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Country Environmental Analysis

Investing in Natural Capital for Sustainable Development

UNION OF THE
COMOROS

Comoros Country Environmental Analysis

Investing in Natural Capital for Sustainable Development

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Abbreviations

AEPA	National Drinking Water Supply and Sanitation Strategy
AFD	French Development Agency (*Agence Française de Développement*)
AFDB	African Development Bank
AAL	Average Annual Loss
AMCC	Global Climate Change Alliance (*Alliance mondiale contre le changement climatique*)
ANAGID	National Agency for Integrated Waste Management
BER	Blue Economy Roadmap
BESF	Strategic Framework for a National Policy on the Blue Economy
CEA	Country Environmental Analysis
CNCSP	National Center for Fisheries Control and Surveillance (*Centre national de contrôle et de surveillance des pêches*)
CoReCSuD	Co-Management of Coastal Resources for Sustainable Livelihoods
CPAD	Development Partners Conference
CPF	Country Partnership Framework
CRCCA	Enhancing Adaptive Capacity for Increased Resilience to Climate Change in the Agricultural Sector
CSA	Climate-Smart Agriculture
DALY	Disability-Adjusted Life Year
DG	General Directorate
DGEME	General Directorate for Energy, Mines and Water (*Direction générale de l'énergie des mines et de l'eau*)
DGEF	General Directorate of Environment and Forests (*Direction générale de l'environnement et des forêts*)
DGRH	General Directorate of Fisheries Resources (*Direction générale des ressources halieutiques*)
DGSAE	General Strategic Directorate of Agriculture and Livestock (*Direction générale de la stratégie agricole et de l'élevage*)
DNEA	National Water and Sanitation Directorate
DOPA	Digital Observatory for Protected Areas
DREA	Regional Directorate of Water and Sanitation
DRM	Disaster Risk Management
DSCRP	Strategy Document for Growth and Poverty Alleviation
DTM	Technical Directorate of Meteorology (*Direction technique de la météorologie*)
DWSS	Drinking Water Supply and Sanitation
DWSSP	Drinking Water Supply and Sanitation Project
EEZ	Exclusive Economic Zone
EIA	Environmental Impact Assessment
EPI	Environmental Performance Index
ESV	Ecosystem Service Value

Acronyms are based on French titles or terms as relevant.

EU	European Union
FEC	*Fonds Environnemental des Comores*
FLE	Framework Law of the Environment
FNDIEA	National Fund for the Development of Water and Sewage Infrastructure
GDP	Gross Domestic Product
GEF	Global Environmental Facility
GHG	Greenhouse Gas
GIS	Geographical Information Systems
GoC	Government of the Union of the Comoros
HDI	Human Development Index
ICMP	Integrated Coastal Management Plan
ICRAF	International Council for Research in Agroforestry
IFAD	International Fund for Agricultural Development
INRAPE	National Institute for Research in Agriculture, Fisheries and the Environment (*Institut national de recherche pour l'agriculture, la pêche et l'environnement*)
IORA	Indian Ocean Rim Association
IOC	Indian Ocean Commission
IOTC	Indian Ocean Tuna Commission
IUU	Illegal, Unreported, and Unregulated
IWRM	Integrated Water Resource Management
LUCF	Land use change and forestry
MAPETA	Ministry of Agriculture, Fisheries, Environment, Tourism, and Handicrafts (*Ministère de l'Agriculture, de la Pêche, de l'Environnement, du Tourisme et de l'Artisanat*)
MCS	Monitoring, Control, And Surveillance
MPA	Marine Protected Area
MTI	Marine Trophic Index
NAPA	National Adaptation Programme of Action
NBT	Nature-Based Tourism
NDC	Nationally Determined Contributions
NFU	National Fishermen's Union
NGO	Non-Governmental Organization
ODA	Official Development Assistance
OVK	Karthala Volcanological Observatory (*Observatoire volcanologique du Karthala*)
PAPDF	Priority Action Plan for Forestry Development (*Plan d'action prioritaire de développement forestier*)
PCE	Comoros Emerging Plan 2030 (*Plan Comores Émergent 2030*)
PIDC	Integrated Development and Competitiveness Project

PNDHD	National Programme for Sustainable Human Development (*Programme National de Développement Humain Durable*)
PNE	National Environmental Policy (*Politique Nationale de L'Environnement*)
PPP	Public-Private Partnership
PREFER	Family Farming Productivity and Resilience Support Project
PRSP	Regional Fisheries Surveillance Program
RCP	Representative Concentration Pathway
RENAP	National Network of Protected Areas (*Réseau National des Aires Protégées*)
RMI	Regional Marine Tropic Index
RP10	10-year Return Period
RP100	100-year Return Period
RP250	250-year Return Period
SCA2D	Accelerated Growth and Sustainable Development Strategy
SCD	Systematic Country Diagnostic
SDG	Sustainable Development Goal
SFPA	Sustainable Fisheries Partnership Agreement
SIDS	Small Island Developing State
SONEDE	*Société Nationale chargée de l'Exploitation et la Distribution des Eaux aux Comores*
SSTL	Seychelles Sustainable Tourism Label
SWIOFC	Southwest Indian Ocean Fisheries Commission
SWIOFish1	South West Indian Ocean Fisheries Governance and Shared Growth Project
UCEA	Union of Water Committees of Ndzuwani
UNCLOS	United Nations Convention on the Law of the Sea
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNICEF	United Nations Children's Fund
USD	U.S. Dollar
WASH	Water, Sanitation, And Hygiene
WHO	World Health Organization
WUA	Water User Association
YLD	Years of healthy life lost due to a disability
YYL	Years of life lost

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1. Executive Summary

The Comoros Islands are a small archipelago in the Indian Ocean and harbor varied ecosystems rich in species diversity, endemism, and abundant natural resources. The Union of the Comoros has stagnating gross domestic product (GDP) per capita growth, is politically fragile, and has weak formal institutions. Limited economic growth has gone hand in hand with modest poverty reduction (World Bank 2020k, 2021e). Approximately 44.8 percent of the population lived below the national poverty line in 2020, based on the national poverty line of 41,495 Comoros francs (KMF) (US$99) per capita per month (World Bank 2021f). Natural capital is at the basis of the country's key economic sectors and livelihoods: about 38 percent of its GDP is generated in activities for which land, sea, and nature are essential inputs, and approximately 50 percent of the rural population is dependent on agriculture and fisheries for their livelihoods (World Bank 2020j). Agriculture is the largest economic sector in the Comoros in terms of GDP contribution (30.5 percent) and source of employment (34 percent). Domestic fisheries make up 2.87 percent of GDP and operate at the subsistence level.

Growth and poverty reduction in the Comoros are strictly linked to the well-being of its natural resources. If sustainably managed, its natural resources have the potential to trigger significant co-benefits in terms of poverty reduction, livelihoods contribution, economic growth, and development, while supporting environmental conservation and climate resilience. The Government of the Union of the Comoros (GoC) recognized the need for such a major shift toward sustainable development and structural transformation of the economy. This translated into the adoption in 2019 of the Comoros Emerging Plan (PCE) 2030, a national strategy for long-term action which describes the focus areas and large-scale projects that will drive the structural transformation of the emerging Comorian economy. The PCE 2030 also acts as a reference for the implementation of the Sustainable Development Goals (SDGs). The revision in 2021 of the nationally determined contribution (NDC) further contributes to laying out the way forward, focusing on strengthening the resilience of the country to the effects of climate change.

The development path envisioned by the GoC risks being hampered by natural capital degradation and depletion. The renewable natural capital of the Comoros, including agricultural land, forests, and

Box 1. The Comoros Country Environmental Analysis (CEA)

- The CEA 2023 aims to identify the main opportunities for the Comoros to better manage its natural capital, achieve its potential sustainably, capitalize on climate co-benefits stemming from the process, and advance the development agenda.
- This is the first CEA for Comoros and, as such, it constitutes an unprecedented opportunity to open avenues for effective natural resource management, poverty reduction, and the potential to boost socioeconomic development.
- The development of the CEA was based on a combination of literature review, secondary data analysis, stakeholder interviews, and focus groups conducted in early 2022. The outcomes of the CEA have been validated through a verification workshop with the country's key stakeholders.
- Given the lack of data on the natural capital of the Comoros, this CEA seeks to identify opportunities to strengthen the methodological soundness of natural resource management in the Comoros to enable evidence-based decision-making and prioritization of interventions.

fisheries, showed a per capita decline. The country's natural assets are, in fact, increasingly vulnerable and exposed to a series of stresses, causing their progressive decline and putting a strain on sustainable economic development and poverty reduction. Population growth has translated into a greater number of Comorians seeking livelihood opportunities, increasing the risk for forests, wetlands, and wildlife habitats to be converted into agricultural lands. Since 1960, the Comoros has experienced rapid population growth, especially concentrated in rural areas and along the coast, and the population was estimated to be approximately 870,000 in 2020 against 542,358 in 2000.

The depletion of the natural capital of the Comoros is also driven by the rural poor's high dependence on natural resource-based incomes. Poverty in the Comoros is overwhelmingly concentrated in rural zones, as 70 percent of the poor live in these areas (World Bank 2017a). Rural households tend to overuse natural resources to carry out their economic activities and meet their food and energy needs.

Climate change accelerates the depletion of the country's natural capital and ecosystem services, as it alters precipitation patterns, average surface and ocean temperatures, oxygen content, and acidity of seawater. The costs of climate-related impacts are estimated to reach US$836 million by 2050 (United Nations Development Programme [UNDP] 2014). Because of its geographical position, the Comoros archipelago is also exposed to many natural hazards, including droughts, storms/cyclones, floods, earthquakes, and volcanic activity. The total average annual direct losses from tropical cyclones, floods, and earthquakes are estimated at US$5.7 million (World Bank 2020k).

Against this backdrop, this country environmental analysis (CEA) for the Comoros calls for transformative change toward sustainable management of natural resources to achieve long-term poverty alleviation and resilience. An integrated approach to natural resource management would play a central role in enabling maximization of the synergies between the core elements of natural capital and to generate opportunities for climate co-benefits to arise. Whenever possible, co-management approaches would need to be adopted to increase local inclusiveness in decision-making processes, promote benefit-sharing and women's empowerment, raise awareness, and contribute to behavioral change among local populations about environmental challenges and opportunities. In addition, this CEA recommends improving the legal and institutional framework, enhancing institutional capacities, increasing resources for environmental management, and strengthening the decentralization agenda. To be effective, the above-presented approach would need to be paralleled by strengthened data availability and gap analyses. This is because, as indicated in this CEA, the lack of adequate data is a key constraint for the development of effective evidence-based decision-making and prioritization of interventions.

Key Environmental Issues

Land degradation in Comoros is widespread and severe

It is estimated that 57 percent of the arable land is in a state of degradation, which has resulted in significant socioeconomic impacts and loss of biodiversity and ecosystem services, such as water purification and flood control. The costs associated with land degradation correspond to a loss of US$274 million per year and a reduction of about 18 percent in the value of ecosystem services (Annex 2).

Severe land degradation is occurring in the Comoros because of overexploitation of natural resources, coupled with unsustainable traditional farming techniques and lack of mechanization and proper training. Land degradation is exacerbated by the impacts of climate change, high density and growing population, and inadequate land governance and management. The socioeconomic complexity of the land tenure regime poses a significant challenge to sustainable land management.

Decreased land productivity caused by land degradation significantly affects agriculture, the sector with the highest contribution to GDP and provision of jobs, and aggravates poverty and food insecurity in rural areas. Land degradation also affects the surrounding environment by increasing the intensity of soil erosion and the consequent disruption of waterways. Rural populations' subsistence dependence on this sector for their livelihoods makes sustainable management simultaneously challenging and urgent.

The Comoros has experienced dire deforestation and forest degradation

Forests represent an essential source of livelihood and food security for rural communities, offer important habitats for the country's rich flora and fauna, and provide CO_2 storage. Natural and planted forests

currently account for 17.7 percent of the country's total land (World Bank 2020a). Mwali National Park has proven to be a successful conservation tool and an important income source for local populations.

The Comoros has experienced a decline in forest area of approximately 13,000 hectares from 1990 through 2020 because of extensive and uncontrolled deforestation, which has, in turn, contributed to land degradation (World Bank 2020b, 2021f). Deforestation and forest degradation are primarily caused by clearance for agricultural expansion, followed by wood harvesting for timber (construction), firewood for household cooking, and the operation of ylang-ylang distilleries. Vulnerable groups, especially women, are highly dependent on forest resources for their livelihoods. The annual loss due to deforestation in the Comoros is estimated at US$1.953 million (Annex 2).

Despite its potential, the Comoros faces grave water scarcity and degradation

Although, in theory, water is an abundant resource in the Comoros (World Bank 2021c), the water supply is insufficient to meet the needs of the growing Comorian population. Water availability varies among the islands. Unlike Ngazidja, which has no surface water bodies, Ndzuwani and Mwali can rely on the availability of seasonally variable rivers and streams for water supply, the availability of which is, however, challenged by climate-induced and anthropogenic factors. Ngazidja has huge potential in groundwater resources, which account for 90 percent of the renewable water resources available on the island, but high operational costs hamper the exploitation of these resources. Rainfall varies considerably across and within islands because of differences in altitude and winds (World Bank 2021b). Water scarcity results from a combination of factors, including human activities, rising demand driven by population growth, inadequate management, climate change, and high operational costs. Water scarcity goes hand in hand with increasing water degradation, which is mainly linked with polluting human activities and poor infrastructure.

Access to basic drinking water supply services[1] in the Comoros was at the relatively high rate of 80 percent in 2019 and above the Sub-Saharan African average of 75 percent, but the country is still far from achieving safely managed standards,[2] as only 65 percent of the population has access to drinking water supply on their premises (63 percent in rural areas, 71 percent in urban areas). While access to basic drinking water is relatively high, access to basic sanitation services lags behind and appears to be a neglected area for investments. Indeed, current access to sanitation services equals 36 percent, which is above the Sub-Saharan African average of 28 percent but far behind the world average of 78 percent.[3]

The coastal and marine ecosystems of the Comoros are rich but degraded, and fisheries are under pressure

The country's coastal ecosystems harbor rich biodiversity and natural assets, including coral reefs, mangroves, and seagrass beds. These ecosystems are being degraded because of coastal erosion, pollution, extraction of natural resources, natural disasters, and climate change. The management of coastal and marine ecosystems and biodiversity is hindered by institutional limitations and a chronic lack of funding.

Subsistence fishing, unsustainable fishing methods, and limited enforcement of policy are placing significant pressure on fisheries. Furthermore, efforts to combat illegal, unreported, and unregulated (IUU) fishing by industrial and particularly artisanal fisheries have not been effective so far. Fisheries laws and decrees are in place, but implementation and enforcement remain key challenges.

Managing solid waste is one of the greatest ecological and social challenges for the Comoros

Poor solid waste management practices in the Comoros result in the pollution of soil, water, and marine and coastal ecosystems, while posing high risks for public health and resulting in economic loss. Widespread open dumping, open burning practices, and waste disposal along the coasts and rivers are common in the Comoros. Urban growth increases waste production and compounds poor waste management characterized by insufficient waste services and no safe disposal methods. Because of the growing

1 Basic drinking water refers to drinking water from an improved source, provided that collection time, including queuing, is not more than 30 minutes for a roundtrip (World Health Organization [WHO] and United Nations Children's Fund [UNICEF], 2021).

2 Safely managed drinking water is drinking water from an improved water source that is accessible on the premises, available when needed, and free from fecal and priority chemical contamination (WHO and UNICEF, 2021).

3 *Ibidem*.

population and new consumption and production patterns, the current efforts of the GoC are insufficient to properly manage the increasing amount of solid waste generated, including hazardous and hospital waste, the majority of which ends up polluting the environment.

The current fragmented and decentralized institutional setting represents a major constraint for sustainable waste management in the Comoros. While the institutional outline is set by the Framework Law of the Environment, no specific legislation is in place except for that addressing plastic waste. With limited funding, the National Agency for Integrated Waste Management (ANAGID) is not yet fully operational and lacks structural funding.

Despites its potential, the nature-based tourism (NBT) sector of the Comoros remains largely untapped

Although NBT contributes only 3.4 percent of the GDP of the Comoros, the potential for development of the sector is high because the country is rich in natural resources, such as forests and coastal and marine ecosystems. However, development of the tourism sector comes at the risk of increasing the pressures on freshwater resources, with infrastructural development and increased pollution damaging and fragmenting ecosystems (Commission Économique pour l'Afrique 2017).

Development of the sector is challenged by the limited competitive offer of high-quality hotels and tourism amenities, the lack of waste services and sanitation, and inadequate and unsafe transportation infrastructure. The difficulties the Comoros is facing are compounded by high competition in an unfavorable business climate, given that neighboring countries such as Madagascar, Mauritius, and Seychelles have a stronger, more developed tourism offer. As such, it would be fundamental for the Comoros to carry out an ex ante analysis to assess the effective potential of developing an NBT sector in the country.

Environmental Governance and Institutional Framework

The Comoros recently stepped up its commitment to upscale its environmental policies and laws, launching the update process of the National Environmental Policy (PNE) and the Framework Law of the Environment (FLE), the country's two key instruments for environmental management. This update process has become necessary as the two instruments become outdated and prove inadequate to fully uphold the country's environmental ambitions. In particular, the update process has the potential to fill the legal and policy gaps the country has faced over the last 30 years by including climate change, strengthening the environmental impact assessment system, and providing support for effective decentralization.

Despite the potential positive effects of the update process, the complex institutional framework of the Comoros is frequently a limitation for effective environmental management and enforcement. While a decentralization framework is in place as per the 2018 constitution, devolution of competencies remains incomplete, further exacerbating the disconnect between the central state and the islands and making environmental governance burdensome. Lack of adequate financial and human resources further aggravates the country's institutional fragility.

Against this backdrop, the PCE 2030 is a cornerstone document for the Comoros, as it sets forth the country's strategic framework for the next few years. It lays the foundation for structural change in the economy through the implementation of flagship projects and structuring projects in the five pillars for economic growth. The plan is supported by the Accelerated Growth and Sustainable Development Strategy 2018–2021, as well as by the Blue Economy Strategic Framework.

