hectares of degraded mangrove forests, with clear tenure agreements and community stewardship protocols.

Output 1.2.2: Mangrove nursery networks established and operationalized, capable of producing 500,000 seedlings annually, supported by community-based ecosystem monitoring systems.

Output 1.2.3: Nature-based jobs for climate adaptation created, including restoration teams trained in nursery management, ecosystem monitoring, and coastal planning, with pathways for transition into longer-term roles such as eco-guards, technicians, and enterprise managers (targeting 30% youth and 60% women employment in restoration activities).

Component 2: Inclusive Value Chain Development, Livelihoods, and Market Diversification

Barrier Addressed:
Limited access to post-harvest infrastructure and processing facilities; weak quality standards and domestic value addition; exclusion of women and youth from higher-value segments; and over-dependence on single-product exports vulnerable to climate and market shocks.

Outcome 2.1: Producer groups and women- and youth-led micro, small, and medium enterprises enhance their capacities in post-harvest handling, quality control, value addition, and enterprise development.
Outcome 2.2: Diversified seaweed-based products and strengthened market linkages contribute to resilient livelihoods and more stable producer incomes and social benefits (targeting 400–600 MSMEs engaged in climate adaptation actions).

Description of Interventions:
This component transforms seaweed from a volatile commodity into a stable foundation for inclusive blue economic growth. Addressing current post-harvest losses of 30-40% due to inadequate drying infrastructure and unpredictable weather, the component establishes community-level processing facilities equipped with climate-resilient technologies (solar drying, proper storage) that extend product shelf life and enable quality consistency.

Recognizing that women dominate post-harvest activities but rarely capture value-added benefits, the component explicitly targets women-led 'blue enterprises' with business development services and technical training. Quality, safety, and grading standards are developed in alignment with international market requirements, enabling access to premium segments. Crucially, the component pilots innovative diversification into climate-friendly applications—specifically bio-stimulants and organic fertilizers that support climate-resilient agriculture while creating buffer income streams when traditional carrageenan markets fluctuate. Market assessments and facilitated business linkages ensure these diversified products reach viable buyers, stabilizing household incomes and reducing the need for environmentally damaging coping strategies during climate emergencies.

Component 2 also integrates traditional and local knowledge into value chain upgrading, recognizing that indigenous communities possess generations of expertise in seaweed processing, preservation, and local market dynamics. Output 2.1.2 (Quality standards) will incorporate traditional quality assessment methods (e.g., texture, color, and drying techniques traditionally used by women processors) alongside international organic/fair-trade certification requirements. Output 2.2.1 (Bio-stimulant development) will draw on traditional agricultural knowledge regarding organic fertilizers and soil amendments to inform product formulation.

Key Outputs under Outcome 2.1:

Output 2.1.1: Community-level seaweed processing and post-harvest facilities established or upgraded, incorporating climate-resilient design and renewable energy sources.
Output 2.1.2: Product quality, safety, and grading standards developed and adopted by producer organizations, aligned with international certification requirements (organic, fair trade).
Output 2.1.3: New livelihoods and MSMEs created along the seaweed value chain, with targeted training for women- and youth-led 'blue enterprises' in business management, financial literacy, and climate adaptation planning.

Key Outputs Under Outcome 2.2

Output 2.2.1: Innovative seaweed-based products (e.g., bio-stimulants, organic fertilizers, and other climate-friendly products) developed, tested, and positioned for market entry, providing income diversification against climate shocks.

Output 2.2.2: Market assessments conducted and business linkages facilitated for diversified seaweed-based products, establishing contractual relationships between producer cooperatives and commercial buyers.

Component 3: Enabling Environment, Financial Resilience, and Policy Support

Outcome 3.1: Policy, regulatory, and financial frameworks increasingly enable inclusive, climate-resilient, and sustainable blue economy development.

Description of Interventions:
This component addresses systemic governance fragmentation across fisheries, environment, and climate authorities that perpetuate vulnerability and unsustainable resource use. Recognizing that seaweed value chains operate within complex regulatory environments spanning aquaculture licensing, mangrove protection, and coastal land use, the component supports the development of coherent spatial planning tools and incentive frameworks that resolve policy contradictions and explicitly reward sustainable, climate-resilient practices.

To bridge the gap between community needs and commercial investment, the component facilitates structured public-private partnerships with clear benefit-sharing mechanisms and social safeguards, de-risking private sector engagement while ensuring local value capture. Understanding that climate shocks frequently force households to deplete assets or degrade ecosystems for emergency liquidity, the component pilots innovative community-based climate risk finance mechanisms—including emergency funds and women-led savings groups synchronized with the seasonal rhythms of seaweed harvests—to provide liquidity buffers that prevent distress sales and ecosystem clearing during crises.

Finally, the component strengthens Madagascar's position in climate finance architecture by assessing and documenting blue carbon co-benefits from mangrove restoration and sustainable seaweed farming, directly feeding this evidence into national Measurement, Reporting, and Verification (MRV) systems. This creates the evidentiary foundation for future climate finance access while explicitly avoiding carbon credit schemes that might compromise community resource rights or equitable benefit distribution.

Output 3.1.1 will integrate traditional governance systems (dina customary law, fokonolona community assemblies) and customary marine tenure (laman-jara, traditional fishing rights) into formal spatial planning tools and regulatory frameworks for sustainable seaweed production. This ensures that blue economy policies do not create conflicts with existing customary institutions but rather build upon them, creating hybrid governance models that are legally coherent and culturally legitimate.

Key Outputs under Outcome 3.1:

Output 3.1.1: Policy notes and recommendations prepared to strengthen enabling regulatory frameworks, including spatial planning tools and incentive frameworks for sustainable seaweed production and broader blue economy activities.
Output 3.1.2: Public–private partnerships and investment plans supported to advance sustainable seaweed enterprises and value chain development.
Output 3.1.3: Community-based climate risk finance mechanisms piloted, including emergency funds with transparent governance structures and shock-trigger disbursement rules, and women-led savings groups aligned with seaweed income cycles. Specific governance frameworks, fiduciary oversight mechanisms, and shock-trigger criteria will be developed during the PPG phase.

Output 3.1.4: Blue carbon co-benefits from mangrove restoration and seaweed farming assessed and documented to strengthen national MRV systems, inform policy development, and support future access to climate finance (without engaging in carbon credit sales).

Component 4: Knowledge Management, and Regional & Global Exchange

Outcome 4.1: Knowledge, evidence, and learning generated by the project inform policy, practice, and scaling of climate-resilient and gender-responsive blue economy interventions.

Description of Interventions:
This component ensures that project investments generate transferable knowledge and contribute to global learning on climate-resilient blue economies. Recognizing that adaptive management requires systematic documentation of what works, the component develops a gender-responsive knowledge management strategy that captures differential impacts on women and men across the value chain, ensuring that learning explicitly addresses barriers faced by women producers and entrepreneurs.

Additionally, particularly regarding the integration of ecosystem protection with economic upgrading, operationalization of climate-resilient business models, and community-based finance mechanisms—are documented in accessible formats for coastal communities, practitioners, and policymakers. The component leverages Madagascar's participation in the United Nations Global Seaweed Initiative (UNGSI) and other regional networks to share lessons on sustainable seaweed value chains and ecosystem-based adaptation, while absorbing relevant innovations from comparable contexts (Tanzania, Mozambique, Indonesia). This bidirectional knowledge flow ensures the project remains at the frontier of climate adaptation practice while contributing evidence to inform national NDCs, NAPs, and blue economy strategies beyond the immediate project sites.

Key Outputs under Outcome 4.1:

Output 4.1.1: A gender-responsive knowledge management and communication plan developed and implemented.
Output 4.1.2: Good practices, lessons learned, and knowledge products documented and disseminated to coastal communities, practitioners, and policymakers at local, national and regional levels.
Output 4.1.3: Knowledge exchange and learning partnerships facilitated with global and regional initiatives, including the United Nations Global Seaweed Initiative (UNGSI).

Component 5: Monitoring, Evaluation and Learning (MEL)
Outcome 5.1: Project Monitoring, Evaluation and Learning system established.

Description of Interventions:
This component institutionalizes rigorous accountability and adaptive management across all project interventions. Recognizing that climate adaptation requires iterative learning, the MEL system tracks both quantitative GEF Core Indicators and qualitative resilience metrics (adaptive capacity indices, ecosystem health trends, shock recovery times).
The system employs participatory monitoring approaches that engage community members, particularly women and youth, in data collection, ensuring reliable official statistics and ownership of results. Real-time monitoring of climate information service usage, processing facility performance, and ecosystem restoration survival rates enables rapid course correction. Terminal evaluations and learning reviews synthesize evidence on the cost-effectiveness of integrating ecosystem-based adaptation with value

chain development, providing practical guidance for scaling and replication in other coastal regions of Madagascar and the Western Indian Ocean.

Key Outputs under Outcome 5.1:

Output 5.1.1: Project monitoring, evaluation, and learning systems implemented to track results, support adaptive management, and inform scaling and replication.

Key Enablers supporting the Outcomes

- A large and established base of seaweed producers providing a scalable entry point (Outcome 1.1)
- Growing global demand for diversified seaweed-based and climate-friendly products (Outcome 2.2)
- Existing community-based ecosystem management structures (Outcome 1.2)
- Increasing policy attention to climate resilience and blue economy development (Outcome 3.1)
- Partnerships and knowledge platforms, including global seaweed initiatives, supporting learning and replication (Outcome 4.1)

1. Global Environmental Benefits (GEBs and five (5) LCDF Core Indicators)

The project will report progress exclusively against the five (5) LDCF Core Indicators. These represent the primary metrics for measuring Global Environmental Benefits and adaptation outcomes. All other environmental outcomes are treated as co-benefits.

Methodological Note: Indicative targets are calculated based on: (i) spatial analysis of degraded mangrove areas suitable for community-based restoration within the target regions; (ii) existing seaweed farming density and cooperative membership data from the Ministry of Fisheries; (iii) budget envelope constraints; and (iv) GEF/LDCF per-capita investment benchmarks for adaptation projects. Specific districts and beneficiary communities will be confirmed during the PPG phase through participatory mapping and feasibility studies.

- LDCF Core Indicator 1: Through strengthened seaweed value chains, establishment of climate information services for seaweed farmers, support for the creation of “Blue enterprises and new livelihood diversification opportunities, the project activities aim to directly benefit 60,000 people (60% women) in coastal communities across the prioritized districts within Analanjirofo, Diana, Melaky, Menabe, and Atsimo-Andrefana. The 60% women target reflects the high representation of women in the seaweed sector and aligns with GEF gender policy requirements.
- LDCF Core Indicator 2: Area of land and coastal ecosystems managed for climate resilience (Target: 6,000 hectares total, comprising:
    - (a) Area of land managed for climate resilience: 2,500 ha (mangrove ecosystems under restoration). The 2,500 ha restoration target represents concentrated, high-quality intervention feasible within the budget across selected districts, not full regional coverage. Mangrove restoration provides natural coastal defense against storm surges

and erosion (EbA), and provide important buffers for coastal communities and seaweed farms by reducing wave energy, protecting against storm surges, damage, and erosion.

- (b) Coastal and marine area managed for climate resilience: 3,500 ha (coastal and nearshore marine habitats under improved climate-resilient management): improved marine habitat management covers seaweed farming areas adopting climate-resilient practices (IMTA, climate-adaptive strains). Sustainable and climate-resilient seaweed farming provides significant environmental benefits, including absorbing excess carbon dioxide and nitrogen, improving water quality, and creating habitat for marine life thereby promoting biodiversity. Seaweed farms have the potential to reduce wave energy and storm surges, protecting coastlines from erosion.

- LDCF Core Indicator 3: Number of policies/plans/frameworks/institutions to strengthen climate adaptation (Target: 5–7 national and sub-national instruments): These include regulatory frameworks for seaweed aquaculture licensing, spatial planning tools for coastal zone management, blue economy strategies, and climate risk finance guidelines. The target reflects integration of project evidence (blue carbon assessments, EbA effectiveness data) into existing national planning instruments (NDC2, NAP, SNDAM).

- LDCF Core Indicator 4: Number of people trained or with awareness raised (Target: 3,000 people (60% women, 30% youth): Training targets climate-resilient farming techniques, post-harvest handling, business management for blue enterprises, and ecosystem monitoring. The sex-disaggregated targets ensure equitable capacity building for vulnerable groups who dominate the seaweed workforce but face structural barriers to skill acquisition.

- LDCF Core Indicator 5: Number of private sector enterprises engaged in climate change adaptation and resilience (Target: 400–600 MSMEs, cooperatives, and women-led 'blue enterprises'): This includes seaweed producer cooperatives, women/youth-led processing enterprises, and input suppliers adopting climate-resilient practices and quality standards. Engagement criteria will be defined during PPG to ensure enterprises are actively contributing to adaptation (e.g., processing climate-resilient products, participating in traceability pilots) rather than passive beneficiaries.

In addition, the broader coastal population of approximately 2.5 million people across Analanjirofo, Diana, Melaky, Menabe, and Atsimo-Andrefana regions will benefit indirectly from restored ecosystem services, including enhanced coastal protection from mangrove restoration, improved fisheries productivity, climate information dissemination, and seaweed value chain development. Specific districts for concentrated pilot interventions will be prioritized during PPG.

Indigenous Peoples/Traditional Knowledge Indicators

The following indicators are indicative commitments to ensure systematic tracking of Indigenous Peoples'/traditional fishers' capacity building, governance participation, and traditional knowledge integration. Specific targets, baselines, and measurement methodologies will be validated through consultation with Indigenous Peoples and traditional fishing communities during the Project Preparation Grant (PPG) phase. At minimum, the project will monitor: (i) integration of traditional ecological knowledge into climate adaptation practices; (ii) representation of Indigenous/local communities in governance structures; (iii) capacity building outcomes for traditional leaders and resource managers; and (iv) application of FPIC protocols in customary marine tenure areas.