Opportunities for Change

The GoC is committed to addressing environmental challenges, including through important institutional frameworks such as the soon-to-be-updated PNE and the FLE, which are already in place. This is reflected through PCE 2030, which aims to achieve strong, inclusive, and equitable growth of the emerging economy without compromising natural resources and the environment. The World Bank's FY20-FY24 Country Partnership Framework for the Union of Comoros is aligned with these strategic efforts and seeks to aid in their implementation by mobilizing resources, carrying out policy reforms, and enhancing institutional capacity building.

When implementing the recommendations spelled out in this CEA, it is pivotal to acknowledge the interactions between the core elements of natural capital and avoid considering environmental sectors in isolation from one another. A landscape approach

for the integrated management of land, forestry, and water resources is needed, while also moving toward sustainable and integrated management of fisheries and marine and coastal resources, as well as an integrated waste management framework. Furthermore, the country would benefit from preliminary opportunity assessments of NBT to evaluate if the sector has the potential for being a growth driver and pro-poor tool. In addition, the development and implementation of successful sustainable natural resource management in the country will hinge on improving institutional and coordination capacities, ensuring that institutions are sufficiently resourced.

While the set of recommendations put forth may require medium- to long-term structural transformations, concrete actions following a phased approach can be undertaken in the short term as a foundation for this medium-long-term vision. In particular, the waste management and water sectors would need to be prioritized in the shortest term, as they represent the two most pressing issues for the Comoros, while also being apt at delivering immediate benefits for livelihoods, the economy, and the country's natural resource base.[4] In addition, the Comoros could leverage lessons learned from successful programs and pilots being implemented or recently concluded in the country by replicating and scaling them up while paving the way for lasting changes in natural asset management.

Recommendation 1: Strengthen environmental governance and support institutional capacity

- **Strengthen the capacity of general and regional directorates to fulfill their mandate by mobilizing human, technical, and financial resources.** Develop targeted continuous professional development programs for technical staff at different levels, as well as capacity building for other stakeholders. Carry out a human resource needs assessment to ascertain the specific level of support needed at the national and regional levels for the directorates to carry out their functions and increase service delivery.

- **Boost law enforcement capacity coupled with targeted livelihood support and community empowerment programs.** Specifically strengthen enforcement capacity concerning key environmental challenges such as overexploitation, deforestation, pollution, water supply, and IUU fishing. Couple enforcement with a co-management approach that involves and empowers local communities in the management of natural resources and livelihoods.

- **Ensure that the environmental implications of projects and actions are taken into account by the GoC before decisions are made.** Enhance the technical capacity of institutions to evaluate the socioenvironmental impacts of a proposed project or development plans, taking into account beneficial and adverse socioeconomic and human-health impacts. In particular, updating the environmental impact assessment (EIA) regulatory framework and management system is recommended. Develop and strengthen the institutional capacity for implementation of the Strategic Environmental and Social Assessment (SESA) to ensure that environmental and social implications are adequately taken into account in the process of elaborating plans and strategies in support of sustainable development.

Recommendation 2: Promote sustainable land, forest, and water management

- **Adopt an integrated landscape approach** to optimize synergies and promote sustainable use and conservation in an equitable manner. The approach would enable the country to maximize productivity, improve livelihoods, and reduce negative environmental impacts, while providing an opportunity to generate significant climate co-benefits and and foster synergies between mitigation and adaptation in the country.

- **Develop and implement land-use plans for Ngazidja and Ndzuwani to protect the natural forest resources and promote climate-smart agriculture (CSA) such as agroforestry and reforestation**. Apply a zoning approach to identify the usage for different zones, including agriculture, agroforestry, protected dry forests, and natural forests in National Parks. Combine this strategy with an integrated landscape approach to ensure that all activities in the area work in complementarity and that each specific zone is used for its intended purpose.

- **Promote reforestation and soil fertility and strengthen climate-resilient integrated water resource management.** Conduct reforestation by planting native trees that offer economic benefits and opportunities to diversify incomes for local communities.

4 In line with this prioritization approach, two policy notes addressing the water and waste sectors have been developed as part of the CEA.

- **Protect terrestrial, coastal, and marine ecosystems and biodiversity** by officially operationalizing the two additional terrestrial national parks.
- **Upscale the simplification and decentralization of the land tenure regime** to enhance legal certainty and strengthen social cohesion while ensuring transparency.
- **Strengthen the sustainable and climate-resilient agriculture capabilities of the rural population.** Establish a climate-resilient agriculture plan and develop a sustainable irrigation strategy. Integrate climate-smart training for farmers to increase the sector's resilience against the effects of climate change and improve yields and soil fertility.
- **Support watershed protection and restauration.** Watershed protection and restauration have the potential to be among the more effective solutions to increase climate resilience and improve the well-being of ecosystems, while also facilitating efforts to meet the increasing demand for water for drinking and environmental and agricultural uses.
- **Improve drinking water quality and higher sanitation standards.** scale-up Water, Sanitation, and Hygiene (WASH) programs and increase investments in sanitation infrastructure in both rural and urban areas.

Recommendation 3: Promote sustainable fisheries and integrated marine and coastal management

- **Support the development of a sustainable fisheries strategy.** Ensure consistency among fisheries decrees and address key challenges such as IUU fishing, international/regional cooperation, and co-management of coastal and marine resources. Include a fisheries management plan in the strategy, where science and research on the status of fish stocks feed into an informed decision-making process.
- **Sustainably protect and manage coastal zones and reduce the impacts of climate change.** Develop an integrated coastal management plan and blue economy roadmap and support the Marine Spatial Plan in one integrated process. The Post-Kenneth Project (see Box 4) could form the foundation for the next interventions. Identify management objectives, measures, actions, and opportunities for coastal risk management. Support and integrate the Marine Spatial Plan initiated by the General Commission for Planning with technical and financial assistance from Indian Ocean Commission (IOC)-United Nations Educational, Scientific and Cultural Organization (UNESCO) beginning in November 2021.
- **Promote the protection and restoration of mangroves, seagrass, and coral reefs.** Assess their potential to function as a nature-based flood defense. Base projects on co-management principles; as part of this approach, include capacity building on sustainable fishing practices to reduce pressures on coastal and marine ecosystems. Strengthen financial support for the creation of the three marine national parks.

Recommendation 4: Invest in Integrated Solid Waste Management (ISWM)

- **Develop a comprehensive strategy for ISWM**, considering interventions in waste prevention, collection, disposal, and waste recycling. An implementation roadmap should be prepared for infrastructural development, taking into account the implementation capacities of national, regional, and local governments and societal parties.
- **Invest in services and infrastructure capable of ensuring adequate waste collection, recycling, and disposal.** Expand and enhance waste collection services to households that are not yet covered, minimize collection losses, and increase voluntary, community-based collection points, including those for recyclable materials. Provide the country with final waste storage sites meeting environmental norms and standards.
- **Improve the institutional and legislative framework**. Update the sector legislation, provide ANAGID with the required funding, strengthen the technical and institutional capacities of all stakeholders at each tier of government, and include adequate provision and mechanisms to enable them to develop.
- **Reduce the generation of solid waste, incentivize design for reuse, use alternative materials, and increase opportunities to establish a circular economy approach.** Carry out a life-cycle assessment of the most problematic waste products, particularly those with higher potential for reuse and recycling, followed by a feasibility study for policy and regulatory options to increase circularity (for example, market-based instruments to restrict, substitute, or incentivize reuse of plastic items).

- **Improve data collection and analysis.** To develop effective and sustainable ISWM policies, it is crucial for the GoC to conduct in-depth, sound studies on cost recovery and sustainability aspects, as well as to quantify the environmental and public health footprint of waste in both rural and urban areas. Assessment of the potential impact of tourism-sector development on waste management in the country is also essential. Implementing such studies would be instrumental for the Comoros to close the gap and inform decision-making across all aspects of ISWM.
- **Raise awareness about waste-related risks and opportunities, in particular the prevention of solid waste generation and sorting at source.** Adequate communication campaigns, awareness-raising events, and capacity building should be planned to promote behavioral change by all stakeholders involved.

Recommendation 5: Promote nature-based tourism

- **Develop upstream opportunity assessments and demand analyses to close the data gap and clarify a realistic market space for NBT in the Comoros.** Filling this data gap would be a prerequisite to the development of strategies and plans. This should include updating the 2013 Comoros Tourism Sector Review to provide evidence-based understanding of the Comoros NBT sector's effective potential as a growth driver for the country.
- **Value protected areas not only as a conservation tool but also as a livelihood support asset and potential engine of growth through NBT opportunities.** To achieve this goal, it would be fundamental to expand the country's protected areas and ensure their sustainable management and financial sustainability.
- **Ensure participatory approaches in decision-making processes, scale co-management opportunities, and ensure the establishment of benefit-sharing mechanisms with local communities.** For the benefits deriving from the development of the NBT sector to trickle down to local populations, participatory approaches and co-management mechanisms will be essential; in turn, these might support behavioral change recognizing the value of environmental conservation. Successful co-management pilots in Mwali National Park could be replicated. Awareness raising and capacity building are equally important to ensure proper understanding and incentivize participation.
- **Monitor biodiversity and ecosystems in protected areas, and plan NBT development according to the carrying capacity of each island.** Evidence-based information on tourism, the status of biodiversity and ecosystems, and island-specific carrying capacity will inform policy development, improve tourist services, assist local communities effectively, and ensure proper conservation of the natural capital of the Comoros.
- **Finalize and adopt the draft Sustainable Tourism Master Plan, the National Tourism Strategy report, and the Strategic Plan 2019–2025 and ensure alignment with the PCE 2030.** This exercise will ensure a solid basis for the achievement of any NBT sector targets in a sustainable fashion.

2. Introduction

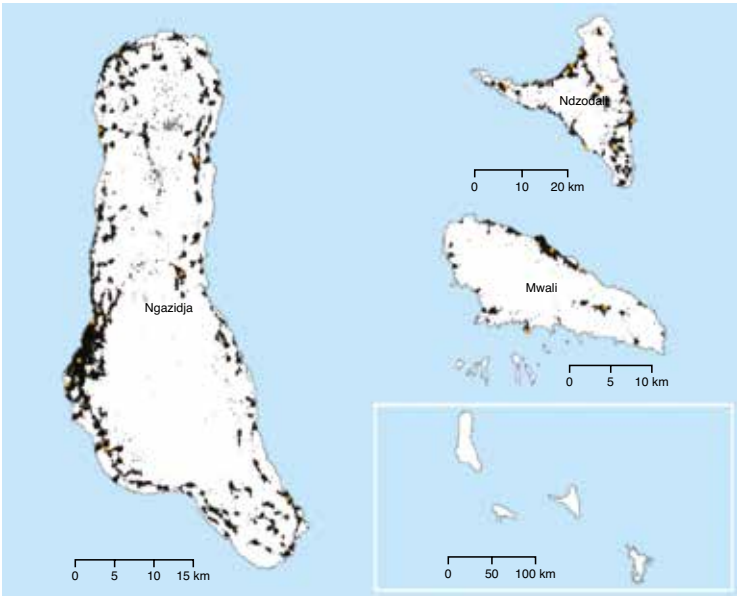
2.1. The Comoros at a Glance

The Union of the Comoros (henceforth "the Comoros") is a small island developing state consisting of an archipelago located at the northern entrance of the Mozambique Channel in the Indian Ocean. The Comoros Islands are made up of Ngazidja, Mwali, and Ndzuwani (see Table 1 for key characteristics), as well as Maore, which currently falls under French administration and is not covered in this study, and many smaller islands. The total land surface is 1,860 square kilometers, surrounded by an exclusive economic zone (EEZ) of 160,000 square kilometers, which is approximately 86 times the size of the land area (Figure 1). The islands have volcanic origins with high topographic relief characterized by drastic altitudinal changes ranging from low-lying coastal areas to elevations higher than 2,000 meters. The fertile volcanic soil and the altitudinal gradient create favorable microclimates for agriculture.

The Comoros is characterized by dense vegetation with varied ecosystems rich in species diversity, endemism, and abundant natural resources. Ecosystems include mangroves, seagrass beds, coral reefs along the coast, savanna shrubs and forests on land, and wetland ecosystems. The Comoros harbors many emblematic, threatened, or migratory species, such as sea turtles, whales, dolphins, lemur, dugong, and sea cucumbers.

The country has a tropical marine climate with two seasons. The rainy season extends from November to April and is characterized by hot and humid weather. The dry season lasts from June to October and brings lower humidity and relatively lower temperatures. The Comoros experiences a hydro-climatic seesaw

Figure 1. Map of the Comoros Islands.



Source: World Bank 2021c.

effect that oscillates between recurrent water scarcity in the dry season and heavy rainfall and floods in the humid season. It is highly vulnerable to climate change and natural hazards, such as droughts, tropical cyclones, earthquakes, floods, landslides, and tidal waves.

Since its independence, the Comoros has experienced recurring political instability, underpinned by the weakness of formal institutions and the lack of a strong sense of national unity. The decentralization process rolled out as envisioned under the 2018 constitution is still incomplete, further exacerbating the disconnect between the central state and the islands. The Comoros is currently classified by the World Bank as a state with high institutional and social fragility.

Although the population of the Comoros has increased steadily since 1960, reaching approximately 870,000 in 2020 (World Bank 2020c), with growth seen especially in rural areas, the country has yet to reap the demographic dividend. The Comoros is still in the early stages of urbanization, with only 30 percent of the population living in urban areas. A growing population and the high population density contribute to the pressure on the environment and wealth of the Comoros.

Although Comorian society is matrilineal, with women playing an important role in terms of asset ownership, gender inequality in the Comoros is entrenched. This results in low education outcomes for women and underrepresentation of females in all spheres of political and socioeconomic activity, among other effects.

The country's Gross Domestic Product (GDP) has been growing at approximately 2.8 percent annually for the last 10 years (World Bank 2020c), although GDP per capita has been stalling due to population growth (Figure 2) (World Bank 2017a). GDP declined in 2020, affected by the COVID-19 pandemic as well as cyclone Kenneth in 2019. Unemployment levels are relatively high at approximately 9.4 percent (World Bank 2021a[5]). This is specifically the case with the younger population: in 2014, one in two young Comorians of working age were unemployed, and only 3 percent were employed in the formal sector (World Bank Country Partnership Framework [CPF] 2020).

Weak economic growth has gone hand in hand with modest poverty reduction (World Bank 2020k, 2021e). Approximately 44.8 percent of the population lived below the national poverty line in 2020, using the national poverty line of KMF 41,495 (US$99) per capita per month (World Bank 2021f). With a Human Development Index (HDI) score of 0.555, the Comoros ranked 156 out of 189 countries (United Nations Development Programme [UNDP] 2020).

Economic inequality is relatively low in the Comoros (World Bank 2021f). The richest 10 percent account for 26.1 percent of the total consumption expenditure of the population, more than the bottom 40 percent who account for 20.4 percent of the total consumption expenditure. This inequality is driven mostly by inequalities within urban and rural areas, as well as within each of the islands, rather than between geographical locations.

2.2. Importance of Natural Capital for the Comoros

Natural capital is at the center of livelihoods and is the basis for key Comoros economic sectors, such as agriculture, fisheries, and nature-based tourism (NBT). Approximately 38 percent of the GDP of the Comoros is generated in activities for which land, sea, and nature are important inputs, and approximately 50 percent of the rural population is dependent on agriculture and fisheries for their livelihood (World Bank 2020j). In particular, agriculture and fisheries account respectively for 30.5 percent and 2.87 percent of GDP (World Bank 2020k). With the majority of the population living along the coast, the Comoros is highly dependent on small-scale fisheries for food security and nutrition. While relatively small in terms of economic contribution (3.4 percent of GDP), NBT has great potential but is largely untapped (World Bank 2020l). The Comoros is also rich in natural and planted forests, which currently account for 17.7 percent of the total land (World Bank 2020a) and are important habitats for biodiversity and for CO_2 storage for the Comoros. They represent an essential source of livelihood and food security for rural communities and have the potential to contribute more significantly to GDP if sustainably managed. Although, in theory, water is an abundant resource in the Comoros, current levels of water supply are insufficient to meet the needs of the growing Comorian population because of low watershed storage capacity, land degradation, and limited investments in green infrastructure.