Indicator	Target	Component	Measurement Method
Number of community-based monitoring systems integrating traditional ecological knowledge (TEK) indicators (e.g., traditional wind/seasonal calendars) alongside scientific metrics	10 systems established	1 (Output 1.2.2)	Quarterly review of monitoring protocols; documentation of TEK indicators used
Percentage of trained seaweed producers demonstrating application of climate-adaptive techniques that incorporate traditional knowledge (seed selection, lunar planting cycles)	70% of 3,000 trained producers (2,100 people)	1 (Output 1.1.1)	Field assessments; participatory evaluation surveys disaggregated by community
Existence of documented FPIC protocols and benefit-sharing agreements for mangrove restoration in customary marine tenure areas	5 agreements covering 2,500 ha	1 & 3 (Outputs 1.2.1, 3.1.1)	Legal documentation review; community verification
Number of policy notes referencing integration of customary governance systems (dina, fokonolona) into formal spatial planning	2 policy notes (Output 3.1.1)	3	Policy document analysis

Co-benefits

- **Blue Carbon Sequestration:** Mangroves and seaweed absorbs CO2 during growth. When biomass drifts to the deep ocean or is buried in sediment, it provides long-term carbon storage. The project seeks to document blue carbon co-benefits from mangrove restoration and sustainable seaweed farming, directly feeding this evidence into national Measurement, Reporting, and Verification (MRV) systems.

- **Ecosystem-Based Adaptation (EbA) as Climate Infrastructure:** By restoring mangroves as natural coastal defenses, the project provides storm surge protection and erosion control that substitutes for carbon-intensive hard infrastructure (seawalls, breakwaters).

Socio-Economic Benefits

- **Gender Equality:** Empowering women, through targeted support for women-led “blue enterprises”. 3,000 people (60% women), including seaweed producers, community members, and local stakeholders will be trained in climate-resilient livelihoods, ecosystem management, and adaptation practices.

Coordination and Cooperation with Ongoing Initiatives and Project.

Does the GEF Agency expect to play an execution role on this project?

If so, please describe that role here. Also, please add a short explanation to describe cooperation with ongoing initiatives and projects, including potential for co-location and/or sharing of expertise/staffing

Madagascar: GEF ID 9546 expanded and consolidated Madagascar’s national network of Marine Protected Areas (MPAs) and Locally Managed Marine Areas (LMMAs), developing management tools and OECM regulatory frameworks, and building capacities for inclusive governance and sustainable livelihoods. GEF ID 10575 enhances conservation, climate adaptation, and community resilience for climate-resilient coral reefs through knowledge building, inclusive governance, sustainable financing, and awareness, establishing a national hub under the Blue Economy Cluster in Madagascar.GEF ID 11802 builds directly on GEF-6 MPA foundations to operationalize legal recognition and sustainable financing for LMMAs across Diana, Manambolo-Tsiribihina, and Mahafaly seascapes for reef conservation and adaptation. This proposal complements all these initiatives by integrating climate-resilient aquaculture resources, mangrove restoration, and value chain diversification in overlapping regions (Analanjirofo, Diana, Melaky, Menabe, and Atsimo-Andrefana), enhancing LMMA community resilience through Ecosystem-based Adaptation (EbA) and climate finance without duplication (sharing coastal expertise, EbA practices, and livelihood strategies to support sustainable blue economy outcomes.

United Nations: The project aligns with FAO's ongoing support for the National Strategy for Aquaculture Development (SNDAM), particularly regarding quality standards and sustainable aquaculture practices. Coordination with WFP's resilience-building and food security programs in southern Madagascar ensures complementary targeting of vulnerable coastal populations. UNDP's climate adaptation initiatives will inform policy coherence on ecosystem-based adaptation and National Adaptation Plan implementation. Through UNIDO's Global Seaweed Initiative (UNGSI), the project will facilitate South-South knowledge exchange with comparable initiatives in Tanzania, Mozambique, and Indonesia.

International Financial Institutions: The project will coordinate with IFAD's ongoing DEFIS programme and the newly launched DEFIS+ (2024-2030, USD 150 million with GCF) to align rural finance mechanisms, climate-resilient agriculture approaches, and private sector engagement strategies . Synergies with IFAD's existing value chain investments in coastal zones will inform the design of community-based climate risk finance mechanisms (Output 3.1.3).

Civil Society and Research Partners: Close collaboration with Blue Ventures, which operates active community-based mangrove restoration (1,200 ha in the Tahiry Honko project) and seaweed value chain programs in western Madagascar, will enable shared learning on community-led ecosystem management . Technical partnerships with the Institut Halieutique et des Sciences Marines (IH.SM) of the University of Toliara will provide scientific backstopping for climate-resilient strain development and tissue culture laboratory establishment .

Government Coordination: Technical Working Groups established under Component 3 will include the Ministry of Environment and Sustainable Development, Ministry of Fisheries and Blue Economy, and National Environment Office (ONE) to ensure alignment with the National Blue Economy Strategy, NDC2, and NAP implementation

Project coordination and implementation arrangements:

The Project will be implemented by UNIDO as Project Implementing Agency (GEF Agency), which entails oversight of project execution to ensure that the project is implemented as planned and carried out in accordance with agreed standards and requirements. UNIDO as the GEF Agency will also be accountable to the GEF Council for the GEF-financed activities, as well as it will be responsible for project cycle management services and corporate activities, including all enquiries regarding the project implementation progress, project-level reporting, mid-term review, terminal evaluation and the achievement of the project's impacts on the global environment.

The Project Executing Entity for this project is the Ministry of Environment and Sustainable Development. The exact execution modalities will be finalized during PPG phase. UNIDO will be issuing an implementing partner agreement to the PEE for the project execution, after project approval, following the UNIDO internal guidelines. The PEE will be responsible for the project execution. A HACT assessment will be carried out to ensure compliance with UN fiduciary standards.

The PEE will contract other Project Executing Partners (PEPs) for specific project activities to support the implementation of different project activities, as needed. For that, an open and competitive process will be applied to select the service providers, following national legislation and rules as well as GEF and UNIDO rules, as applicable.

UNIDO will support the selection of a Project Management Unit (PMU) which will be responsible for monitoring of the project activities, coordination among project partners and providing project implementation support on the ground. The Madagascar PMU will consolidate project information, track progress and report to UNIDO, which will conduct oversight, quality assurance, and participate in monitoring missions.

Core Indicators

Explain the methodological approach and underlying logic to justify target levels for Core and Sub-Indicators (max. 250 words, approximately 1/2 page)

META INFORMATION – LDCF

LDCF **true**	SCCF-B (Window B) on technology transfer **false**	SCCF-A (Window-A) on climate Change adaptation **false**

Is this project LDCF SCCF challenge program?

false

This Project involves at least one small island developing State(SIDS).

false

This Project involves at least one fragile and conflict affected state.

false
This Project will provide direct adaptation benefits to the private sector.
true
This Project is explicitly related to the formulation and/or implementation of national adaptation plans (NAPs).
true
This project will collaborate with activities begin supported by other adaptation funds. If yes, please select below

Green Climate Fund	Adaptation Fund	Pilot Program for Climate Resilience (PPCR)
true	**false**	**false**

This Project has an urban focus.
false
This project will directly engage local communities in project design and implementation
false
This project will support South-South knowledge exchange
true

This Project covers the following sector(s)[the total should be 100%]: *	
Agriculture	35.00%
Nature-based management	25.00%
Climate information services	10.00%
Coastal zone management	15.00%
Water resources management	3.00%
Disaster risk management	10.00%
Other infrastructure	0.00%
Tourism	0.00%
Health	0.00%
Other (Please specify comments) Knowledge management, gender programming, MEL systems	2.00%
Total	100.00%

This Project targets the following Climate change Exacerbated/introduced challenges:*