The natural assets of the Comoros are increasingly vulnerable and exposed to multiple stressors, such

5 World Bank, 2021. Comoros Unemployment, total (% of total labor force). Available at: https://data.worldbank.org/indicator/SL.UEM.TOTL.ZS?locations=KM

Table 1. Key characteristics of the main islands of Comoros (Source: stakeholder consultations unless otherwise stated)

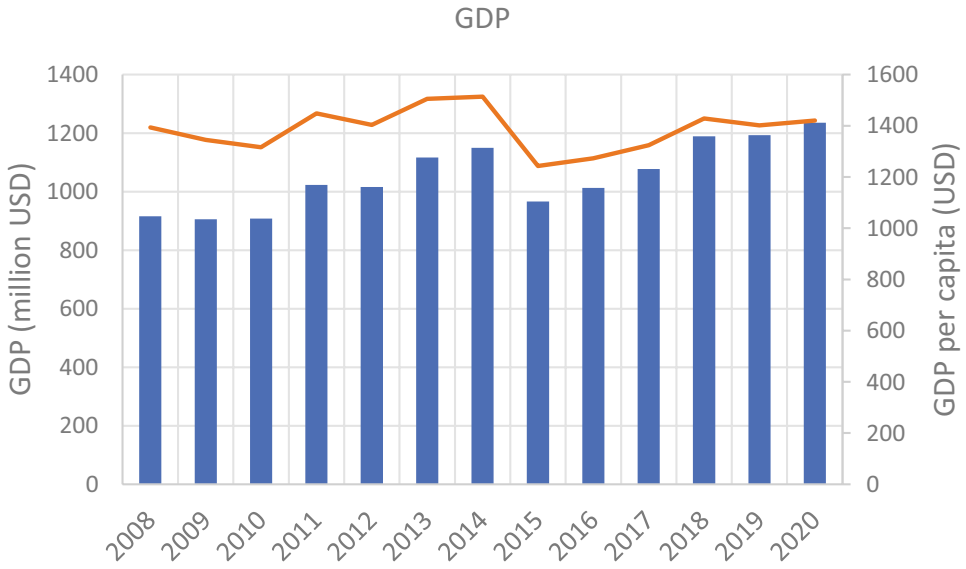
	Ngazidja	Mwali	Ndzuwani
Population density	330.46 inhabitants/km^2 (projection) (INSEED 2021) Significant emigration to France	192.45 inhabitants/ km^2 (projection) (INSEED 2021) The least densely populated island High immigration of citizens from the other islands (mainly from Ndzuwani)	835.77 inhabitants/km^2 (projection) (INSEED 2021) One of the highest density populations in the world Significant emigration to other islands including Mayotte
Physical and natural characteristics	Geologically youngest island Active volcano (high risk of disaster in case of an eruption, geothermal potential, etc.) Very porous basalt soils Home to largest natural forest in the country Absence of surface water Availability of crushing materials 60 percent of coastline covered by coral reefs	Geologically oldest island Clayey and very fertile soils The most natural island (whole island is a United Nations Educational, Scientific and Cultural Organization [UNESCO] biosphere reserve) Presence of permanent rivers Quite rare crushing materials 100 percent of coastline covered by coral reefs	Most mountainous island Very limited agricultural land Presence of permanent rivers 80 percent of coastline covered by coral reefs
Key economic sectors	Agriculture/vanilla production/vegetables Fisheries, including tuna fishing Trade	Subsistence agriculture/clove production/ strong increase of ylang-ylang cultivation Reef fish fishing	Agriculture: ylang-ylang and clove production/milk production Tuna fishing Active business initiatives
Key environmental challenges	Pollution/solid waste management Deforestation Extraction of gravel for construction	Deforestation Mining of coastal materials Land erosion Coastal and marine ecosystem degradation (coral reef, seagrass, mangrove forests) Drying up of rivers	Deforestation Land erosion Drying up of rivers Solid waste management Very strong pressure on the land
Social organization	Significant power of notables Strong participation of diaspora in the realization of community projects Local associations very proactive	Local associations very proactive Participation of diaspora in the realization of community projects	Local associations very proactive Participation of diaspora in the realization of community projects

as population growth and density, high dependency of the rural poor on the country's natural resources, climate change, and natural disasters. The combined impact of these factors drives the Comoros' declining natural capital and triggers major environmental challenges that need to be addressed to invert the trend and release its considerable socioeconomic potential.

Despite traditionally being one of the main drivers of growth in the Comoros, agriculture and fisheries suffer low productivity. Agricultural productivity is hampered by unsustainable land uses, outdated farming practices, natural disasters, climate change, and hydro-climatic risks. The socioeconomic potential of fisheries has yet to be realized sustainably, given the many challenges including unsustainable practices; illegal, unreported, and unregulated (IUU) fishing; the lack of governance and enforcement of policies; and climate change. The contribution of NBT to growth and development is also limited due to the lack of adequate infrastructure, including waste management, sanitation, and freshwater supply systems. These limitations of the Comoros are visible, for instance, along the coastlines, where large amounts of debris collect on beaches and in the reefs. During the past decades, the Comoros also experienced severe deforestation and forest degradation, as evident in the 20 percent decline in forest natural capital per capita between 1990 and 2020.

If sustainably managed, the natural resource base of the Comoros could become an engine for growth and poverty reduction. Improving the management and utilization of the country's rich natural capital will underpin environmental conservation while supporting poverty reduction, the livelihoods of rural communities depending on natural assets, and growth

Figure 2. GDP (blue bars) and GDP per capita (orange line) in the Comoros from 2008 to 2020.



Sources: World Bank 2020d, 2020c.

and development in key sectors of the economy. It also opens opportunities for generating significant climate co-benefits and enhanced climate resilience, ultimately contributing to structural transformation and sustainable development. Healthy ecosystems could become a source of socioeconomic well-being and a way out of poverty and unemployment, especially for young Comorians, as they create a potential asset for the enhancement of economic growth if combined with education and employment diversification opportunities (World Bank 2020j).

2.3. A Country Environmental Analysis for the Comoros

Against this backdrop of cumulative pressures on the country's natural capital, the Government of the Union of the Comoros (GoC) has recognized the need for a major shift toward sustainable development and structural transformation of the economy, as stated in the Comoros Emerging Plan (PCE) 2030. The World Bank aims to support the GoC along this path, in line with the 2020–2024 Country Partnership Framework (CPF) and the Systematic Country Diagnostic (SCD).

The Comoros CEA is situated within the context of that framework. The CEA is a World Bank country-level diagnostic tool designed to close the gap between environmental sustainability and socioeconomic development.

The objective of the Comoros CEA is to provide a critical review of the country's natural resources and associated challenges, as well as their potential role for poverty alleviation and sustainable development if properly managed. The CEA identifies and describes the status of the key natural assets and their contribution to the country's wealth, economic growth, and livelihoods. It explores the costs of environmental degradation, providing the basis for policy dialogue on the economic and social costs of nonaction. In addition, it assesses and identifies the gaps in institutional capacity for environmental and natural resource management. It also analyzes the specific challenges for each key environmental sector. Finally, the CEA makes recommendations on critical interventions required to protect the country's natural assets and open the pathway toward sustainable, resilient development, by helping define and prioritize donor support that can strengthen natural resource management in the country. Given that this is the first CEA for the Comoros, it constitutes an unprecedented opportunity to open avenues for effective natural resource management, simultaneously boosting the potential for socioeconomic development.

Methodology

The Comoros CEA was developed based on a literature review, secondary data analysis, stakeholder interviews, and focus groups conducted in early 2022. The outcomes of the CEA were validated through a verification workshop with the country's key

stakeholders (see stakeholder list, Annex 8). Given the lack of available and updated data on the natural capital of the Comoros, this CEA seeks to identify opportunities to strengthen the methodological soundness of natural resource management in the Comoros, to inform effective, evidence-based decision-making and prioritization of interventions.

Structure of the CEA

This CEA is structured into four chapters (chapters 3–6), followed by a final chapter with conclusions (chapter 7) (Figure 3):

Chapter 3: The Decline in Natural Capital. This chapter describes the natural capital of the country and the main drivers of degradation and decline in natural capital. It provides the rationale for the need to protect natural capital and, consequently, to boost the country's prospects for sustainable development.

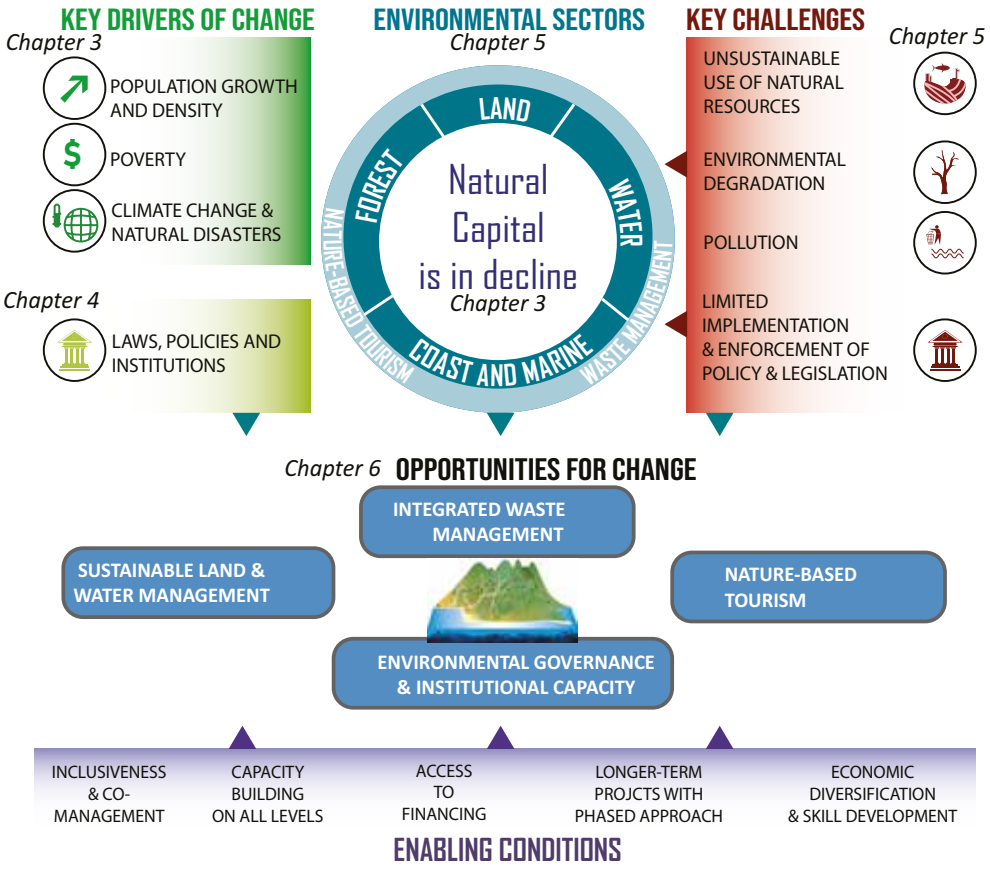
Chapter 4: Environmental Governance and Institutional Framework. This chapter describes the key environmental policies and environmental legislation, the institutional setting and governance challenges of the Comoros, and the key strategic documents for sustainable development adopted to date.

Chapter 5: Key Environmental Sectors. This chapter provides a comprehensive analysis of the most important environmental sectors of the Comoros, from land, forests, and water to the coastal and marine sectors, including NBT and waste management. It also assesses the key challenges and makes associated recommendations for sustainable, resilient development.

Chapter 6: Looking Ahead. This chapter puts forward the cross-sectoral opportunities for change that enhance sustainable, resilient development in the Comoros. It also describes the enabling conditions to achieve this path.

Chapter 7: Conclusions. This chapter summarizes the main results and recommendations of the Comoros CEA. It identifies concrete opportunities that could be leveraged in the short term to help steer the Comoros toward a sustainable, inclusive, and climate-resilient development path.

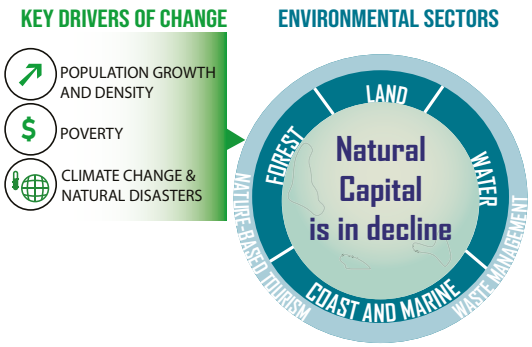
Figure 3. Structure of the Comoros CEA.



3. The Decline in Natural Capital

The main challenge for the Comoros is to achieve strong, inclusive, and equitable growth without compromising natural resources and the environment. To lay out the way forward, which is the main objective of this CEA, it is critical to look at the wealth of the Comoros and fully assess the main challenges and opportunities along the pathway toward sustainable development (Box 2). However, the gross domestic product (GDP) of the Comoros can provide only a partial picture of the health of the country's economy over the long term and is unable to capture the sustainability aspects of growth. A closer look at the country's natural capital, in contrast, highlights a more concerning picture of a decline in natural capital per capita. An in-depth analysis of the drivers of this decline can ensure that economic and political decision-making adequately incorporate an assessment of how growth and development trajectories are affecting and being affected by natural capital, both currently and in the future.

This chapter presents the natural capital of the Comoros, describes the trend of decline in natural capital, and identifies the main drivers of the decline, namely a growing population and density, high dependency of the rural poor on natural assets, and climate change and natural disasters. Finally, it makes the case for sustainable development by addressing the costs of environmental degradation and the benefits of environmental restoration.



3.1. Natural Capital

As for many other lower- and middle-income countries, the Comoros is dependent on natural capital for its wealth, meaning that the economy is still largely based on the primary sector. Natural capital accounts for approximately 8 percent of the country's total wealth (World Bank 2021d) (Figure 6). This percentage is relatively low compared to its peer countries; for example, the share of renewable natural resources of Madagascar, Mozambique, Tanzania, and Kenya are 30 percent, 42 percent, 20 percent, and 16 percent, respectively (Box 3). The main share of the country's renewable natural capital comes from agricultural land. Therefore, an increase in the productivity of the Comoros agriculture sector could enable the population to diversify away from subsistence agriculture, alleviating rural poverty and creating opportunities for the development of other economic sectors such as tourism. Other natural assets such as forests, fisheries, biodiversity, and mangroves all have the potential to contribute to the livelihoods and well-being of the population, particularly the rural poor (see chapter 5). This is both through the economic potential they offer (for example, potential contribution to nature-based tourism in the Comoros), as well as through the ecosystem services they provide that contribute to well-being (for example, stabilization of the shoreline and uptake of CO_2). This highlights the importance of sustainable management of the natural capital of the Comoros to ensure long-term economic growth.

The renewable natural capital of the Comoros, including agricultural land, forests, and fisheries, has shown a decline per capita. These renewable assets are directly linked to the country's most important economic sectors. Growth in GDP, coupled with demographic expansion and decline in natural capital per capita, seem to indicate that in the long run, the natural capital stock may not keep up with the rate of use. In addition, urban

Box 2. The Wealth of Nations and the Wealth of the Comoros

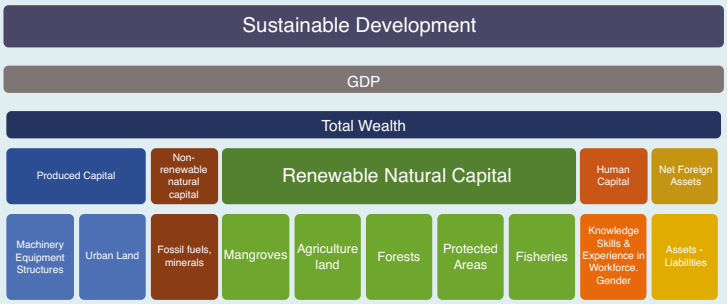
Why look at wealth?

To assess and design sustainable development paths, it is essential to go beyond the traditional focus on GDP and analyze wealth, namely the stock of natural and human capital and net foreign assets (Figure 4). Although GDP provides an important measure of economic progress, it measures only income and production and does not reflect changes in the underlying asset base. GDP says nothing about a country's natural capital. For instance, GDP could show double-digit growth without indicating whether natural assets have been depleting, whether investment and accumulation of wealth are keeping pace with population growth, or whether the mix of assets is consistent with a country's development goals. For this reason, this CEA has opted to look at the Comoros' development path through the lens of wealth, to fully capture the value of natural assets in generating income and supporting human well-being.

Wealth in the Comoros

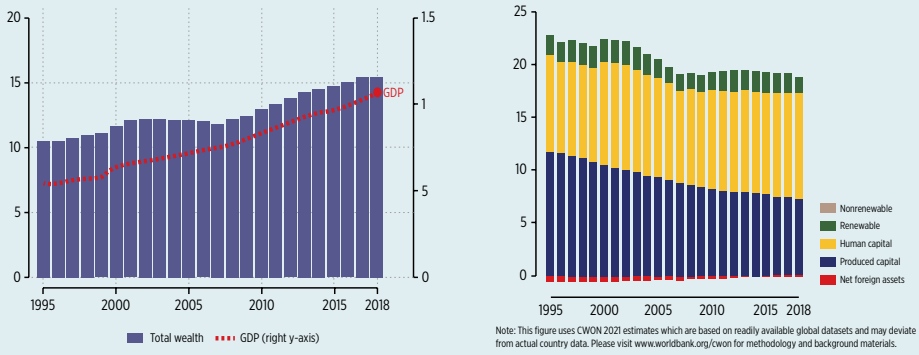
Total wealth of the Comoros has shown an increase over time, whereas total wealth per capita has been declining. The increase in total wealth was mainly driven by an increase in human capital. Human capital is considered to be the most important component of global wealth, as it indicates estimated earnings in a lifetime (World Bank 2021d). This increase in human capital indicates a shift toward the services sector, where earnings are higher. The decrease in wealth per capita, a leading measure of long-term sustainability, is most clearly illustrated by a reduction in produced capital because of population growth (Figure 5) or deterioration of materials. The decline in produced capital per capita indicates that machinery, equipment, and structures require additional investments to keep up with the growing population.

Figure 4. The assets and capital that drive wealth and underpin economic and sustainable development (based on the Kenya and Malawi CEAs and the World Bank's Changing Wealth of Nations.



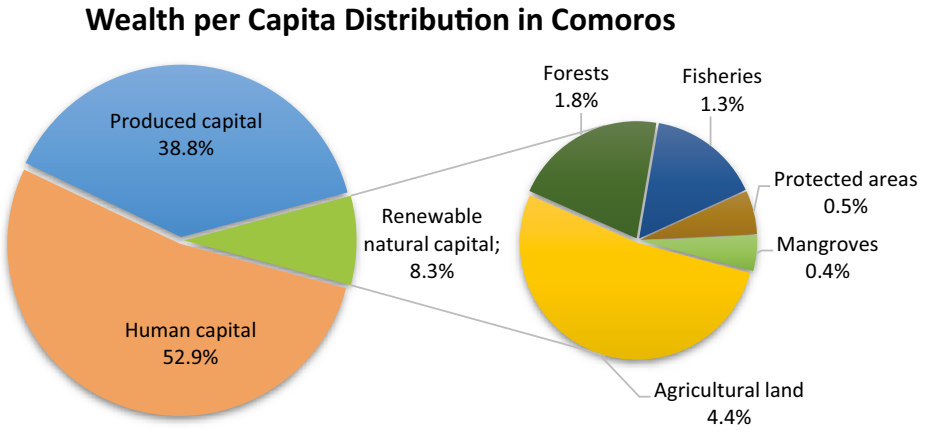
Source: World Bank 2021d.

Figure 5. Total wealth and GDP of the Comoros (left) and wealth per capital by contributor (right) from 1995 to 2018.



Source: World Bank 2021d.

Figure 6. Distribution of per capita wealth in the Comoros.



Source: World Bank 2021f.

land is becoming more densely populated, giving rise to environmental pollution because of the limited wastewater and solid waste infrastructure.

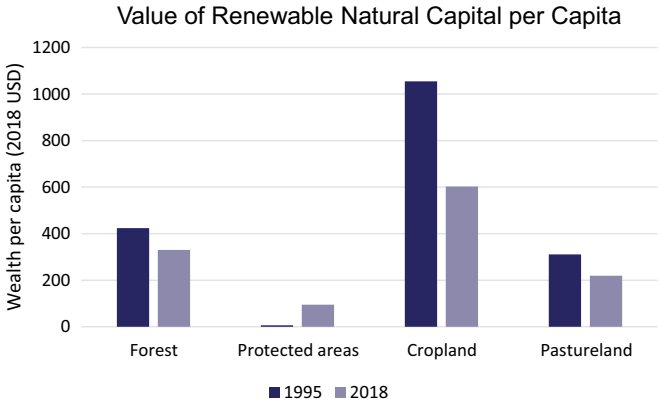
A more detailed evaluation of changes in the renewable natural capital of the Comoros shows that the general decrease is mainly caused by a significant drop in the value of cropland per capita (Figure 7) (see section 5.1 for a detailed analysis of land degradation and its drivers). This decline in the value of cropland per capita is due to an increase in population size and land degradation since the natural capital total value of cropland itself remained stable and the decrease is only visible in wealth per capita. Nontimber forest, which offers ecosystem services such as minor forest products, hunting, recreation, and watershed protection, is decreasing at the expense of forest land used for timber. This indicates that rather than increasing productivity in existing timber forests, natural forests are degraded to production forests with implications for species diversity as well as ecosystem functioning.

3.2. Main Drivers of Decline in Natural Capital

Growing Population and Density, and Urbanization

Population growth, concentrated in rural areas and underpinned by lack of governance and investments, is one of the main drivers of the decline in the Comoros' natural capital. About 88 percent of Comorians live along the coastline (World Bank 2021c) and about 70 percent in rural areas. Since 1960, the Comoros has experienced rapid growth, especially concentrated in rural areas and along the coast, and the population

Figure 7. Changes in wealth from renewable natural capital per capita in the Comoros from 1995 to 2018.



Source: World Bank 2021d.

estimated at approximately 870,000 in 2020 compared to 542,358 in 2000 (Figure 9). Population growth has translated into a greater number of Comorians seeking livelihood opportunities, increasing the risk for forests, wetlands, and wildlife habitats to be converted into agricultural lands. The impact of these demographic trends on the Comoros' natural capital has been further exacerbated by the lack of adequate governance, management, and enforcement of the implementation of environmental legislation (see chapter 4).

Although the country is in the early stages of urbanization, cities have a pivotal role to play in addressing the main ecological and development challenges. This is especially true given that most of the population lives within 20 kilometers of a city because of the small size of the islands (World Bank 2021c). The Comoros Emerging Plan (PCE) 2030 aligns to this vision, acknowledging the potential of cities in driving economic growth without compromising natural resources and the environment. Despite representing an opportunity, the urbanization process has been taking place in an unmanaged way because of a lack of urban planning, inadequate funds, and low institutional capacity. As such, cities are not equipped with the necessary waste management, water, and health facilities to meet the needs of the growing population. Given the limited availability and higher costs of residential land in the capital, 56 percent of migrants have set up in vulnerable urban settlements, where land is leased to them informally and connections to electricity, water, or sanitation networks are often lacking (World Bank 2021c). As a result, pressures on the environment continue to surge, and a parallel increase is occurring in the likelihood of disease spread across the population.

High Dependency of Rural Poor on Natural Assets

The depletion of the Comoros' natural capital is also driven by the rural poor's high dependence on natural-resource-based incomes. In fact, poverty in the Comoros is overwhelmingly concentrated in rural areas (70 percent of the poor) (World Bank 2017a), where households tend to overuse natural resources to carry out their economic activities and meet their food and energy needs. Indeed, the average person living in poverty in the Comoros lives off subsistence agriculture and artisanal fishing rather than commerce and services, putting additional pressure on the natural assets on which they depend.

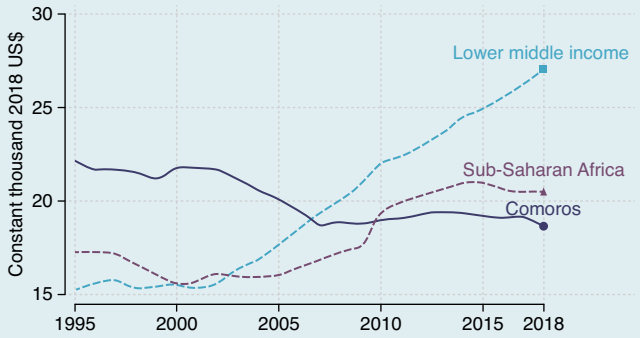
Rural poverty affects but is also affected by the decline of the Comoros' natural capital. The unsustainable use of natural resources risks triggering a vicious cycle of declining livelihoods, increased ecological degradation, and loss of natural resources, further exacerbating poverty in the country. Rural households are generally worse off because of bigger family sizes, fewer assets, limited access to employment, and lower access to infrastructure and basic services—compounding pressures on natural assets and, in turn, on their own livelihoods. The depletion of ecosystem

Box 3. The Wealth of the Comoros Compared to the Wealth of Other Countries

The wealth gap between low-income and high-income countries is increasing. Although national total wealth increased in all 146 countries assessed in Changing Wealth of Nations, 22 countries saw a decline or stagnation in per capita wealth (World Bank 2021d). Even compared to countries in the same income group and other countries in sub-Saharan Africa, the Comoros scored low in total wealth per capita (Figure 8). This can be explained by the small size of the Comoros, combined with a high population density that is dependent on current capital.

Table 2 compares the Comoros (lower-middle income) to several peer countries based on proximity: Seychelles (high income), Madagascar (low income), Mozambique (low income), Tanzania (low income), and Kenya (lower-middle income). Except in Kenya, the total wealth per capita is higher in the Comoros than in the other countries, attributed to higher produced capital and human capital. However, with the exception of Seychelles, the Comoros scored lower on natural capital, mainly due to lower scores of forests, cropland, and pastureland, and higher per capita wealth with regard to mangroves and fisheries. Sustainably increasing the productivity of the sectors depending on natural capital could help the Comoros increase its wealth. Furthermore, preservation of the existing natural capital is required to benefit both the developing economic sectors, such as tourism, as well as current livelihoods. This will ultimately lead to increasing total wealth.

Figure 8. Change in total wealth per capital in the lower middle-income countries, Sub-Saharan Africa, and the Comoros from 1995 to 2018.



Source: World Bank 2021d.

Table 2. Comparison of per capita wealth in 2018, constant 2018 US$.

	Comoros	Seychelles	Madagascar	Mozambique	Tanzania	Kenya
Total wealth	18,698	-	8,375	6,505	15,378	22,055
Produced capital	7,276	9,307	1,461	1,354	3,314	3,566
Human capital	9,932	-	4,647	3,551	9,365	15,260
Natural capital	1,567	873	2,538	3,388	3,238	3,618
Renewable natural resources	1,567	873	2,522	2,700	3,118	3,617
Forests, timber	213	39	855	1,046	782	808
Forests, nontimber	117	5	356	447	471	91
Mangroves	78	549	16	15	5	10
Fisheries	243	184	16	15	6	6
Protected areas	95	71	52	57	492	464
Cropland	603	23	632	972	1,010	833
Pastureland	219	2	595	147	352	1,406

Source: World Bank 2021d.

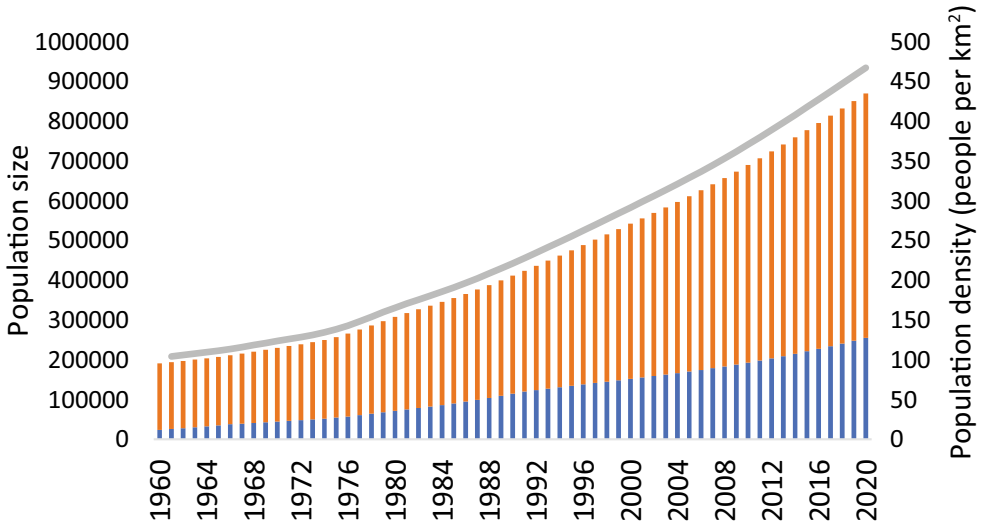
services coupled with worsening living conditions in rural areas also contributes to the intensification of the rural-urban migration, further increasing the pressure on the environment. Moroni receives most of the influx, and an estimated 78 percent of the city's population growth stems from internal migration (World Bank 2021c).

Climate Change and Natural Disasters

Climate change accelerates the depletion of the Comoros' natural capital and ecosystem services, as it alters precipitation patterns, average surface and ocean temperatures, oxygen content, and the acidity of seawater. These trends jeopardize the country's economy, livelihoods, and natural resource-based sectors, while hampering poverty alleviation (Bourgoin et al., 2016). The costs of climate-related impacts were estimated to reach US$836 million by 2050 (UNDP 2014), equivalent to an average cost of US$23 million per year for the same period and representing 1.9 percent of the GDP in 2019 (Ministère de l'Agriculture, de la Pêche, de l'Environnement, du Tourisme et de l'Artisanat [MAPETA] 2021a). While this is described in more detail throughout the report in the relevant subsections, an overview of key impacts is provided here.

Droughts pose a significant threat to the Comorian population and natural resources, in light of changes in precipitation patterns and warming. Indeed, the rainy season has become more irregular and has shortened in duration from six months to approximately three months per year, while the average annual temperature has increased by 0.9°C (Figure 10)

Figure 9. Urban (blue bar) and rural (orange bar) population size and density in the Comoros from 1960 to 2020.



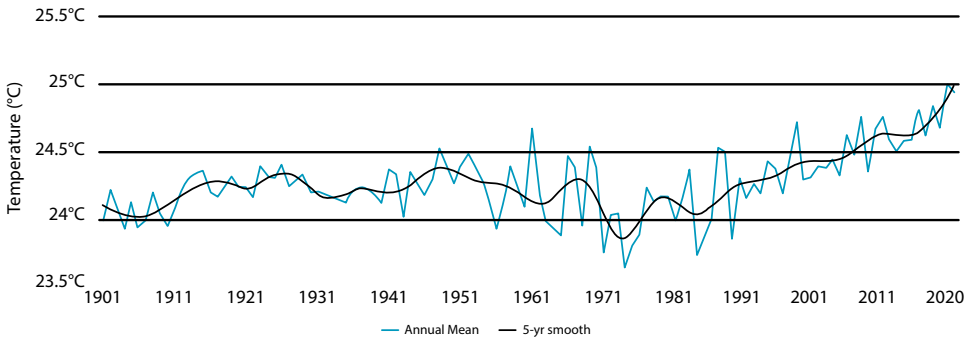
Sources: World Bank 2020h, 2020m, 2020g.

and is projected to increase by an additional 0.8 °C (Representative Concentration Pathway [RCP] 2.6) to 2.1 °C (RCP 8.5) by 2060 (MAPETA 2021a) (Figure 11). Prolonged drought observed in the late 1990s and early 2000s (World Bank 2021c) led to water shortages and affected the hydrographic network. For instance, several rivers on Ndzuwani, the primary water supply for the island, dried up (Bourgoin et al., 2016). Droughts continue to represent a threat for agriculture and food production (World Bank 2021b), although costs are probably underreported, as drought monitoring and impact assessments are not well developed.

Floods, the occurrence of which is expected to increase because of more frequent heavy rainfall events and cyclones (UNDP 2017), put additional pressure on the Comoros' natural capital and pose a significant threat to the Comorian population. Indeed, floods account for direct annual losses of approximately US$2.0 million and indirect emergency costs of US$460,000. Ndzuwani experiences the greatest risk for flood loss and has an average annual loss of US$1.3 million (World Bank 2016a).

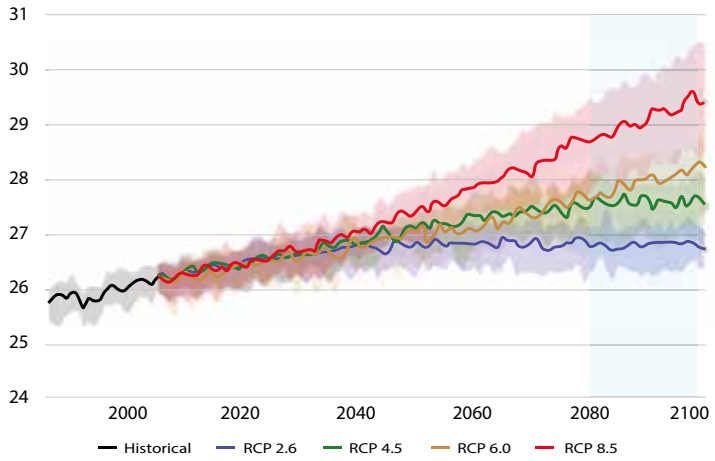
Since 1993, sea level has risen between 1 millimeter and 6 millimeters per year and is expected to further increase by 4 millimeters annually (World Bank 2020k), resulting in growing coastal erosion (Figure 12). In particular, this phenomenon threatens the coasts of Mwali and Ndzuwani and is already causing the disappearance of coastal areas, beaches, agricultural land, and forests. For instance, in Mutsamudu, the capital of Ndzuwani, massive erosion has caused a significant part of the coastline to disappear and

Figure 10. Observed average annual mean temperature of the Comoros, 1901–2020.



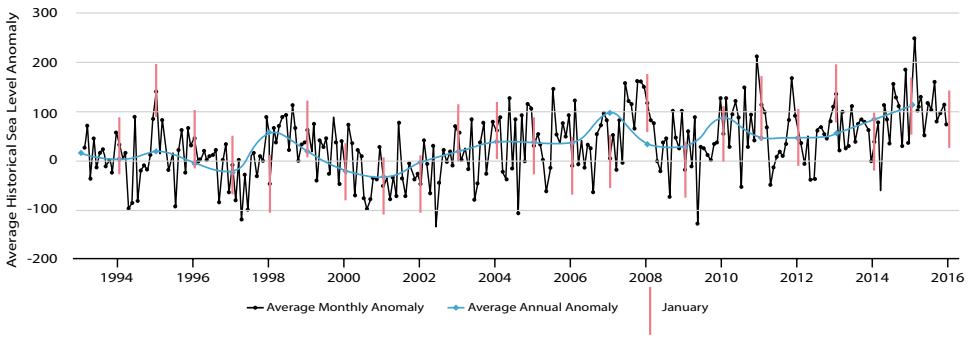
Source: World Bank 2021b.

Figure 11. Observed and projected mean temperature in the Comoros from 1990 to 2100.



Source: World Bank 2021b.

Figure 12. Historical sea level for coastal Comoros (1993–2015) based on satellite data, observed anomalies (mm) relative to mean for 1993–2012.



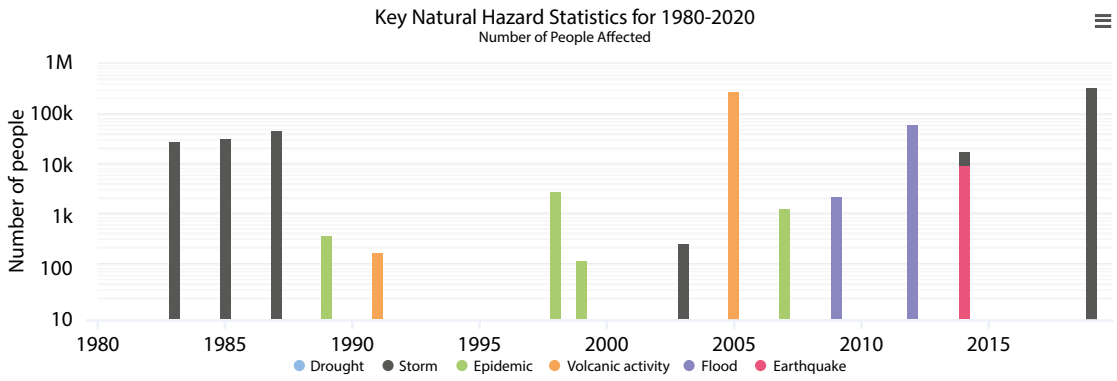
Source: World Bank 2021b.

also threatens the airport. The impact of coastal erosion is estimated at damage to 29 percent of roads and strategic infrastructure and displacement of at least 10 percent of the population (Ministry of Rural Development, Fisheries, Handicrafts and Environment 2006). Floods are extremely impactful for Comorians settled in degraded urban areas and living in vulnerable housing made of sheets and other easily destroyed materials (World Bank 2020j). Agriculture is also affected by floods via the salinization of coastal aquifers and reduction of soil quality, which has negative consequences for food production and thus food security (Bourgoin et al., 2016).

Ocean acidification, increasing seawater temperatures, deoxygenation, and changes in ocean currents are likely to have an impact on fisheries, although the severity of this phenomenon is not yet well documented. According to the vulnerability assessment of climate change and marine fisheries in Africa (World Bank 2019c), the ecological risk score (species-specific estimates of exposure and ecological and biological traits) for the Comoros is 69.996, which is classified as high (63–75).

The Comoros archipelago is exposed to many natural hazards, including storms/cyclones, droughts and floods, earthquakes, and volcanic activity (Figures 13–14). Natural disasters, combined with the overexploitation of natural resources, have a dramatic impact on the Comoros' natural capital, as well as on people and physical infrastructure and buildings. Because of their reliance on natural-resource-based livelihoods and limited availability of alternative options, impoverished Comorians are the most vulnerable to such events. Furthermore, natural disasters cause displacement of farmers, who tend to migrate to urban areas where they end up living in precarious conditions and joining the ranks of the urban poor (World Bank 2021c). The impacts

Figure 13. Overview of the most frequent natural disasters in the Comoros from 1980 through 2020 and the number of people affected.