Sea level rise	Change in mean temperature	Increased climatic variability	Natural hazards
true	**false**	**false**	**false**

Land degradation	Coastal and/or Coral reef degradation	Groundwater quality/quantity
true	**true**	**false**

CORE INDICATORS – LDCF

	Total	Male	Female	% for Women
CORE INDICATOR 1 Total number of direct beneficiaries	60,000	24,000.00	36,000.00	60.00%
CORE INDICATOR 2 (a) Area of land managed for climate resilience (ha) (b) Coastal and marine area managed for climate resilience (ha)	0.00 5,000.00			
CORE INDICATOR 3	7.00			

Number of policies/plans/ frameworks/institutions for to strengthen climate adaptation				
CORE INDICATOR 4 Number of people trained or with awareness raised	3,000	1,200.00	1,800.00	60.00%
CORE INDICATOR 5 Number of private sector enterprises engaged in climate change adaptation and resilience	600.00			

Key Risks

	Rating	Explanation of risk and mitigation measures
CONTEXT		
Climate	Moderate	Assessment: Madagascar's coastal zones are highly exposed to climate hazards, including tropical cyclones, storm surges, sea level rise and marine heat stress. These hazards pose significant risks to climate-sensitive livelihoods such as seaweed farming and to coastal ecosystems that underpin community resilience. Without intervention, the inherent risk would be High. Mitigation: Climate risk is directly addressed through Component 1, which promotes climate-resilient seaweed farming practices (Outcome 1.1) through farmer training, demonstration sites, and digital climate information services providing early warnings and seasonal guidance (Outputs 1.1.1–1.1.3). In parallel, ecosystem-based adaptation measures under Outcome 1.2 strengthen natural coastal defenses through mangrove restoration, community-based ecosystem management, and nature-based jobs for adaptation (Outputs 1.2.1–1.2.3), reducing exposure to climate shocks. These measures collectively reduce exposure, improve preparedness, and strengthen natural defenses. Residual risk: Moderate – while catastrophic climate events cannot be eliminated entirely, the combination of early warning, adaptive production practices, and ecosystem-based adaptation significantly lowers the likelihood of project outcome failure to a manageable level consistent with the overall Moderate project risk rating.
Environmental and Social	Moderate	Assessment: Project activities will take place in sensitive coastal and marine ecosystems and involve diverse community stakeholders. There is a risk of unintended ecosystem disturbance or inequitable access to project benefits if activities are not carefully designed and implemented. Mitigation: Environmental and social risks will be mitigated through ecosystem-based approaches under Component 1, including community-led mangrove restoration and monitoring (Outputs 1.2.1–1.2.2), and inclusive livelihood support under Component 2, with targeted training and enterprise development for women- and youth-led MSMEs (Outputs 2.1.3). A gender-responsive knowledge management and communication plan under Component 4 (Output 4.1.1) will further support inclusive participation and benefit-sharing.
Political and Governance	Moderate	Assessment: Institutional coordination challenges and evolving policy priorities may affect implementation of integrated coastal adaptation and livelihood interventions. Mitigation: This risk is mitigated through Component

		3, which strengthens the enabling environment for sustainable and climate-resilient blue economy development (Outcome 3.1). Activities include improving regulatory and planning frameworks for seaweed production and coastal management (Output 3.1.1) and supporting public–private partnerships that enhance coordination across public and private actors (Output 3.1.2). Also the establishment of inter-ministerial Technical Working Groups (Output 3.1.1) that harmonize national and local planning instruments, and by anchoring community-based management within GELOSE/GCF frameworks (community-based natural resource management) that bridge national policy and local implementation.
INNOVATION		
Institutional and Policy	Moderate	Assessment: Policies and regulatory frameworks supporting climate-resilient seaweed value chains and ecosystem-based adaptation remain fragmented or underdeveloped. Mitigation: Under Component 3, the project will support policy and regulatory improvements, including spatial planning tools and incentive frameworks for sustainable seaweed production and coastal management (Output 3.1.1). Evidence generated on blue carbon co-benefits (Output 3.1.4) will further inform policy development and long-term climate finance strategies.
Technological	Moderate	Assessment: Adoption of improved farming techniques, digital climate services, and innovative seaweed-based products may face initial capacity or uptake challenges among producers and MSMEs. Mitigation: Technology-related risks will be mitigated through hands-on training and demonstration under Component 1 (Outputs 1.1.1–1.1.2), use of low-tech digital platforms such as SMS and WhatsApp, community radio for climate services (Output 1.1.3), and phased piloting of innovative seaweed-based products under Component 2 (Output 2.2.1).
Financial and Business Model	Moderate	Assessment: Limited access to finance and low private sector investment in climate-resilient seaweed value chains may affect enterprise sustainability and scaling beyond the project period. Mitigation: This risk is addressed through Component 2, which strengthens MSME capacities, market linkages, and value addition (Outcomes 2.1 and 2.2), and Component 3, which pilots community-based climate risk finance mechanisms such as emergency funds and women-led savings groups aligned with seaweed income cycles (Output 3.1.3), alongside support to PPPs and investment planning (Output 3.1.2).
EXECUTION		
Capacity	Moderate	Assessment: Local institutions, producer organizations, and community groups may have uneven capacity to implement integrated adaptation, ecosystem restoration, and value chain development activities. Mitigation: Capacity constraints will be addressed through targeted technical assistance across Components 1 and 2, complemented by institutional strengthening and policy support under Component 3. Project monitoring, evaluation, and learning

		systems under Component 5 (Output 5.1.1) will support adaptive management throughout implementation.
Fiduciary	Moderate	Assessment: Given Madagascar's governance context, fiduciary risk is Moderate. Key risks include: (i) potential delays in fund flow to community level; (ii) procurement challenges in remote coastal districts; (iii) capacity gaps in community-based financial management. Mitigation: UNIDO's established financial management systems, assessment compliance, direct oversight of Project Management Unit, milestone-based disbursements to executing partners, and dedicated fiduciary oversight mechanisms for community-based climate risk finance (Output 3.1.3)
Stakeholder	Low	Assessment: The project involves multiple stakeholder groups with differing interests and incentives, including seaweed producers, coastal community members, local authorities, MSMEs, and private sector actors along the seaweed value chain. Potential risks include uneven participation, limited trust between communities and private actors, and coordination challenges across local and national levels, which could affect ownership and effective implementation. Mitigation: Stakeholder risks will be mitigated through structured and continuous engagement mechanisms embedded across project components. Community-based governance arrangements for mangrove and coastal ecosystem management will be strengthened under Component 1 (Output 1.2.2), while producer organizations and women- and youth-led enterprises will be supported to participate meaningfully in value chain development under Component 2 (Outputs 2.1.3 and 2.2.2). Knowledge sharing, transparency, and feedback mechanisms under Component 4 (Outputs 4.1.1–4.1.3), combined with adaptive management supported by the MEL system (Component 5), will help maintain alignment, trust, and sustained stakeholder engagement.
Other	Low	Assessment: No additional risks have been identified at this stage. Mitigation: Emerging risks will be monitored and addressed through adaptive management supported by the project MEL system (Component 5).
Overall Risk Rating	Moderate	Assessment: While Madagascar presents High climate exposure and moderate institutional complexity, the risk profile is mitigable through: (i) specific alignment with Madagascar's NDC2 and NAP providing policy anchors; (ii) UNIDO's established fiduciary presence; (iii) community-based implementation modalities (iv) explicit gender quotas (60% women, 30% youth) addressing structural barriers. The Moderate rating reflects residual risk after mitigation, appropriate for a full-sized project in a least developed country with transformational ambitions.

C. ALIGNMENT WITH GEF-8 PROGRAMMING STRATEGIES AND COUNTRY/REGIONAL PRIORITIES

Describe how the proposed interventions are aligned with GEF- 8 programming strategies and country and regional priorities, including how these country strategies and plans relate to the multilateral environmental agreements.

Confirm if any country policies that might contradict with intended outcomes of the project have been identified, and how the project will address this.

For projects aiming to generate biodiversity benefits (regardless of what the source of the resources is - i.e., BD, CC or LD), please identify which of the 23 targets of the Kunming-Montreal Global Biodiversity Framework the project contributes to and explain how. (max. 500 words, approximately 1 page)

The project aligns with GEF-8 LDCF Programming Strategy through ecosystem-based adaptation (2,500 ha mangrove restoration, 3,500 ha marine habitat management), climate-resilient value chains, and digital early warning systems (Output 1.1.3). It applies GEF-8 transformation levers: policy coherence (Output 3.1.1), strengthened governance (inter-ministerial Technical Working Groups), and knowledge exchange (UNGSI partnerships). The gender-responsive design (60% women beneficiaries) and private sector engagement (Output 3.1.2) align with GEF-8 priorities for vulnerable groups and innovation.

The project operationalizes Madagascar's NDC2 (January 2024), which identifies blue economy as a priority sector and commits to restoring 170,000 ha of mangroves by 2030; this project's 2,500 ha restoration contributes directly to that target while strengthening MRV systems (Output 3.1.4). It aligns with the National Adaptation Plan (2022) priorities on coastal ecosystem-based adaptation and climate information services, and the *Lettre de Politique Bleue (2015)* objectives for sustainable fisheries value chains and export growth.

Through NDC2/NAP implementation, the project supports Madagascar's UNFCCC and Paris Agreement commitments (Articles 7 and 8). Its biodiversity co-benefits align with the CBD Kunming-Montreal Global Biodiversity Framework Targets 2 (restoration), 3 (conservation of 30% of marine areas), and 23 (gender equality). UNGSI partnerships support SDG 13 (Climate Action), SDG 14 (Life Below Water), and SDG 5 (Gender Equality).

Policy contradictions exist between the Fisheries Code (promoting aquaculture expansion) and environmental protection mandates. The project addresses this through spatial planning tools (Output 3.1.1) that zone sustainable production while protecting critical habitats. Tension between decentralized governance (CTD law transferring authority to Communes) and national sectoral policies is mitigated through inter-ministerial Technical Working Groups (Output 3.1.1) anchoring community-based management (GELOSE frameworks) within national climate strategies (NDC2/NAP).

A GEF Least Developed Countries Fund (LDCF) project in Madagascar that integrates seaweed farming, mangrove restoration, value-chain development, and support for women-led blue economy enterprises is strongly aligned with both GEF-8 programming strategies and country/regional priorities. Under GEF-8, nature-based solutions, climate resilience, sustainable livelihoods, and blue economy opportunities are emphasized, including sustaining healthy coastal and marine ecosystems such as mangroves and supporting inclusive value chains and private sector engagement for climate adaptation and environmental benefits. This project directly contributes to those strategic objectives by promoting ecosystem restoration (2,500 ha mangrove restoration and 3,500 ha marine habitat management), climate-smart seaweed aquaculture, digital early warning systems (Output 1.1.3), and small to medium enterprise growth as pathways to improve resilience and economic well-being for vulnerable coastal communities. The approach also reflects GEF's cross-cutting themes such as gender-responsive strategies (60% women beneficiaries) and private sector inclusion (Output 3.1.2), which are central to scaling impact in GEF-8 interventions. It applies GEF-8 transformation levers: policy coherence (Output 3.1.1), strengthened governance (inter-ministerial Technical Working Groups), and knowledge exchange (UNGSI partnerships).

At the country level, Madagascar's national climate change, adaptation, and economic development strategies (including its National Climate Change Policy, NDC2 (January 2024), and National Adaptation Plan (2022)) prioritize enhancing resilience to climate impacts, conserving biodiversity, and supporting MSMEs that drive innovation and livelihoods, particularly in rural areas where women are key economic actors. The NDC2 identifies blue economy as a priority sector and commits to restoring 170,000 ha of mangroves by 2030; this project's 2,500 ha restoration contributes directly to that target while strengthening MRV systems (Output 3.1.4). It aligns with the Lettre de Politique Bleue (2015) objectives for sustainable fisheries value chains and export growth.

Through NDC2/NAP implementation, the project supports Madagascar's UNFCCC and Paris Agreement commitments (Articles 7 and 8). Its biodiversity co-benefits align with the CBD Kunming-Montreal Global Biodiversity Framework Targets 2 (restoration), 3 (conservation of 30% of marine areas), and 23 (gender equality). UNGSI partnerships support SDG 13 (Climate Action), SDG 14 (Life Below Water), and SDG 5 (Gender Equality). This project's emphasis on women-led blue economy enterprises thus fits with these national priorities by boosting inclusive economic development, strengthening community participation in coastal management, and advancing integrated nature-positive solutions in line with regional adaptation and biodiversity frameworks.

Contribution to Kunming-Montreal Global Biodiversity Framework (GBF)
The project directly contributes to the following five GBF targets through its integrated approach to ecosystem-based adaptation and sustainable blue economy development:

Target 2: Restoration: Ensure that by 2030 at least 30% of areas of degraded terrestrial, inland water, and coastal and marine ecosystems are under effective restoration
Contribution: The project restores 2,500 ha of degraded mangrove forests in Analanjirofo, Diana, Melaky, Menabe, and Atsimo-Andrefana regions (Output 1.2.1). This represents a quantifiable contribution to Madagascar's national restoration commitment under NDC2 (170,000 ha by 2030) and the global 30% restoration target. The restoration employs participatory community stewardship protocols with clear tenure agreements, ensuring long-term effectiveness beyond the project period.

Target 3: Conservation: Ensure and enable that by 2030 at least 30% of terrestrial and inland water areas, and of marine and coastal areas, especially areas of particular importance for biodiversity and ecosystem functions and services, are effectively conserved and managed
Contribution: The project brings 3,500 ha of coastal and nearshore marine habitats under improved climate-resilient management through sustainable seaweed aquaculture practices (Integrated Multi-Trophic Aquaculture IMTA, climate-adaptive strains) and ecosystem-based adaptation (Outcome 1.2). This contributes to the '30% of planet protected' goal through Other Effective Area-Based Conservation Measures (OECMs) in productive seascapes, complementing formal protected area systems.

Target 10: Agriculture/Aquaculture: Ensure that areas under agriculture, aquaculture, fisheries, and forestry are managed sustainably, in particular through the conservation and sustainable use of biodiversity
Contribution: The project transforms 3,500 ha of marine habitat under improved practices (Outcome 1.1) through climate-resilient aquaculture techniques including Integrated Multi-Trophic Aquaculture (IMTA), which enhances resource efficiency and reduces pressure on overexploited fisheries. By diversifying into bio-stimulants and organic fertilizers (Output 2.2.1), the project reduces dependence on synthetic inputs, supporting biodiversity-friendly production systems.