Source: World Bank 2021b.

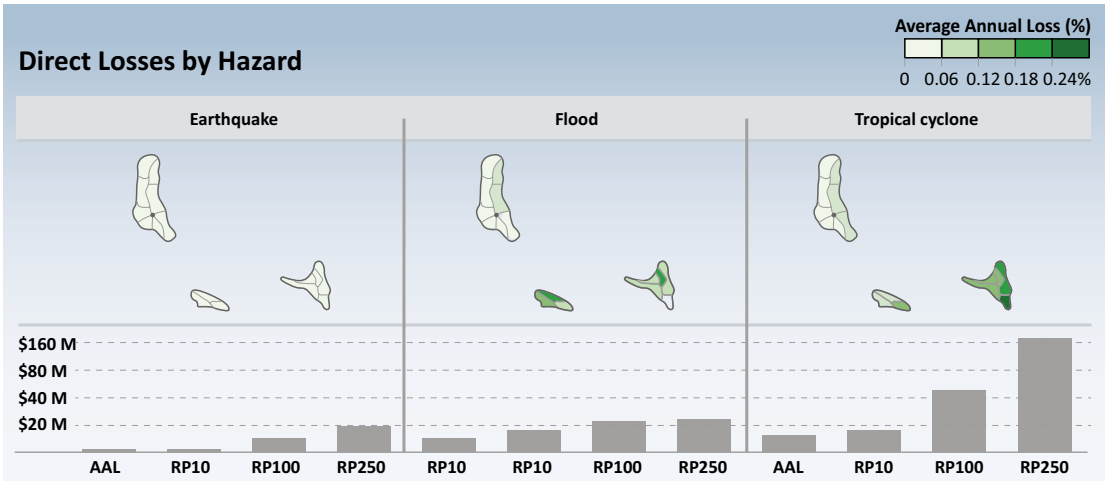
of natural disasters are compounded by inadequate and inefficient disaster risk management and disaster response (Box 5).

The total average annual direct losses from tropical cyclones, floods, and earthquakes are estimated at US$5.7 million, or 0.92 percent of the GDP in 2014 (World Bank 2020k). Tropical cyclones are the most significant disaster risk in the Comoros, causing approximately 64 percent of the estimated US$5.7 million combined direct losses. Losses from these natural disasters are not evenly spatially distributed. For example, because of its geographical location, Ndzuwani has the greatest risk of direct loss from tropical cyclones (Figure 14).

The Comoros has experienced ongoing seismic activity in the past 20 years. It began with a series of thousands of "seemingly tectonic" earthquakes, culminating in a magnitude 5.9 earthquake in May 2018. This spike in activity is attributed to an underwater volcano just off the coast of the Comoros. Since then, submarine seismicity has been registered an additional 16 times. A recent powerful tremor was registered on all islands in March 2020, with the epicenter located between Ndzuwani and Maore (World Bank 2021c). Although earthquakes account only for 2 percent of the Comoros' total annual direct losses from natural disasters, recent ongoing seismic activity suggests that they may become a serious high risk in the (near) future (World Bank 2021c).

Volcanic eruptions could represent a significant threat to the majority of the Comorian population and ecosystems. The Karthala volcano, which forms the southern two-thirds of Ngazidja, is the

Figure 14. Modeled direct losses from earthquakes, floods, and tropical cyclones.



Source: World Bank 2016a.

Note: AAL: Average annual loss; RP10: 10-year return period; RP100: 100-year return period; RP250: 250-year return period.

Box 4. Cyclone Kenneth and the Post-Kenneth Project

In April 2019, the Comoros was hit hard by Tropical Cyclone Kenneth, one of the most devastating tropical cyclones in the country's history. Cyclone Kenneth affected more than 345,000 people and caused damage to approximately 14 percent of the national GDP (World Bank 2021). Impacts included economic growth falling from 3.6 percent in 2018 to 1.9 percent in 2019. A fast-track post-disaster evaluation and damage assessment estimated the recovery and reconstruction need at US$277.5 million over five years.

The country suffered from damage to the housing sector (67.5 percent of the estimated damage and losses), the agricultural sector (53 percent), infrastructure and transport (21.1 percent), energy (12.6 percent), and health and nutrition (12.3 percent). Other damage included education and social protection, water and sanitation, environment, and the public sector (World Bank 2021c).

Almost 80 percent of farms were destroyed, including 63 percent of crop plants and 35 percent of cash crops. This resulted in significant losses for rural communities, given that agriculture constitutes their main economic sector (UNICEF 2019).

The economic impacts of these damages were partially offset by increased public and private spending, consisting mainly of external aid and private remittances for reconstruction and social transfers (World Bank 2020e).

In the aftermath of this catastrophe, the Ministry of Land Use Planning and Urban Development in charge of Land Affairs and Land Transport has been carrying out the Post-Kenneth Recovery and Resilience Project financed by the World Bank. As part of this project, a study is being conducted to develop an action plan for coastal risk management which will consist of a framework document for investments to be implemented over the next 10 years on the coastlines of the Comoros. It will also provide technical and scientific knowledge and tools to inform activities to reduce risks related to coastal erosion and coastal flooding for the three islands of Mwali, Ndzuwani, and Ngazidja. The study will also inform the design of preliminary infrastructure aimed at reinforcing Comorian coastlines, prioritizing those areas most affected by Cyclone Kenneth.

only active volcano in the archipelago, although no eruptions have occurred since 2007. Since 1808, Karthala has erupted approximately 25 to 38 times, at an average eruption recurrence interval ranging from 5.3 to 8.0 years. This recurrence was exceeded with a succession of four eruptions occurring at half-year intervals in 2005, 2006, and 2007 (Morin et al., 2009). During the 2005 eruption, approximately 40,000 inhabitants were evacuated.

3.3. Costs of Environmental Degradation

Environmental degradation and loss of natural capital will come at a price if not brought to a halt (Table 3). (See Annex 2 for cost calculations of environmental degradation and Annex 3 for an overview of the impacts of degradation on livelihoods of Comorians). The pressures exerted on natural resources and ecosystems, underpinned by persisting poverty, the high vulnerability of rural populations, climate change, and natural disasters, are contributing significantly to squandering the Comoros' precious natural capital (Bourgoin et al., 2016). Unsustainable management and use of agricultural land, climate change, and natural disasters are estimated to result in yearly losses of US$274 million resulting from land degradation (see section 5.1; see also Annex 2 for the calculations on losses resulting from land degradation). Severe and persisting deforestation and overexploitation of forests are depleting the asset, threatening the island's biodiversity and the livelihoods of people depending on the forestry sector (see section 5.2). The costs of deforestation based on the deforestation rate, the ecosystem service value of forests, and the ecosystem value of the new land use are estimated at US$1.953 million per year (Annex 2). Although coastal and marine degradation are particularly severe due to inadequate management of resources and climate change, as well as the associated risks of natural disasters, it was not possible to undertake specific calculations because of the lack of reliable and comparable data. In particular, although there is evidence showing that fish stocks are being overexploited, coral reefs are bleaching, and mangrove forests and seagrass beds are declining (Freed et al., 2018; IOTC 2021), additional studies are required to fully assess the magnitude of these trends (see section 5.3.). An upcoming PROBLUE-financed activity by the World Bank will be carried out to fill some of these gaps and support the sustainable and integrated development of marine and coastal resources (see Box 23). Quantification of the loss of biodiversity also suffers from a lack of data, hampering the ability to provide reliable and comprehensive

Box 5. Disaster Risk Management

Disaster risk management (DRM) analyzes the underlying causes of vulnerability to improve and strengthen the resilience of vulnerable communities and ecosystems. The institutional DRM framework of the Comoros includes the General Directorate of Civil Security and its branches at the island level: the Karthala Volcanological Observatory (OVK), the Technical Directorate of Meteorology (DTM), the epidemiological watch center, the national platform for disaster risk reduction, and civil society organizations in the field. In addition, the Comoros has developed the following tools for emergency preparedness and response:

1. National Strategy for Disaster Risk Reduction
2. National Emergency Preparedness and Response Plan
3. National Contingency Plan
4. Rescue organization plans at the island level
5. Specific plans for the primary hazards (for example, cyclone, tsunami, Karthala volcano, cholera, and marine pollution) (Union des Comores 2019b)

For Cyclone Kenneth, the General Directorate of Civil Security, supported by the United Nations System (UNS), United Nations Development Programme (UNDP), the World Bank, and the International Federation of Red Cross and Red Crescent Societies (IFRC), conducted a fast-track postdisaster evaluation and damage assessment. This resulted in the swift restoration of main accesses to essential infrastructure following emergency funding (World Bank 2021c).

The main challenges of the Comoros related to disaster risk management and response revolve around the limited institutional and systemic capacities of stakeholders. These result from inadequate legislative and regulatory framework as well as a lack of operational and transparent funding mechanisms for disaster risk management. Additional challenges include operationalization hampered by very limited qualified human resources, appropriate equipment, basic infrastructure, and scientific knowledge of hazards, and a lack of ownership of national disaster risk management tools (Union des Comores 2019b). For example, during the 2006 eruption of the Karthala volcano, it became clear that the Comoros remained unprepared to face a minor eruptive event, resulting in a failure of the crisis management system (Morin et al., 2009) The eruption forced people living in the shadow of the mountain to flee, and many people were unaware of the health hazards. Further analysis of the environmental institutional framework and main policies is provided in chapter 4.

characterization of the decline in natural capital in the Comoros. The impacts of environmental degradation on health also generate serious economic losses for the Comoros. The costs to advert disability-adjusted life years (DALYs)[6] attributable to unsafe water, sanitation, and hygiene are estimated at US$40.7 million per year and the costs to advert DALYs attributable to outdoor and indoor air pollution are estimated at US$51 million per year and US$142 million per year, respectively.

Table 3. The estimated annual costs of environmental degradation in the Comoros

Degradation of Asset	Economic Costs (US$, millions/year)	Specification of Calculation
Terrestrial ecosystem services	274	Terrestrial ecosystem services are lost as a consequence of degradation (based on Sutton et al., 2016).
Forest ecosystem services[7]	2	The loss of ecosystem services is associated with deforestation, taking into account the new land use (agriculture) (based on De Groot et al., 2012; FAO 2008; World Bank 2020b).
Coastal and marine ecosystem services	No data	No data for estimation
Biodiversity	No data	No data for estimation

6 Disability-adjusted life years. One DALY represents the loss of the equivalent of one year of full health. DALYs for a disease or health condition are the sum of the years of life lost to due to premature mortality (YLL) and the years of healthy life lost due to a disability (YLD) due to prevalent cases of the disease or health condition in a population (World Health Organization [WHO] definition).

7 This value does not include forest degradation, only deforestation; the actual number is therefore expected to be higher.

Table 3. (*Continued*)

Degradation of Asset	Economic Costs (US$, millions/year)	Specification of Calculation
Health	41	Cost to avert DALYs attributable to water, sanitation, and hygiene (based on World Health Organization 2013)
	51	Cost to avert DALYs attributable to indoor air pollution (based on World Health Organization 2018b)
	142	Cost to avert DALYs attributable to ambient air pollution DALYs in Comoros (based on World Health Organization 2018a)
	Total 234	

Table 4. The qualitative magnitude of the costs and benefits of restoration projects

Ecosystem	Typical Cost of Restoration	Benefits (over 40 Years)
Temperate forest	+	++
Tropical forest	+	+++
Wetlands	+	+++
Rivers/lakes	+	++
Coastal ecosystems	++	++++
Mangroves	+	++
Coral reef	+++	++++

Source: Adapted from Pravettoni, UNEP, and GRID-Arendal 2012.

3.4. Benefits of Environmental Restoration

The benefits of ecosystem restoration generally outweigh the costs (TEEB 2010). Precise values of the benefits of restoration and reforestation are not available for the Comoros, as these are highly dependent on local conditions and context. Table 4 gives a qualitative overview of the magnitude of the costs and the benefits of restoration actions (based on figures in Annex 2). These do not include the benefits of the restoration of agricultural land or the restoration of biodiversity. To be beneficial, restoration projects should prioritize ecosystems that have relatively low restoration costs and relatively high benefits, such as tropical forests, wetlands, and coastal ecosystems. More detailed suggestions for potential restoration projects are provided for the key environmental sectors in chapter.

Since the Comoros is a small island state, all ecosystems are connected and affected by each other. To take effective restoration actions, it is therefore vital to always consider the source of the degradation and to adopt an integrated landscape management approach. Rather than a single sector or ecosystem restoration action, an integrated landscape management approach would have the advantage of taking into account the health of the ecosystems that support livelihoods and contribute to communities. Integrated activities have been shown to help coordinate the multitude of actions of multiple land users and other stakeholders, reduce conflicts, and improve overall governance of water, land, and other resources (Gray et al., 2016) reduced conflicts, and improved overall governance of water, land, and other resources. Integrated landscape management is thus a useful approach to enhance the intensification of dryland cropping systems and will, in many locations (but not always. This integrated approach to natural resource management should range from the land ecosystems, including forests, to coasts and marine environment. This recommendation is further elaborated as part of chapter 6: Opportunities for Change.

4. Environmental Governance and Institutional Framework

The Comoros has a broad range of laws and policies to guide environmental and natural resource management. This chapter provides an overview of the country's environmental laws and policies (4.1), as well as the institutions in place to support them (4.2) and the national plans and strategies that have been adopted to steer the country toward a sustainable economic development path (4.3). A way forward with key recommendations for improvement is proposed in section 4.4.

4.1. Environmental Legal and Policy Framework

The first instruments for environmental management adopted by the Comoros are the 1993 National Environmental Policy (PNE) and the 1994 Framework Law of the Environment (FLE). The FLE provides the legislative foundation for all environmental sectors, defines the general principles for the protection of the environment, and establishes an environmental impact assessment (EIA) process. The PNE was established to integrate environmental dimensions into social and economic development policies, covering resource management and strengthening sector policies. Both the FLE and the PNE address similar emerging issues, including the recommendations to:

- Mainstream climate change into sectors
- Increase responsibilities of municipalities in environmental management
- Strengthen the EIA system
- Increase focus on enforcement, for example, by establishing a forest monitoring and protection unit

Both the FLE and PNE are being updated. The revision process aims to incorporate lessons learned in three decades of environmental management practice as well as key emerging issues such as decentralization support, climate change, and strengthening the EIA system. For the FLE, which had already been updated once in 1995, the law approval process is complex and involves technical committee reviews, public participation, and dialogue in Parliament. On the contrary, the PNE is in the late stages of the process (see Box 6). The FLE and PNE updating process is an opportunity to incorporate emerging environmental issues, overhaul priorities, and facilitate the implementation of environmental management objectives.

After the adoption of the PNE and FLE, the Comoros took significant steps to improve its environmental legal and policy framework. The Government of the Union of the Comoros (GoC) enacted numerous sector laws, adopted several national sector policies, and entered into international agreements related to environment and natural resources management (for details, see Annex 7). In 2018, the right to a healthy environment was enshrined in the Constitution: "All citizens have the right to a healthy and ecologically stable environment, as well as having a duty to protect and conserve it." In 2020, the GoC updated the Fishing and Aquaculture Code to include specific provisions regarding illegal, unregulated, and unreported (IUU) fishing, and the Water Code to further enable participative and decentralized use and protection of water management on each of the three Comorian islands.

Currently, there is no dedicated climate change policy, though climate change is being incorporated in the updated FLE and PNE. The Comoros has ratified the UN Framework Convention on Climate Change and the Kyoto Protocol and must integrate these into sectoral policies, strategies, and development programs. In

Box 6. Updated National Environmental Policy of the Comoros

The PNE is currently in the process of being updated (MAPETA 2021). The updated PNE aims to provide a relevant response framework to the current environmental and climatic challenges, as well as to include the legal and regulatory advances made at the national and international levels.

The PNE includes an action plan which mobilized actors in a transversal, collaborative, and integrated way. The action plan is structured into 10 main actions:

1. Reconcile the sustainable management and protection of natural resources with the practice of subsistence activities of the most vulnerable populations.
2. Monitor and control practices that risk environmental degradation.
3. Clarify the roles and responsibilities of actors and the different levels of public administration in environmental matters.
4. Ensure the protection and enhancement of terrestrial and marine biodiversity.
5. Improve the living environment of the population and responsiveness to environmental risks.
6. Ensure sustainable economic development of the Comoros through decision-making that includes climate change and the preservation of natural capital.
7. Strengthen knowledge in the fields of biodiversity, environment, and climate change, and make this knowledge accessible to everyone.
8. Ensure the development of a blue economy that respects biodiversity and marine and coastal resources.
9. Develop financing for the preservation of natural resources and the environment based on the "polluter pays" principle and the sustainability of funding sources.
10. Integrate natural capital and ecosystem services into national accounts and economic performance systems.

The implementation of these strategies will involve the following:

- The principle of co-management and the development of income-generating activities
- Establishment of an environmental police corps as well as enforcement tools
- Updating the legal framework and its application and the framework law on the environment
- Environmental awareness and education
- Reinforcement of knowledge in environmental matters
- Strengthening the consideration of environmental requirements in economic and social investments

Through the updated PNE, the Comoros aims to "ensure a healthy and sustainable environment for the Comorian population and its descendants and to preserve and enhance the natural resources and environmental heritage of Comoros" (MAPETA 2021).

2006, the Ministry of Rural Development, Fisheries, Handicrafts, and Environment adopted the National Adaptation Programme of Action (NAPA). The NAPA describes the main pressures on the environment and economy of the Comoros and the vulnerability of the country to climate change. It further elaborates on links with development programs and reviews actions taken in the past to face climate change. Despite its low contribution to greenhouse gas (GHG) emissions, the Comoros adopted its nationally determined contribution (NDC) in 2021 aimed at placing the Comoros as a carbon sink (see Box 7). The NDC pledges to reduce net GHG emissions of the Comoros in 2030 by approximately 23 percent -excluding land use change and forestry (LUCF)- compared to the emissions projected for the same year according to a reference scenario.