Target 19: Financial Resources: Substantially and progressively increase the level of financial resources from all sources... for the implementation of national biodiversity strategies and action plans
Contribution: The project mobilizes USD 7 million in co-financing and pilots innovative community-based climate risk finance mechanisms (Output 3.1.3) with transparent governance structures. The blue carbon assessment (Output 3.1.4) strengthens national Measurement, Reporting, and Verification (MRV) systems, creating the evidentiary foundation for future access to biodiversity and climate finance.

Target 23: Gender Equality: Ensure gender equality in the implementation of the Framework through a gender-responsive approach
Contribution: The project ensures 60% of direct beneficiaries are women and targets 60% women's employment in restoration activities (Outputs 1.1.1, 1.2.3). It establishes women-led savings groups aligned with seaweed income cycles (Output 3.1.3) and provides targeted training for women-led 'blue enterprises' in business management and climate adaptation planning (Output 2.1.3), closing structural gender gaps in resource access, leadership, and decision-making.

Secondary Contributions:
The project also generates co-benefits toward:
Target 4 (Spatial Planning): Through spatial planning tools and incentive frameworks for sustainable seaweed production (Output 3.1.1) that integrate biodiversity conservation into coastal zone management.

Target 6 (Pollution Reduction): By developing seaweed-based bio-stimulants and organic fertilizers (Output 2.2.1) that provide alternatives to carbon-intensive synthetic fertilizers, reducing nutrient pollution in coastal waters.

Target 15 (Livelihoods): By directly benefiting 60,000 people through diversified, climate-resilient livelihoods that reduce pressure on biodiversity while improving human well-being.

D. POLICY REQUIREMENTS

Gender Equality and Women's Empowerment:

We confirm that gender dimensions relevant to the project have been addressed as per GEF Policy and are clearly articulated in the Project Description (Section B).

Yes

Stakeholder Engagement

We confirm that key stakeholders were consulted during PIF development as required per GEF policy, their relevant roles to project outcomes and plan to develop a Stakeholder Engagement Plan before CEO endorsement has been clearly articulated in the Project Description (Section B).

Yes

Were the following stakeholders consulted during project identification phase:

Indigenous Peoples and Local Communities:

Civil Society Organizations:

Private Sector:

Provide a brief summary and list of names and dates of consultations

During the Project Preparation Grant (PPG) phase, gender equality and women's empowerment will be a core design principle of the GEF LDCF project, with a specific focus on strengthening women-led blue economy enterprises in seaweed farming, mangrove restoration, and associated value chains. A gender analysis will be undertaken to identify structural barriers, differentiated climate vulnerabilities, and economic opportunities affecting women's participation, leadership, and access to assets, finance, technology, and markets. The PPG will engage women seaweed farmers, processors, and entrepreneurs through targeted consultations and co-creation workshops to ensure their priorities shape project interventions, including enterprise development, skills upgrading, and climate-resilient livelihood options. Measures to promote women's leadership in producer organizations, SMEs, and local governance structures will be integrated into the project design, alongside safeguards to address unpaid care burdens, occupational health risks, and equitable benefit sharing. By embedding gender-responsive indicators, budgets, and accountability mechanisms during the PPG, the project will lay a strong foundation for transformative impacts on women's economic empowerment and resilience within the blue economy.

In preparation of the PIF, UNIDO has consulted with the government agencies, in particular the Ministry of Blue Economy and Fisheries, and the Ministry of Environment and Sustainable Development. UNIDO, as a founding member of the UN Global Seaweed Initiative, that was founded at the requested of the Government of Madagascar, has already possessed a good understanding of the dynamics of the sector, and the needs and challenges of the private sector, the civil society and the local communities.

Nevertheless, during the Project Preparation Grant (PPG) phase, the project will undertake a comprehensive stakeholder engagement process to further refine project design, roles, and implementation arrangements. A dedicated Stakeholder Engagement Plan will be developed as part of the CEO Endorsement Document, ensuring inclusive participation, clear feedback mechanisms, and alignment with GEF environmental and social safeguards.

The stakeholder engagement strategy for the GEF LDCF project will adopt an inclusive, participatory, and gender-responsive approach to ensure that the design of interventions for seaweed farming, mangrove restoration, and value chain and SME development is locally grounded and technically robust. Key stakeholders—including coastal communities and producer groups, women and youth entrepreneurs, local SMEs, traditional leaders, government agencies, research institutions, NGOs, and private sector actors across the seaweed and mangrove-related value chains—will be systematically identified and engaged through consultations, focus group discussions, and co-design workshops. The PPG will prioritize early engagement of vulnerable and climate-exposed groups to integrate indigenous knowledge, livelihood priorities, and climate risk perceptions into project design, while also engaging market actors and financiers to assess commercial viability, value addition opportunities, and barriers to SME growth. Continuous feedback mechanisms will be established to validate proposed activities, refine institutional and governance arrangements, and build stakeholder ownership, thereby strengthening the project's effectiveness, sustainability, and alignment with national adaptation priorities.

Following main stakeholder groups have been identified and will be included in the Stakeholder Consultation in the PPG phase:

Local Communities and Producer Groups

Coastal communities, including seaweed farmers, artisanal fishers, and households dependent on coastal resources, are central actors in the project. They play a primary role in seaweed production, post-harvest handling, and day-to-day interaction with coastal ecosystems. Community members are also key stewards of mangroves and seagrasses through participation in restoration, monitoring, and community-based management mechanisms.

Their engagement is critical for achieving adaptation benefits, as adoption of climate-resilient farming practices, use of climate information services, and sustainable resource management directly determine reductions in climate vulnerability. Their role in ecosystem restoration and reduced pressure on mangroves is essential for delivering GEBs, including biodiversity conservation, ecosystem services, and climate mitigation co-benefits.

Women and Youth

Women and youth are highly represented in seaweed farming, post-harvest activities, and informal coastal livelihoods, yet remain concentrated in lower-value and more vulnerable segments of the system. Their participation as producers, entrepreneurs, members of savings groups, and contributors to local governance is essential for inclusive value chain development and livelihood diversification.

Targeted engagement of women and youth strengthens adoption of sustainable practices, supports enterprise development, and improves social resilience. Their inclusion is therefore critical to sustaining adaptation outcomes and ensuring that environmental benefits are not undermined by inequality-driven coping strategies.

Indigenous Peoples as Partners

Traditional fishers and Indigenous Peoples will be engaged as partners in project implementation, particularly in Component 1 (co-designing climate-resilient farming techniques, participating in mangrove restoration planning, and leading community-based ecosystem monitoring), Component 2 (integrating traditional processing knowledge into quality standards and bio-stimulant development, and supporting Indigenous-owned blue enterprises) and Component 3 (co-designing spatial planning and governance frameworks), rather than treated solely as passive beneficiaries. This partnership approach will be operationalized through: (i) representation on Project Steering Committee and Technical Working Groups; (ii) leadership roles in community-managed disaster risk reduction committees (Output 1.1.3); and (iii) contractual arrangements for ecosystem monitoring and restoration activities.