A transparent and robust EIA system is crucial for a country such as the Comoros, which relies heavily

on natural resources for economic development and livelihoods. A functioning EIA system is critical for identifying and managing potential impacts of development such as agriculture-induced deforestation or fisheries management, as well as for striking the right balance between economic growth and environmental protection. In addition, a functioning EIA system is key to set an adequate enabling environment to attract private investments. The EIA legal and regulatory framework should factor in considerations related to social risks and impacts to identify and assess social risks at the planning stage of project cycles and ensure that such risks can be managed as an integral part of project design and implementation. Finally, the development and strengthening of institutional capacity for SESA implementation is also key to ensure that environmental and social implications are adequately taken into account in the process of formulating plans, strategies, and projects in support of sustainable development.

Box 7. Nationally Determined Contribution (NDC)

GHG emissions from the Comoros represent approximately 0.001 percent of the global emissions. Its net balance of emissions is negative, meaning that the country absorbs more than it emits. Yet, the Comoros still has benefits and potential for reducing its GHG emissions further. The Comoros declares to contribute to the international effort to combat global warming by pursuing its objective of being a carbon sink. The Comoros plans to reduce its net CO2 emissions by 23 percent and increase its net CO2 absorption by 47 percent by 2030 compared to the baseline scenario (MAPETA 2021). To achieve these goals, the government is focusing on the mitigation actions outlined in Table 5.

To strengthen the resilience of the country to the effects of climate change, the revised NDC identified several adaptation targets for the most vulnerable sectors of the Comoros (Table 6).

Table 5. Mitigation actions for the Comoros

Short-term Priorities	Medium- to Long-term Priorities
Consolidation of the electrical network	Continuation of development projects for photovoltaic power plants
Improvements in waste collection	Launch of a first geothermal sector
Reduction of firewood and industrial wood by promoting alternative energy sources and protecting forests	Afforestation, reforestation, agroforestry, and arboriculture
Reduction of residential firewood usage through the use of efficient wood burners	Increase in effective management of protected areas
	Promotion of organic waste compost

Source: MAPETA 2021.

Table 6. Adaptation measures for the most vulnerable sectors of the Comoros

Sector	Adaptation measure
Agriculture	1. Development of a resilient and climate-smart agricultural policy 2. Development of agro-pastoral irrigation 3. Establishment of an early warning system for the emergence of new bovine or caprine diseases
Forests and biodiversity	4. Extension of protected areas and reforested areas
Fisheries and coastal/marine ecosystems	5. Restoration and monitoring of marine and coastal ecosystems 6. Raising awareness and increasing security of fishers in the face of climatic hazards
Water management	7. Increase access to water and improve water quality 8. Adopt integrated water resources management
Disaster risk management (DRM)	9. Identification and mapping of areas vulnerable to natural disasters 10. Adopt building standards based on disaster risks

Source: MAPETA 2021.

In its revised NDC, the government recognizes the importance of the role of women in many sectors strongly affected by climate change. The success of these mitigation and adaptation efforts depends on the integration of women into various sectoral policies, capacity building, and mobilizing sufficient financial resources. According to the estimates presented in the revised NDC, the Comoros will need an overall envelope of about US$1,450 million to successfully implement its NDC, comprising US$1.005 million for mitigation measures and US$445 million for adaptation measures.

The legal, regulatory, and institutional framework for EIA provides the foundation for a sound EIA process. The FLE enacted the first elements of the EIA system by establishing the minimum EIA content, as well as penalties for infringement of EIA requirements. The FLE also mandated the Council of Ministers to prepare regulations establishing the EIA rules and procedures, including information to the public, and the list of projects subject to EIA. A 2001 decree complied with that mandate and established the EIA process in more detail and regulated projects subject to EIA. A 2012 Ministerial Order established and set the terms of reference for an EIA Evaluation Committee tasked with the review and approval of all EIAs. Despite being operational,[8] the committee requires further key expertise, for example, on social impact. Projects expected to have limited environmental and social impacts do not require a full EIA but rather an environmental notice with the associated environmental management plan. These environmental notices can be approved at the level of the regional directorate.

Despite the significant progress in the EIA legal framework, several challenges remain ahead. While general guidelines for the preparation of environmental and social impact assessments have been developed and approved, sectoral guidelines for key sectors such as fisheries, agriculture, energy, and mining have been developed but not approved yet, and guidelines for tourism, infrastructure, and oil and gas still need to be developed. At this time, no formal requirements exist for EIA consultants to be certified and registered in the Comoros, allowing any company or consultant to provide EIA services in the country. In addition, although the FLE mandated the Ministry of Environment and Public Health to develop environmental quality standards, national standards on water and air quality are yet to be approved and World Bank/International Financial Corporation (IFC) and World Health Organization (WHO) Standards are applied instead.

In addition, no reference is made to the application of strategic environmental assessment for policies, plans, and programs in any of the environmental laws and decrees. Despite the general legal requirement included in the FLE, there are no regulations or guidelines for public participation and disclosure and there is a lack of clarity on which ministry/department is responsible for social issues.

Moreover, gender and social inclusion are not mentioned in the EIA regulation, making the case for increasing the institutional capacity Environmental and Social Impact Assessment (ESIA) implementation. Although recourse to justice is possible in case of infringement of EIA laws, the process involves a complex and time-consuming legal process that might delay or deter access to justice. Finally, limited capacity and insufficient resources are causing a significant gap in EIA monitoring, inspection, and compliance in ongoing and new development across all sectors. To address these challenges and support the ongoing effort to develop the EIA process, it is crucial to do the following:

- Strengthen the capacity of the EIA committee with additional key expertise and capacity building.
- Strengthen the capacity of EIA units at the national and regional directorate levels to both process environmental notices and monitor the implementation of management plans.
- Review and approve the existing draft sectoral guidelines for EIA (that is, for the fisheries, agriculture, energy, and mining sectors) and develop and approve additional sectoral and cross-cutting guidelines (for example, for tourism, infrastructure, oil and gas, and social assessments to incorporate social inclusion considerations).
- Establish a transparent environmental management information system to track EIA preparation, review, disclosure, and monitoring status.
- Operationalize a dedicated financial system to collect the fees associated with EIA management.
- Provide EIA institutions at the national, island, and local levels with technical and financial support to deliver their mandate appropriately.
- Undertake an in-depth gap analysis to inform key options for program strengthening in the medium term.

4.2. Environmental Institutional Framework

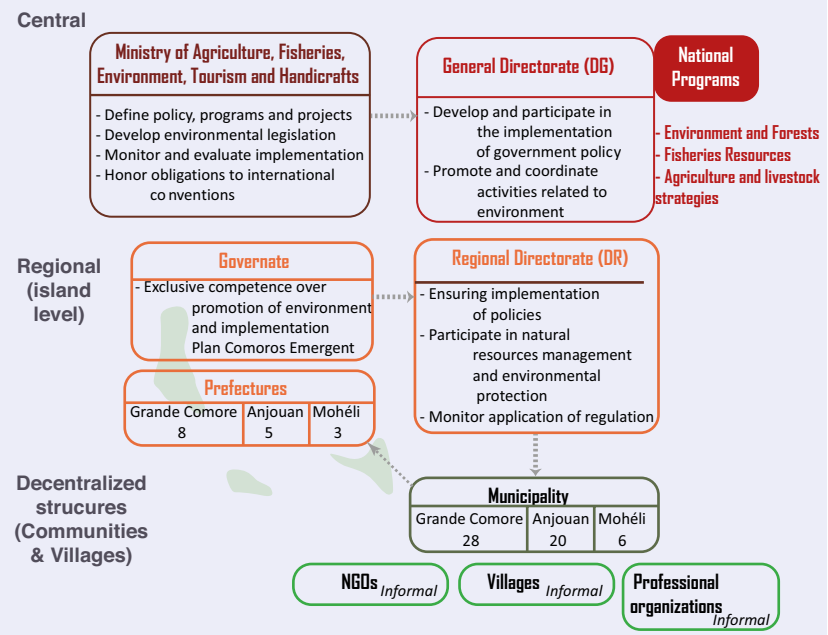
The Comoros environmental institutional framework is organized on three levels: central (national), regional (island), and local (community). This framework is the result of a decentralization process envisioned under the 2018 constitution that started in 2011 when the 2001 constitutional agreement was enacted; however, the process remains incomplete and only partially effective. The environmental institutional setting is also characterized by the coexistence of formal and informal

8 The committee met approximately eight times in 2021 and twice in 2022.

institutions, reflecting the difficulty for formal institutions to establish their legitimacy, while local communities continue to rely heavily on local traditional and informal governance systems. The three-level environmental institutional framework, mixing formal and informal actors, is structured as follows (Figure 15):

- **Central level (national):** The Comoros institutional framework places the Ministry of Agriculture, Fisheries, Environment, Tourism, and Handicrafts (MAPETA) at the core of environmental management. Under MAPETA, the General Directorate of Environment and Forest, Fisheries Resources, and Agriculture and Livestock Strategies was established to develop and monitor the implementation of environmental policies and promote and coordinate governmental and nongovernmental activities related to the environment (Figure 15) (MAPETA 2021a). The General Directorate has a regional office on each of the three main islands of the country.
- **Regional level (island):** The main body responsible of ensuring the implementation of environmental policies and strategies at the island level is the regional directorate, which acts on behalf of the DG. Environmental management at the regional level is also ensured by governorates. Each island constitutes a governorate and has autonomous status (United Nations Environment Programme [UNEP] 2016). The governorate, selected by universal suffrage, is accompanied by a consultative council whose members are appointed by the community councils. In particular, the governorate is responsible for the design and implementation of the Comoros Emerging Plan (PCE) for each island and has the following mandates related to natural resource management: (1) the economic and social development plan; (2) land-use planning; (3) the promotion of tourism, the environment, and the historical heritage of the island; (4) artisanal fishing; and (5) agriculture and livestock, excluding strategies and research. Despite enjoying an independent administration and management autonomy, governorates are largely financially dependent on central institutions, limiting their capacity to fulfill their mandates effectively. The islands are divided into 16 prefectures, each with a head appointed by the central government. The prefect, who is responsible for the enforcement of laws and regulations, is the interface between municipalities and the governorate, on the one hand, and the central government on the other. The authority of the prefecture is contested by some municipalities, and prefectures generally do not have sufficient human or financial resources.

Figure 15. Environmental institutional framework of the Comoros showing the subdivision of general and regional directorates into specific sectors: environment and forests, fishery resources, and agriculture and livestock strategies.[9]



Sources: Adapted from MAPETA 2021; Suez et al., 2021.

9 The Comorian names for the islands are Ngazidja (Grande Comore), Ndzuwani (Anjouan), and Mwali (Moheli).

- **Local level (community):** Municipalities are the basic formal territorial authority in the Comoros. They group together several villages, are headed by a mayor, and are in charge of environmental management, water supply, sanitation, housing and habitat, and communal equipment. While they are a formal institution, they do not have the adequate administrative services and financial means to accomplish their missions. Together with municipalities, informal institutions such as nongovernmental organizations (NGOs), villages, and professional organizations play key roles in local communities, as they are rooted in traditional local power and benefit from greater credibility and legitimacy among the population. Villages, the core unit of identification and societal organization at the local level, host several associations, including environmental-protection associations, which carry out activities in the field of environmental and sustainable development. These associations are typically able to mobilize funds to carry out local projects aimed at providing environmental management services. As soon as the scale of the village or neighborhood is reduced, the social cohesion to mobilize actors or funding for projects becomes quite challenging (Suez et al., 2021). In addition to villages, NGOs and professional organizations form two other types of informal institutions relevant to environmental management. Both national and international NGOs play a role in the implementation of donor-financed environmental and natural resource management projects, often together with village communities. Professional organizations in the field of agriculture and fisheries often operate as cooperatives, positioning themselves as the beneficiaries of agricultural and fishery development projects. The best-known professional organizations are the Union of Chambers of Agriculture and Fisheries, National Union of Comorian Farmers, and the National Union Comorian Fishers. Through the projects of professional organizations, farmers and fishers can directly receive technical or financial support.

Challenges

The effectiveness of the current environmental institutional framework of the Comoros is challenged primarily by the following:

- **Fragmentation, unclear distribution of roles, and limited inter-level collaboration.** While a decentralization framework is in place, the devolution of competencies is not complete and functions among institutions have not been clearly defined. Competing governance structures at the national and regional levels often do not provide the right incentives for collaboration and further fragment the delivery of state services. The incomplete decentralization process has deepened the sense of disconnect between the central state and local centers, increasing the importance of local informal institutions in providing environmental management services.
- **Limited technical capacity.** The environmental institutions of the Comoros generally lack the required technical capacity to fulfill their mandate, comprehensive capacity-building and professional-development programs, and human resource allocation at national, island, and local levels.
- **Financial constraints.** Insufficient financial resources risk jeopardizing the capacities of the general and regional directorates, and environmental expenditures are often not aligned with the environmental priorities, hampering effective and efficient management of public resources. Indeed, a detailed look at expenditures and budget executions in 2013 pointed out a general prioritization of remuneration-related spending, underspending on public services, and expenditure bias toward the administrative institutions at the expense of economic and social sectors and investment programs. The 2013 budget designation to the Ministry of Production, Environment, Energy, Industry, and Handicrafts—the predecessor to the current MAPETA—accounted for 88 million KMF or 1.5 percent of the national budget, 32 percent of which was executed (World Bank, n.d.).

4.2.1. National Plans and Strategies for Sustainable Economic Development

The GoC has recently invested in a concerted effort to develop ambitious plans and strategies to further define a path for sustainable development. With this purpose in mind and in line with the Agenda for Sustainable Development 2030, the GoC developed the following main strategic planning documents:

- Comoros Emerging Plan (PCE) 2030
- Accelerated Growth and Sustainable Development Strategy
- Blue Economy Strategic Framework

Box 8. Land Tenure in the Comoros

In the Comoros, three land tenure systems coexist—customary law, Islamic law, and civil law inspired by modern French law. This original, but highly complex and incoherent, situation is the result of a history of multiple foreign nations importing their legal system to the Comoros.

The coexistence of these tenure regimes creates confusion and low-level territorial disputes over land ownership (World Bank 2020d). Land ownership can be at the state, community, religious, family, and individual levels with these modes of ownership often overlapping. The transfer of land is also governed by both religious and customary laws, practices, and codes. Land ownership has an important gender component in the Comoros with approximately 59 percent of women owning land versus 42 percent of men (2012 Demographic and Health Survey).

Although women generally inherit land according to custom, usufruct rights tend to go to their male relatives. The land tenure system is challenging economic development as the complexity of land ownership does not create a favorable climate for private investors. This is in part reflected by the low rank (160 out of 190 countries in 2020) of the Doing Business Index of the Comoros, which analyzes the regulation that encourages efficiency and supports freedom of doing business (World Bank 2020g).

Under short-term informal contracts, farmers use the lands for production. Since these farmers do not own the land, there are no incentives to make any long-term investments in production techniques or land conservation. As a result, agricultural yields remain low and the land degrades, leading to land abandonment when the land becomes less productive (stakeholder consultations). The increasing demand for arable land results in further clearing for agricultural expansion, involving deforestation and burning (UNEP 2016). Besides the complexity of the tenure system, a key problem lies in the lack of authorities empowered to settle disputes over access to land or land use. As a result, disputes become conflicts. A recent urbanization review carried out by the World Bank specifically recommends setting up a dispute resolution mechanism for municipal cooperation tasked with clarifying property rights and reforming land governance.

Table 7. Advantages and disadvantages of the three tenure regimes

	Customary Law	Muslim Law	Civil Law
Land ownership	Land inherited through matrilineal lines	Land belongs to whomever puts it to productive use	Private and domanial land ownership
Advantages	Efficient, strong social basis, firmly rooted in Comorian customs	Anchored in Comorians who practice Sunni Islam	High land security through land official titles
Disadvantages	Weak legal aspects	Weak legal aspects	Double allocations of land, absence of a modern cadaster, complex procedures

Source: Sow 2021.

The main challenge consists in integrating the three systems into a single legal regime that takes into account the cultures of the other regimes. To address this issue, the Provisional Report of the Diagnostic Study on Land Tenure in the Comoros proposes an integrated tenure regime that focuses on simplified and clear procedures, reduction of land disputes, and increased efficiency and effectiveness (Sow 2021). The objective of this new regime is to provide legal certainty and strengthen social cohesion while ensuring transparency. The new regime would operate at the municipality level, but the established village land committees and the cadi would remain in charge of customary and religious rights. Findings by these authorities have to be validated by the land counter. The decentralization of tenure securitization could be envisaged in the short term but requires capacity building of technical staff and funding (World Bank 2021c). A key component of this new land regime should be to reduce the costs of land registration and tax landowners, creating incentives to use their land productively and invest in long-term land conservation.

This strategic effort is in line with the World Bank Country Partnership Framework (CPF), which is aimed at supporting the Comoros in finding a sustainable growth path and building the resilience of its population against multidimensional shocks.

Comoros Emerging Plan 2030

In 2019, the GoC adopted a national strategic plan for long-term action: the Comoros PCE 2030. The PCE describes the focus areas and large-scale projects that will drive the structural transformation of the emerging Comorian economy. The plan is a reference document for the implementation of the Sustainable Development Goals (SDGs), to which the Comoros has been committed since 2015. In addition, it advocates joint implementation of the SDG 2030 agenda as well as the African Union's Agenda 2063. The PCE is based on five strategic pillars (Figure 16): (1) tourism and entrepreneurship, (2) an established blue economy of the Comoros, (3) a hub for financial services and logistics in the Indian Ocean, (4) modernized agriculture for food security, and (5) industrial niches to diversify economy.