Formal consultations with Indigenous Peoples/traditional fishers and local communities holding customary marine tenure rights were not conducted during PIF development due to time constraints and the early stage of project conceptualization. However, the PIF design has been informed by existing research and documentation regarding customary resource use rights in Madagascar's coastal zones, including studies by Blue Ventures and IOM on traditional fisher migration patterns and customary marine tenure systems. During the Project Preparation Grant (PPG) phase, consultations with traditional

fishers and Indigenous Peoples will be conducted in all targeted districts (Analanjirofo, Diana, Melaky, Menabe, and Atsimo-Andrefana) to: (i) validate the project design elements affecting customary marine areas; (ii) integrate traditional ecological knowledge into Component 1 (climate-resilient farming and ecosystem management); and (iii) ensure free, prior and informed consent (FPIC) protocols are established before any site-specific interventions commence. Results from these PPG consultations will refine the implementation arrangements, benefit-sharing mechanisms, and governance.

Free, Prior and Informed Consent (FPIC)

The project commits to obtaining Free, Prior and Informed Consent (FPIC) from Indigenous Peoples/traditional fishers and local communities during the Project Preparation Grant (PPG) phase prior to any physical interventions, and maintaining FPIC protocols throughout implementation. FPIC will specifically cover: (a) site selection for mangrove restoration and seaweed farming zones; (b) design of community-based climate risk finance mechanisms (Component 3); and (c) benefit-sharing arrangements for ecosystem services. An Indigenous Peoples Plan (IPP) will be prepared during PPG if the consultations reveal that project activities will affect lands or territories traditionally owned, occupied, or used by Indigenous Peoples, including specific measures for capacity building of traditional governance institutions and documentation of traditional ecological knowledge.

Private Sector Actors

Private sector stakeholders include seaweed buyers, processors, traders, input suppliers, service providers, and emerging enterprises engaged in value-added seaweed-based products. At present, private engagement is limited and risk-averse, but these actors are essential for scaling sustainable production, processing, and market diversification.

Their role is critical in:

- Investing in post-harvest facilities and product development
- Applying quality, safety, and traceability standards
- Establishing durable market linkages for diversified seaweed products

By improving market incentives and domestic value capture, private sector engagement helps stabilize incomes and reduces reliance on environmentally damaging coping strategies, thereby supporting both adaptation outcomes and long-term Global Environmental Benefits (GEBs).

Public Institutions and Relevant Ministries

Relevant public institutions include national and sub-national authorities responsible for aquaculture, fisheries, forestry, environment, land use, and climate policy. These actors shape the regulatory, planning, and incentive frameworks that govern coastal resource use and investment.

Their role is critical in:

- Enabling coherent coastal and aquaculture management
- Supporting community-based ecosystem governance

- Integrating climate risk and ecosystem services into planning
- Facilitating access to finance and investment

Effective engagement of public institutions ensures that project-supported practices are embedded in policy and planning processes, supporting durability and scalability of environmental and adaptation benefits.

Financial and Community-Based Finance Actors

Community-based savings groups, local financial service providers, and partners supporting risk management mechanisms play a key role in strengthening financial resilience. Their involvement enables households and enterprises to recover from climate shocks without depleting natural capital.

These actors are critical for sustaining adaptation benefits, as access to savings and emergency finance reduces environmentally harmful coping strategies and encourages reinvestment in sustainable production and ecosystem management.

(Please upload to the portal documents tab any stakeholder engagement plan or assessments that have been done during the PIF development phase.)

Private Sector

Will there be private sector engagement in the project?

Yes

And if so, has its role been described and justified in the section B project description?

Yes

Environmental and Social Safeguard (ESS) Risks

We confirm that we have provided indicative information regarding Environmental and Social risks associated with the proposed project or program and any measures to address such risks and impacts (this information should be presented in Annex D).

Yes

Overall Project/Program Risk Classification

PIF	CEO Endorsement/Approval	MTR	TE
Medium/Moderate			

E. OTHER REQUIREMENTS

Knowledge management

We confirm that an approach to Knowledge Management and Learning has been clearly described in the Project Description (Section B)

Yes

ANNEX A: FINANCING TABLES

GEF Financing Table

Indicative Trust Fund Resources Requested by Agency(ies), Country(ies), Focal Area and the Programming of Funds

GEF Agency	Trust Fund	Country/ Regional/ Global	Focal Area	Programming of Funds	Grant / Non-Grant	GEF Project Grant($)	Agency Fee($)	Total GEF Financing ($)
UNIDO	LDCF	Madagascar	Climate Change	LDCF Country allocation	Grant	4,476,210.00	425,240.00	4,901,450.00
Total GEF Resources ($)						**4,476,210.00**	**425,240.00**	**4,901,450.00**

Project Preparation Grant (PPG)

Is Project Preparation Grant requested?

true

PPG Amount ($)

90000

PPG Agency Fee ($)

8550

GEF Agency	Trust Fund	Country/ Regional/ Global	Focal Area	Programming of Funds	Grant / Non-Grant	PPG($)	Agency Fee($)	Total PPG Funding($)
UNIDO	LDCF	Madagascar	Climate Change	LDCF Country allocation	Grant	90,000.00	8,550.00	98,550.00
Total PPG Amount ($)						**90,000.00**	**8,550.00**	**98,550.00**

Please provide justification

Sources of Funds for Country Star Allocation

GEF Agency	Trust Fund	Country/ Regional/ Global	Focal Area	Sources of Funds	Total($)
Total GEF Resources					**0.00**

Indicative Focal Area Elements

Programming Directions	Trust Fund	GEF Project Financing($)	Co-financing($)
CCA-1-2	LDCF	4,476,210.00	10350000
Total Project Cost		**4,476,210.00**	**10,350,000.00**

Indicative Co-financing

Sources of Co-financing	Name of Co-financier	Type of Co-financing	Investment Mobilized	Amount($)
Recipient Country Government	Ministry of Environment and Sustainable Development	In-kind	Recurrent expenditures	300000
Recipient Country Government	Ministry of Fisheries and Marine Resources	In-kind	Recurrent expenditures	700000
GEF Agency	UNIDO - Activities related to United Nations Global Seaweed Initiative (UNGSI)	In-kind	Recurrent expenditures	350000
Beneficiaries	Cooperatives, Producer Groups	In-kind	Recurrent expenditures	1500000
Private Sector	SMEs	In-kind	Investment mobilized	7500000
Total Co-financing				**10,350,000.00**

Describe how any "Investment Mobilized" was identified

The USD 4,000,000 in Investment Mobilized represents anticipated private sector SME investment in seaweed processing infrastructure, equipement, and working capital identifeid through preliminary consultations with seaweed cooperatives, existing buyers, and potential enterprise partners. This estimate is based on: (i) market assessments indicating demand for 4–6 community-level processing facilities equipped with climate-resilient drying and storage technology; (ii) engagement with existing seaweed export associations indicating willinegness to invest in value-added product lines (bio-stimulants, organic fertilizers) once quality standards and traceability systems are established under Component 2; and (iii) projected working capital requirements for 400–600 MSMEs upgrading to climate-resilient practices. The investment will be mobilized through public-private partnerships facilitated under Output 3.1.2, with specific investment commitments to be finalized during the PPG phase following feasibility studies and the price transparency/traceability pilot with anchor buyers. This figure represents a conservative estimate (approximately 1:1 ratio to GEF project financing) based on comparable value chain upgrading projects in coastal East Africa.

ANNEX B: ENDORSEMENTS

GEF Agency(ies) Certification

GEF Agency Type	Name	Date	Project Contact Person	Phone	Email
Project Coordinator	Nima Bahramalian	3/27/2026			N.BAHRAMALIAN@unido.org
GEF Agency Coordinator	Ganna Onysko	3/27/2026			G.ONYSKO@unido.org

Record of Endorsement of GEF Operational Focal Point (s) on Behalf of the Government(s):

Name	Position	Ministry	Date (MM/DD/YYYY)
Dr Hery A. RAKOTONDRAVONY	GEF Operational Focal Point	MINISTERE DE L'ENVIRONNEMENT ET DU DEVELOPPEMENT DURABLE	1/30/2026

ANNEX C: PROJECT LOCATION

Please provide geo-referenced information and map where the project interventions will take place

The project targets Madagascar's principal seaweed-producing coastal belt across five administrative regions selected for acute climate vulnerability and production potential.

Region	Priority Districts	Coordinates (Approximate)	Ecosystem Focus
Analanjirofo	Antalaha, Sambava	14°52'S, 50°16'E to 15°20'S, 50°20'E	Mangrove restoration (Antalaha Bay), Seaweed zones (Sambava Bay)
Diana	Antsiranana II, Ramena	12°18'S, 49°18'E to 13°00'S, 49°20'E	Marine habitat management (Diego Bay)
Melaky	Morombe, Maintirano	20°56'S, 43°40'E to 21°30'S, 43°40'E	Mangrove restoration (Morombe estuary)
Menabe	Morondava, Belo sur Mer	20°17'S, 44°17'E to 20°45'S, 44°30'E	Mangrove conservation (Tsiribihina delta)
Atsimo-Andrefana	Toliara I, II, Ifaty	23°21'S, 43°40'E to 24°00'S, 43°40'E	Marine habitat management (Toliara Bay)

Geo-Referenced Interventions:

Mangrove Restoration (2,000 ha):

- Analanjirofo (Antalaha Bay): 14.9000°S, 50.3000°E – 500 ha
- Melaky (Morombe): 20.9500°S, 43.7500°E – 600 ha
- Menabe (Tsiribihina): 20.2500°S, 44.4500°E – 400 ha
- Atsimo-Andrefana (Onilahy): 23.3500°S, 43.7500°E – 500 ha

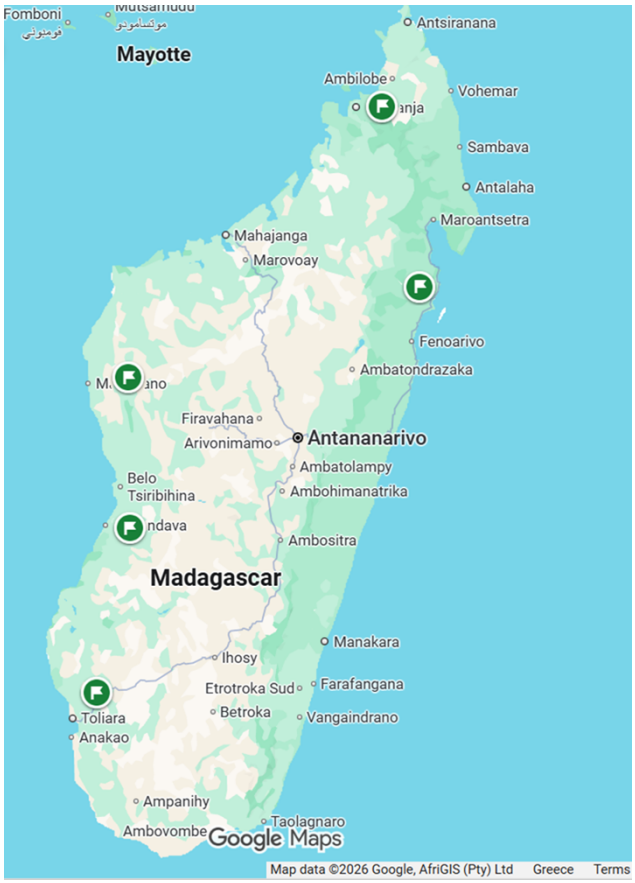
Marine Habitat Management (3,000 ha):

- Nearshore seaweed farming concessions (3-15m depth) distributed across: Analanjirofo (1,000 ha), Diana (600 ha), Melaky (600 ha), Menabe (400 ha), Atsimo-Andrefana (400 ha).

Coordinates provided are approximate district centers. Exact site boundaries (polygons) will be geo-referenced during PPG inception mission using participatory GIS mapping with local communities and BNCCC.

Site Selection Criteria (PPG Phase):

- Climate risk: Districts with >3 cyclone strikes (2020-2024)
- Seaweed presence: >100 active farmers per commune
- Ecosystem degradation: Mangroves with >30% loss (Global Forest Watch 2024)
- Tenure readiness: Communities with existing GELOSE agreements or ongoing LMMA establishment
- Private sector proximity: Operational seaweed buying stations within 20km



ANNEX D: ENVIRONMENTAL AND SOCIAL SAFEGUARDS SCREEN AND RATING

(PIF level) Attach agency safeguard screen form including rating of risk types and overall risk rating.

Title
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ANNEX E: RIO MARKERS

Climate Change Mitigation	Climate Change Adaptation	Biodiversity	Land Degradation

No Contribution 0	Principal Objective 2	Significant Objective 1	Significant Objective 1

ANNEX F: TAXONOMY WORKSHEET

Level 1	Level 2	Level 3	Level 4
Focal Area/Theme Influencing Models	Climate Change Adaptation (LDCF)	CCA-1: Increase resilience of vulnerable communities	CCA-1.1: Ecosystem-based Adaptation (EbA) in coastal zones (2,000 ha mangrove restoration)
		CCA-2: Mainstream adaptation into development	CCA-2.2: Climate-resilient value chains and private sector engagement
Influencing Models	Policy & Regulatory	Spatial planning & zoning	Marine spatial planning for sustainable aquaculture and coastal resource use
		Incentive structures	Blue economy incentives and climate risk finance mechanisms
Stakeholders	Private Sector Engagement	MSME development	Value chain upgrading, PPP facilitation, support to 400–600 enterprises
	Vulnerable Groups	Women	Women-led blue enterprises (≥50% beneficiaries, ≥60% workforce participation)
		Youth	Youth-led SMEs and restoration technicians (target: 30%)
	Local Communities	Seaweed producers	2,500 trained producers; community-managed disaster risk committees
	Private Sector	SMEs / Cooperatives	Input suppliers, processors, aggregators, buyers
	Government	Ministries & Local Authorities	Environment & Fisheries ministries; local governance systems (e.g., GELOSE-type structures)
Capacity & Knowledge	Technical Capacity	Climate-resilient practices	IMTA systems, tissue culture, seed banking, post-harvest loss reduction
		Digital services	Climate information services (SMS/WhatsApp alerts, seasonal forecasts)
	Knowledge Management	South–South exchange	Partnerships (e.g., UNGSI), learning from Tanzania & Mozambique
	MRV Systems	Blue carbon monitoring	Strengthened national MRV systems (e.g., Output 3.1.4)

Gender Equality	Economic Empowerment	Access to finance	Women-led savings groups, microfinance access, emergency resilience funds
		Leadership & inclusion	Quotas in producer organizations; decision-making roles for women
		Skills development	Business management and financial literacy training (≥50% women)