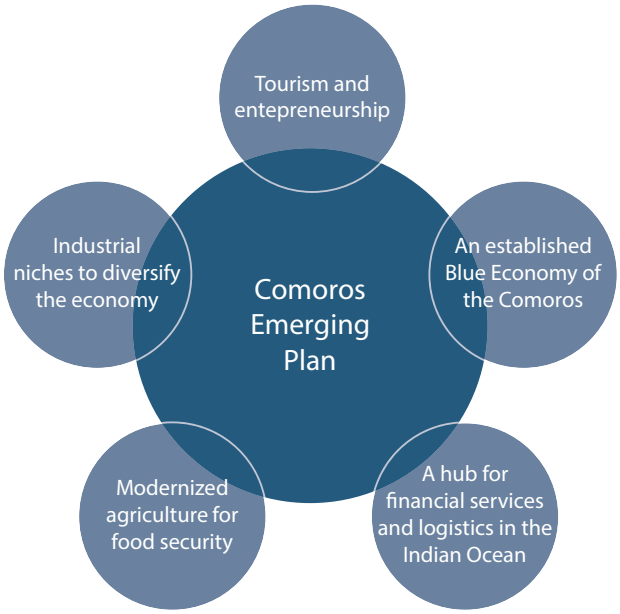
Five essential catalysts have been identified for achieving these pillars: (1) a reformed and stable political and institutional framework, (2) up-to-date infrastructure for an efficient economy, (3) human capital that is ready for the future, (4) structural reforms for a competitive environment, and (5) digital revolution.

After the adoption of the PCE in 2019, the GoC initiated a process for resource mobilization as well as the necessary reforms for implementation. The Development Partners Conference (CPAD) was held in Paris in 2019, resulting in a pledge of approximately €4 billion toward the implementation of the Comoros PCE. The implementation of the PCE will take place through flagship projects, structuring projects, and priority sectoral projects (see the overview of the topics and their cost estimate in Table 8). The structuring projects include six proposed projects, two of which are aimed at environmental and natural resource challenges: the promotion and development of the agricultural sector, and integrated waste management in the Comoros. The costs of the development components proposed for the agricultural sector are estimated at €12.8 million (US$14 million) and the costs of integrated waste management development are set at €35.575 million (US$39.32 million). Implementation mechanisms of the PCE aim to involve Comorians at all institutional levels, ranging from national, island, municipality, and village governments and NGOs (Union des Comores 2019b).

Accelerated Growth and Sustainable Development Strategy (SCA2D), 2018–2021

The SCA2D 2018–2021 is a national benchmark document that lays the foundation for the structural transformation of the national economy and fed into the preparation of the principal development plan for the country, the PCE 2030. It was initially developed in

Figure 16. The five strategic pillars of the PCE 2030.



Source: Adapted from UNDP 2019b.

Table 8. Total overview of the topics addressed in the flagship projects and structuring projects of the PCE 2030, including their cost estimates in US$ millions

Flagship Projects (US$ Millions)		Total (US$ Millions)
Maritime development	68.2	1,534.1
Tourism sector	747.7	
Hospital	129.7	
Energy sector	378.3	
Airport development	114.5	
Administrative district and smart city	95.6	
Structuring Projects		
Port infrastructure	249.6	1,482.6
Moroni smart city	1,036.6	
Urbanization	4.1	
Roads	139.3	
Agricultural development	13.9	
Waste management	39.0	
TOTAL AMOUNT PLEDGED AT THE 2019 PCE 2030 CONFERENCE		4,360

Sources: Union des Comores 2019; Union des Comores et al., 2019.

partnership with United Nations System (UNS) in 2015 and was revised in 2018 to be aligned with the PCE 2030. The SCA2D has been the second development document, following the Strategy Document for Growth and Poverty Alleviation (DSCRP), and aims for accelerated, strong economic growth that generates decent jobs, while promoting the sustainable development of the Comoros. The SCA2D is the first milestone on a path toward prosperity and emergence, in line with the vision of the PCE 2030, the 2030 Agenda for Sustainable Development, and the African Union's Vision 2063 (General Secretary of the Presidency and General Planning Commission 2017).

The overall objectives of the SCA2D are to (1) strengthen the foundations of a structural transformation of the economy, to achieve strong, viable, sustainable, equitable, and inclusive growth; (2) improve the quality of life of the population and guarantee equitable access to basic social services; (3) ensure the rational exploitation of natural resources following the principles of sustainable development, while taking into account climate change; (4) strengthen good governance and resilience in the face of political and institutional fragility; and (5) promote the rule of law and social cohesion.

Good progress was made in the implementation of the SCA2D through 2018, after which progress was disrupted by Cyclone Kenneth in 2019 and the COVID-19 pandemic in 2020. These events highly affected agriculture, fisheries, natural resources more broadly, and infrastructure. The outcomes of the SCA2D were incorporated into the PCE 2030, currently the main development plan for the country.

Blue Economy Strategic Framework

In 2018, the GoC adopted the Strategic Framework for a National Policy on the Blue Economy (BESF) (Union des Comores 2018). The main objective of the BESF is to define a strategic framework to integrate the Comorian maritime space and its resources into the country's long-term sustainable socioeconomic development policy. Exploitation activities include the sustainable development of aquaculture, coastal tourism, marine biotechnologies, and marine energy. The BESF is in line with the PCE 2030, which recognizes the blue economy as a key pillar for the country.

The strategic framework is structured into five specific objectives: (1) strengthen national safety and security; (2) enhance key sectors of the blue economy, including training and job creation for young people; (3) protect coastal, aquatic, and marine ecosystems and waste management; (4) adapt the institutional framework; and (5) reorient the areas of regional cooperation.

The BESF comes along with an action plan, which is meant to support the implementation of the Strategic Framework (Union des Comores 2018). Following the adoption of the BESF, a national committee co-chaired by the Ministry of Foreign Affairs and the General Planning Commission was established to step up this implementation process. Nevertheless, as of August 2022, this committee exists only on paper and is not operational. The main constraints for the operationalization of the action plan are (1) inadequate structural and long-term funding, (2) the absence of a clear mandate establishing the roles and responsibilities of the committee, and (3) lack of an investment plan with clearly identified financing mechanisms for the proposed action plan.

Comoros Country Partnership Framework FY20–FY24

The CPF's overall goal is to accompany the Comoros in launching a path for higher economic growth, investing in human capacity and building resilience (World Bank 2020k). The CPF builds on the Systematic Country Diagnostic (SCD), which takes stock of development progress in the Comoros and reflects on constraints and opportunities for growth (World

Bank 2020j). The CPF concentrates on two focus areas: (1) crisis response and building resilience through investing in human capital, disaster recovery, and resilience; and (2) economic recovery and inclusive growth through improving the governance and business environment, fostering private sector growth, and improving connectivity. The CPF seeks to mobilize resources and carry out political reforms to help the country advance toward achieving its ambitious goals of economic development. The CPF is aligned with the PCE 2030 (Figure 17).

Under focus area 1, the World Bank will support national and local institutional capacity building to prepare for natural events, which will increase in incidence because of climate change. It will support the government in adopting a proactive approach to disaster risk management. These activities will support the PCE essential catalyst of "human capital that is ready for the future."

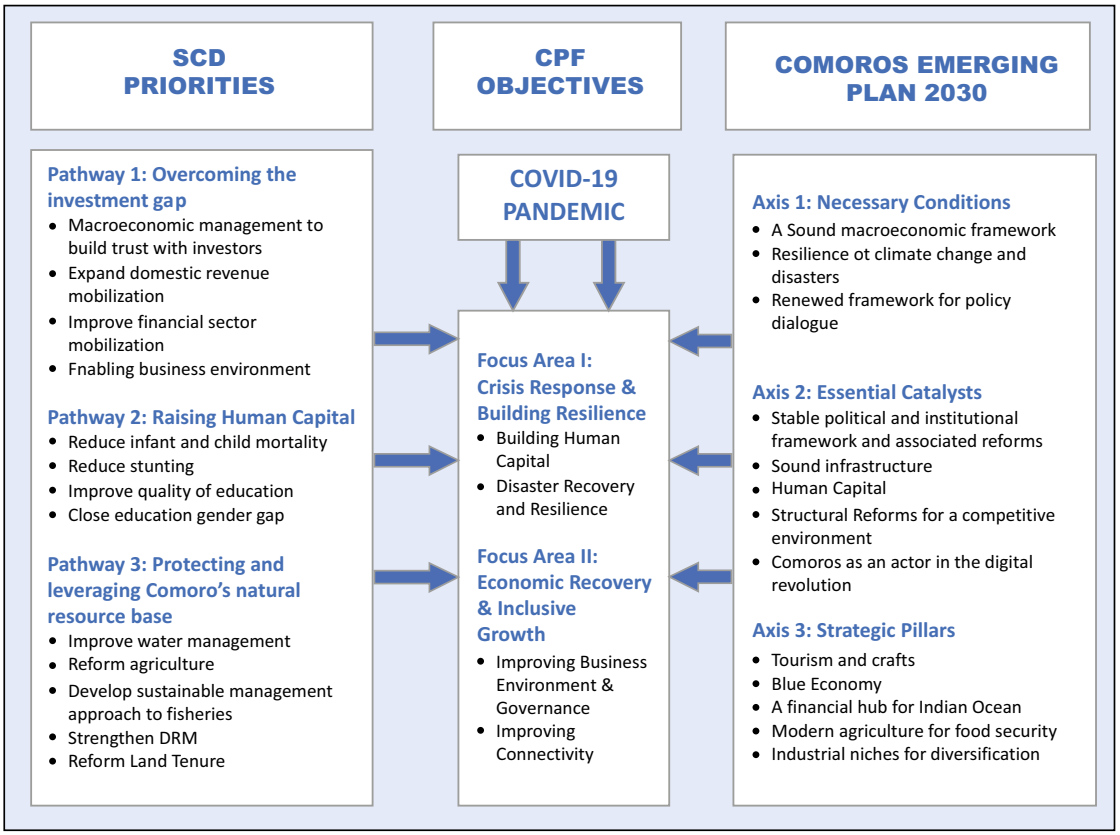
Under focus area 2, the World Bank will help the government accelerate the sustainable transformation of the agriculture and fisheries sectors (connecting to the PCE 2030 objectives). It will complete and strengthen the selected value chains of selected sectors (for example, tourism, fisheries, and agriculture), connecting to the PCE strategic pillars.

The CPF will study options and pathways for developing a blue economy framework and undertake preliminary steps where possible, which directly contributes to the PCE pillar of "an established blue economy of the Comoros."

4.3. The Way Forward

- **Approve the updated PNE and FLE.** The approval of these two fundamental elements of the environmental framework can help upgrade environmental priorities, incorporate emerging issues and lessons learned, and facilitate the implementation of ambitious environmental management objectives. In addition, the updates of the PNE and FLE should be accompanied by a monitoring system to track implementation and draw lessons learned.

Figure 17. Alignment of SCD and CPF with government priorities.



Source: World Bank 2020k.

- **Strengthen the capacity of general and regional directorates to fulfill their mandate by mobilizing the human, technical, and financial resources necessary**. Develop targeted continuous professional development programs for technical staff at different levels as well as capacity building for other stakeholders. Carry out a human resource needs assessment to ascertain the specific level of support needed at the national and regional levels for the directorates. Align environmental expenditure with priorities and use results-based agreements to improve effectiveness and efficiency in the use of public resources. The Comoros might benefit from a dedicated environmental expenditure review to provide more clarity on the specific challenges and needs in the sector.

- **Strengthen vertical (between the national, island, and local levels) and horizontal (between sectors) inter-institutional coordination by setting coordination incentives and quantifiable goals that are regularly monitored**. The process of updating both the PNE and the FLE represents an opportunity to bring government officials and other key stakeholders together to generate a policy dialogue focused on cross-cutting coordination. Continuation of the decentralization process can emphasize the role of national and regional directorates in supporting governorates and local institutions to fulfill their environmental management mandates.

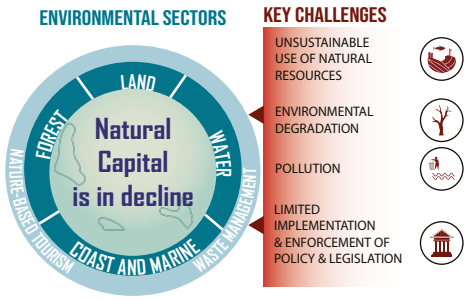
- **Update the EIA regulatory framework and management system, also factoring in social impacts and risks by developing and strengthening the institutional capacity for implementing ESIA.** Key immediate improvements include to (1) strengthen the capacity of the EIA committee with additional key expertise and capacity building, (2) strengthen the capacity of the EIA unit at the national and regional directorate level to both process environmental notices and monitor the implementation of management plans, (3) review and approve existing draft sectoral guidelines for EIA (that is, for the fisheries, agriculture, energy, and mining sectors) and develop and approve additional sectoral and cross-cutting guidelines (for example, tourism, infrastructure, oil and gas, social assessment incorporating social inclusion considerations,), (4) establish a transparent environmental management information system to track the status of EIA preparation, review, disclosure, and monitoring, and (5) operationalize a dedicated financial system to collect the fees associated with EIA management. An in-depth gap analysis can further inform key program strengthening options in the medium term. Within this context, institutional capacity for developing the SESA will need to be developed and strengthened, to ensure that development plans and strategies adequately take into account the social and environmental implications of sustainable development plans and strategies.

- **Boost enforcement capacity coupled with targeted livelihoods support and community empowerment programs**. Dedicate targeted efforts to enhance enforcement capacity by providing human, technical, and financial resources to the implementation of environmental and natural resource regulations and policies; the establishment of the specialized forest monitoring and protection unit included in the draft PNE is a step in the right direction. Enforcement needs to be coupled with a co-management approach that involves and empowers local communities in the management of resources and livelihoods and creates a framework for dialogue and consultation between the various stakeholders concerned by the exploitation of natural resources. Co-management approaches are bringing positive results in the areas where they have been piloted (for example, the South West Indian Ocean Fisheries Governance and Shared Growth Project [SWIOFish1], see section 5.4.3).

- **Increase public participation and socially inclusive service delivery participation by establishing and strengthening environmental monitoring systems, public disclosure, and feedback mechanisms.** Public awareness, coupled with important feedback mechanisms on the design, implementation, overall performance, and grievances related to environmental programs, can help build trust between the government and the communities it serves.

5. Key Environmental Sectors

This chapter assesses the environmental challenges of the Comoros in six key environmental sectors: land (5.1), forest (5.2), water (5.3), fisheries, coast, and marine (5.4), solid waste management (5.5), and nature-based tourism (5.6). For each sector, analysis of the state of environmental degradation, its cost, and its impact on livelihoods is presented. Recommendations to overcome degradation are then proposed to inform the opportunities for change described in chapter 6.



5.1. Land

Key Features

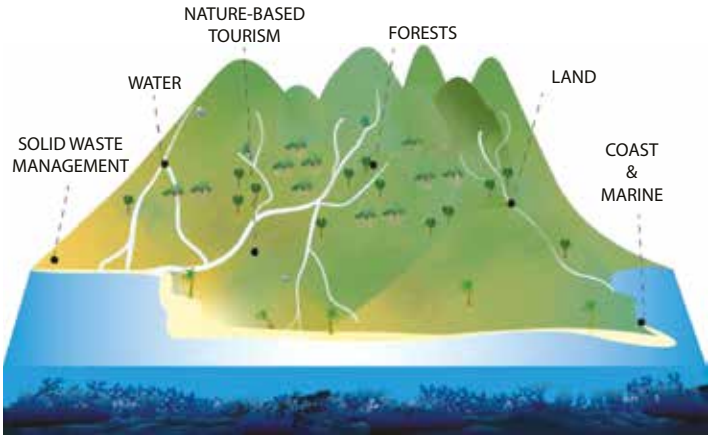
- It is estimated that 57 percent of the arable land of the Comoros is in a state of degradation.
- Land degradation in the Comoros is mainly driven by unsustainable management of agriculture.
- Climate change and natural hazards accelerate the country's land degradation.
- Land degradation in the Comoros results in a reduction of ecosystem service value of about 18 percent, corresponding to a loss of US$274 million per year.

- Agriculture, the largest economic sector in the Comoros in terms of gross domestic product (GDP), constitutes 70.4 percent of land use. Together with forestry and fishing, agriculture represents 36.7 percent of the GDP and 34 percent of employment.
- The agricultural sector is predominantly subsistence-based. Productivity is low relative to peer countries, implying opportunities for change.
- The socioeconomic complexity of the land tenure regime poses a significant challenge to sustainable land management.

5.1.1. Sector Characteristics

Given the volcanic soil, the Comoros is endowed with abundant fertile land, which creates favorable conditions for agriculture. Agriculture accounts for 70.4 percent of land use, with 0.08 ha of arable land estimated per person. Agriculture is the largest economic sector in the Comoros in terms of GDP contribution and source of employment, estimated at 30.5 percent and 34 percent, respectively (Table 9). Land is largely used for subsistence agriculture, while the main cash crops are ylang-ylang, cloves, and vanilla. These cash crop cultures are mainly produced in the coastal lowlands of the Comoros and are central to the economy, accounting for 90 percent of all export income (Breuil and Grima 2014; World Bank 2019). However, these crops are cultivated in monocultures, and are therefore quite destructive to the environment and result in land degradation. To find new fertile land to cultivate the cash crops, these plantations are being moved up to higher altitudes, resulting in additional deforestation. Furthermore, in recent years, the production of cash crops has

Figure 18. Overview of identified environmental challenges in the Comoros.



Source: Deltares.

declined, primarily because of natural disasters and price variations in international markets (Union des Comores 2019b).

5.1.2. Land Degradation and Its Drivers

Land degradation,[10] underpinned by high population density and inadequate governance and management, is a major challenge for the Comoros. It is estimated that 57 percent of the arable land is in a state of degradation (Bourgoin et al., 2016). According to the Digital Observatory for Protected Areas (DOPA) developed by the European Union, coastal areas saw the most significant declines in the productive capacity of land between 1999 and 2013 (Figure 19). Land degradation in the Comoros has gone hand in and hand with a progressive expansion of land used for agricultural purposes. In fact, to cope with agricultural plot degradation, smallholder farmers are compelled to use additional plots to maintain usual levels of crop planting and harvesting. Nevertheless, this cropland expansion has not kept up with the country's population growth, resulting in an estimated decline in cropland wealth per capita of approximately 43 percent between 1995 and 2018.

Comorian banana farmer
Photo Credit: Deltares

Land degradation in the Comoros increases the intensity of soil erosion and causes significant loss of biodiversity and ecosystem services, such as water purification and flood control. The risk of soil erosion is higher in the Northeast and South of Ngazidja and the West, East, and South of Ndzuwani than in other locations (Bourgoin et al., 2016). This risk differs between Ngazidja and Ndzuwani because of differences in slope relief and soil quality. With the erosion of young fragile soils, waterways get disrupted and increased sediment loads are released into rivers, further contributing to water scarcity and poor water quality (see section 5.3). Additionally, land degradation and soil erosion expose Comorian communities to hydro-climatic risks such as floods and droughts.

10 Land degradation is defined here as "the deterioration or loss of the productive capacity of the soils for present and future" (Global Environmental Facility [GEF], n.d.). Land degradation is one of the world's most pressing environmental problems and is essentially caused by land clearance, poor agricultural practices, inappropriate irrigation, deforestation, and climate change.

Table 9. Economic importance of the agricultural sector

Indicator	Value
Share of GDP (value-added)	30.5%
Share of employment	34%
Share of total land area	70%
Arable land per person	0.08 ha
Added value per worker	US$4,304
Cereal yield	1,370 (kg/ha)

Sources: World Bank 2018, 2019b, 2019a, 2020a.

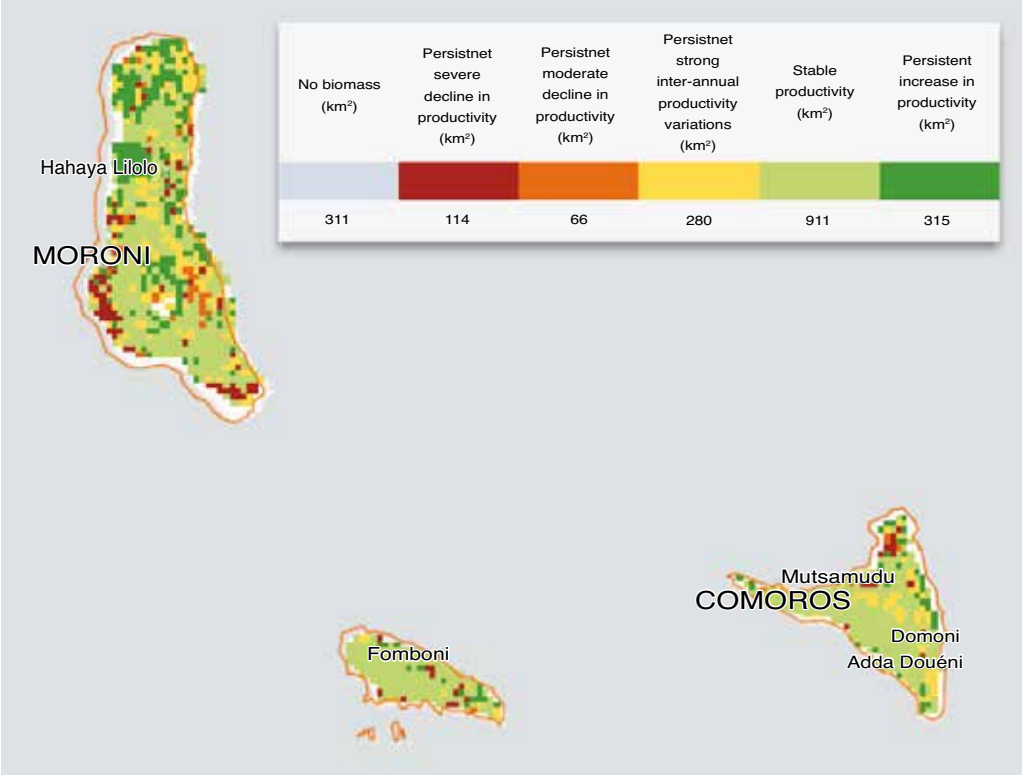
Land degradation results in a loss of land productivity and thus in the reduction of agricultural output, aggravating poverty, food insecurity, and unemployment levels in rural areas. Smallholder farms, which dominate farming in the Comoros, are particularly vulnerable to the effects of land degradation, as they generally produce lower and more volatile yields than large-scale commercial farms (World Bank 2020j). Another liability factor is the fact that agriculture in the Comoros is mainly rainfed, and less than 1 percent of the arable land is currently actively irrigated. This makes the degradation process, which is compounded by droughts and changes in precipitation patterns (Bourgoin et al., 2016), even more impactful for the Comoros, as degraded lands reduce the water-holding capacity of the soil and soil water infiltration and diminish the amount of groundwater available for crop growth.

In the Comoros, land degradation is closely related to inequality and rural poverty. The rural poor cultivate cassava, banana, yam, and maize, are generally not engaged in the farming of cash crops, but are involved in harvesting ylang-ylang. Since poor rural Comorians are primarily located in the most unfavorable lands and engaged in land-related activities for their livelihoods, as land degrades, they face a higher risk of losing their main source of income. This mechanism also tends to widen the income gap between rural-based poor and Comorians who rely on other types of assets to generate income, thereby exacerbating social inequalities within islands.

Unsustainable Farming Techniques, Climate Change, and Natural Hazards

One of the main drivers of land degradation in the Comoros is the unsustainable management of agriculture, which is still dominated by slash-and-burn farming and monoculture cropping (ylang-ylang, vanilla, cloves). Most farming is done without any fertilizer, and water management is still largely underdeveloped; for example, small-scale water control

Figure 19. Changes in land health and productive capacity over 15 years (1999–2013).



Source: European Commission 2021.

for improving production during dry spells is almost nonexistent (UNEP 2016). Most farmers lack technical knowledge on sustainable irrigation practices and rely on labor-intensive agricultural production techniques that offer few diversification options. These unsustainable farming techniques, compounded by the lack of adequate agricultural infrastructure, contribute to land degradation through declining soil fertility, increasing pressure on the steep slopes, higher degree of soil erosion, deforestation, watershed degradation, and high sediment loads to the marine environment (Bourgoin et al., 2016).

Climate change and natural hazards exacerbate the effects of unsustainable farming practices, further increasing and accelerating the ongoing land degradation processes. Increased frequency and intensity of heavy precipitation, coastal erosion affected by a rise in sea level, floods, droughts, and cyclones put addition pressure on soil losses in the Comoros while contributing to changing vegetation cover and composition. The combined impact of these phenomena contributes to reducing the productivity of the agriculture sector, especially considering that the Comoros suffers from the lack of appropriate irrigation systems. At the same time, degraded lands are more vulnerable to the impact of climate change and natural hazards, triggering a downward spiral of land degradation, climate vulnerability, and productivity losses. Although the mitigation agenda is not the most urgent concern for the Comoros, it cannot be overlooked that land degradation, if unchecked, reduces the valuable function of lands as carbon sinks, thus likely resulting in an increase in the country's GHG emissions. In light of the decline in the value of cropland as described in Chapter 3, soil degradation can indeed hamper carbon sequestration potential and thus jeopardize the achievement of the ambitious nationally determined contribution (NDC) goal of increasing net CO_2 absorption by 47 percent by 2030 compared to the baseline scenario (see Box 7).

The impacts of climate change on land are not equally distributed among the different cultivation systems of the Comoros. Cultivated crops in open fields are the most vulnerable to climate change, given the lack of protection by forest cover. Cultivation systems near natural forests and agroforestry systems are most resilient to the effects of climate change. Lowland monocultures, such as ylang-ylang, vanilla, and cloves, which are essential to the country's economy, are affected not only by droughts but also by increased saltwater intrusion via surface and subsurface water connections between land and coastal water systems.

Box 9. Family Farming Productivity and Resilience Support Project (PREFER)

The PREFER project launched by the International Fund for Agricultural Development (IFAD) aims to improve the country's food and nutritional security by sustainably increasing food availability while strengthening the livelihoods of poor rural populations by increasing agricultural incomes at the household level (IFAD 2021). The project runs from December 2017 to December 2022. During the mid-term review in 2020, it was found that more than 3,000 households had benefited from the project (40 percent of women and 27 percent of young people). The direct effects of the PREFER project were:

- Adoption and replication of improved production techniques at the farmer field school level in individual plots (for example, hedging, cultivation techniques, and organic fertilization)
- Improvement of productive capacity by increasing cultivable areas through restoration of land fertility on previously uncultivated steep slopes
- Yield improvements, particularly by providing access to cassava cuttings and banana shoots
- Establishment of good farming techniques and practices
- Hedging of plots, creating multiple benefits including improved soil fertility and protection against erosion

Despite these achievements, PREFER has not been able to improve market access, which remains weak. Therefore, this CEA recommends mobilizing technical assistance to support the development of a value chain for livestock products.

5.1.3. Costs of Inaction and Opportunities for Change

Land degradation[11] has significant cost implications for the economy of the Comoros. Although there is

11 In this current CEA, land degradation is measured as the ratio between the total ecosystem service value before land degradation (ESV Terrestrial) and the total ecosystem service value after land degradation (ESV degraded). Their approach of using simple benefit transfer methods to estimate the impacts on the value of ecosystem services allows the definition of the "land efficiency ratio" but has certain shortcomings like the use of an oversimplification of the ecological reality. Nevertheless, their findings are relevant to understanding the economic consequences of land degradation.

no comprehensive recent study on land degradation in the country, it has been estimated that land degradation in the Comoros results in a reduction of ecosystem service value of about 18 percent (Sutton et al., 2016), which corresponds to a loss of US$274 million per year, accounting for 22.5 percent of the country's GDP (Annex 2). Lower land productivity caused by land degradation significantly affects agriculture, which is indeed the largest sector of the country's economy in terms of contribution to GDP and the provision of jobs.

The Comoros Emerging Plan (PCE) 2030 aims to address these losses by intensifying the fight against land degradation through the establishment of a program aimed at restoring degraded soils and promoting the sustainable maintenance of soil fertility. Addressing land degradation is generally economically beneficial in both the short and long terms. Although no studies on the economics of land degradation in the Comoros have been conducted, a 30-year study on the economics of land degradation in nearby Kenya determined that the costs of action against land degradation are about four times lower than the costs of inaction (Mulinge et al., 2016), implying that every dollar spent on combating land degradation likely generates about four dollars in return. Even over a short-term period of six years, the costs of action are about three times lower than the costs of inaction, representing a very strong economic justification for taking action to address land degradation.

To reduce land degradation while increasing the sector's resilience against the effects of climate change, farmers should receive training and incentives to help transition to climate-smart agriculture (CSA) practices.[12] Various aspects of CSA should be considered, ranging from improved knowledge of smart irrigation options, awareness of local weather prediction information, soil conditions, and selection of crop varieties that are more resistant to diseases and adapted to the current climatic context. Examples of projects that have focused on implementing CSA systems are provided in Box 10. Specifically, the opportunities agroforestry practices can bring on the higher slopes should be further discussed with local communities. To cope with longer periods of droughts, nature-based solutions such as for water storage should be considered in cash crop areas. Additionally, to improve the agricultural sector, attention needs to be paid to the age distribution in the farming community. Agricultural innovation projects can benefit from actively involving the young and unemployed population group on the islands, which is currently not included in the agricultural sector. By providing education to the current farmers, and the inclusion of this additional group of young potential workers, the prospect of a more flourishing and sustainable agriculture sector is feasible.

Transformations to reach more sustainable farming practices and the promotion of CSA systems represent major opportunities for the economy of the Comoros. Capitalizing on these measures and opportunities for change would not only enhance soil and land management while contributing to climate change mitigation but would also maximize local co-benefits. Indeed, land-based approaches for carbon sequestration and CSA and programs for land management would offer new jobs and income opportunities, while reducing widespread poverty and fostering synergies between mitigation and adaptation in the country. From this perspective, carbon sequestration needs to be considered not only as a tool for mitigating climate change but also as a contributor to soil health, increased food security, and thus a sustainable development propeller. By sustainably increasing agricultural productivity, the Comoros can strengthen food and nutrition security and support income generation.

5.1.4. Institutional and Legal Context

In the Comoros there are currently three contradictory land tenure regimes that create complexity, low-level disputes over land ownership, and land abandonment. Both the National Agricultural Policy and the National Action Plan to Combat Desertification contain objectives to clarify the land tenure regime to promote sustainable land management and secure land tenure for farmers. Integrating the three systems into a single regime with decentralized tenure securitization would provide legal clarity and strengthen social cohesion. The Institutional Capacity Building Project (Projet de renforcement des capacités institutionnelles), financed by the African Development Bank, proposed the establishment of a Land Reform Commission to be in charge of producing a tenure reform roadmap, taking into account the land strategy already available after its political and legal validation (Sow 2021).

12 CSA is an integrated approach to managing landscapes—cropland, livestock, forests, and fisheries—that addresses the interlinked challenges of food security and accelerating climate change. CSA aims to simultaneously achieve (1) increased productivity, (2) enhanced resilience, and (3) reduced emissions (World Bank definition).

Box 10. Enhancing Adaptive Capacity for Increased Resilience to Climate Change in the Agricultural Sector (CRCCA)

In 2014, the GEF and UNDP donor-funded CRCCA project was implemented. The project aimed to support the Comoros in reducing the vulnerability of its agricultural sector to climate change and weather variability (GEF and UNDP 2019). The main outcomes achieved by the project were:

- At the national level, adaptation approaches for climate change resilience were integrated with agricultural strategies and sustainable development plans.
- Farmers received several training sessions on sustainable agriculture and were introduced to rural entrepreneurship through the establishment of agricultural pilot farms. These pilot farms support young farmers with modernizing farming practices to move toward larger-scale farming. Examples of modernization include water management for irrigation and livestock and improvements in accessibility via new infrastructure such as roads.
- Farmers were supported in terms of skills acquisition, resilient seeds, and access to technical tools and information.
- Four agro-meteorological stations were installed to provide weather broadcasts.

To scale up the project and build upon its results, priority should be given to supporting rural entrepreneurship through the establishment of additional agricultural farms, as well as to promoting sustainable agriculture through the acquisition of climate-smart agriculture skills and the distribution of resilient seeds and technical tools. The follow-up project should involve local NGOs in partnership with local authorities.

Box 11. Global Climate Change Alliance (AMCC)

The general objective of the national program under the European Union Global Alliance against Climate Change (Alliance Mondiale contre le Changement Climatique) was to contribute to the efforts made by the Comoros in terms of development and the fight against poverty. More specifically, the program focused on improving the importance attached to climate change by national and local actors in their strategies, projects, and mechanisms of planning, coordination, and monitoring. One of the results concerned the production and update of cartographic data, including high-definition aerial photographs, which made it possible to update national databases and improve the Geographical Information Systems (GIS) information. Agriculture is one of the key potential applications of these images, to obtain, for instance, more reliable calculations of agricultural plots or counting of ylang-ylang plants. This could lead to more accurate assessments of agricultural production and its local impacts on the environment, contributing to the necessary statistics required for further development and improvement of practices. The program identified the need for further fundamental studies on critical ecosystems in terms of productivity as well as resilience to climate change, and it highlighted the potential to test the application of the high-definition images in pilot projects.

The national legislation of the agricultural sector is characterized by a food law, a livestock code, a phytosanitary law, and a plant protection law (MAPETA 2021b). The World Bank Integrated Development and Competitiveness Project (PIDC) is supporting the preparation of the text to implement this food law. Nevertheless, this framework does not include sustainability considerations, thus raising the need to mainstream environmental issues, including climate change, in the sectoral legislation. In this regard, the NDC 2021 indicates the way forward, as it sets three adaptation actions to be implemented for the agriculture-livestock sector: (1) development of a climate-resilient and smart agricultural policy, (2) the development of agro-pastoral irrigation, and (3) the establishment of an early warning and effective intervention system throughout the country in the event of the emergence of new bovine or caprine diseases.

In addition, government institutions, agricultural enterprises, and farming communities have limited technical capacities and knowledge of the risks resulting from climate change. The capacities of the institutions in charge of the agricultural portfolio are very weak, with low budgets, limited staff, and limited understanding of the potential benefits that adaptation and mitigation strategies hold for both the economy and the society. Furthermore, cooperation, coordination, and knowledge exchange among institutions

are far from being fully systematized, although some forms of collaboration do exist, such as between the National Institute for Research in Agriculture, Fisheries and the Environment (INRAPE) and the National Agricultural Strategy and Livestock Directorate (DNSAE).[13] The World Bank PIDC project is currently being implemented in the Comoros to address these gaps and strengthen value chains in strategic sectors, capacity building of key public institutions, and development of agriculture and livestock sectors in the private sector (Box 12).

5.1.5. The Way Forward

- **Restore degraded land areas, adopt nature-based solutions, and scale up agroforestry.** On low-lying plots where soil fertility was lost because of soil erosion, restoration actions should focus on reestablishing soil fertility and health and improving yields of food crops that are essential for food security. In upland areas, agroforestry practices should be promoted to halt deforestation and soil erosion while contributing to improve and diversify yields. Develop sustainable irrigation strategies and related nature-based solutions such as natural water retention measures to reduce agricultural vulnerability to land degradation.
- **Expand the uptake of CSA**. This would include improved knowledge of smart irrigation options, awareness of local weather prediction information, understanding of soil conditions, and selection of more disease-resistant crop varieties adapted to the current climatic context.
- **Build on the results achieved by successful pilot projects** (Enhancing Adaptive Capacity for Increased Resilience to Climate Change in the Agricultural Sector [CRCCA] and Family Farming Productivity and Resilience Support Project [PREFER]) **to further encourage the transition to sustainable land use, increase climate change resilience, and support rural livelihoods**. By leveraging lessons learned and recommendations from successful past projects, sustainable value chain development and enhanced market access could be promoted, and more farmers could be trained in sustainable and CSA techniques.

Box 12. Integrated Development and Competitiveness Project (PIDC)

The PIDC is a World Bank project aimed at supporting the competitiveness in targeted Comoros value chains in three priority sectors: agriculture (fresh fruits and vegetables, export commodities including ylang-ylang, cloves, and vanilla), livestock (dairy and poultry), and tourism. Project interventions are designed to help the public sector of the Comoros play its role as a provider of public goods (infrastructure, investment protection, provider of information, and coordination services), and enable market dynamics to foster private sector-led growth and development. In particular, given the potential of the private sector to create job opportunities, the PIDC aims to supporting micro, small, and medium enterprises with a special focus on empowering vulnerable and excluded segments of the Comorian population, such as women and youth.

The project aligns with priorities identified in the Systematic Country Diagnostic (SCD), specifically with regard to addressing the investment gap and leveraging national resources in agriculture and tourism sectors. Furthermore, the project aligns with the framework provided by the Accelerated Growth and Sustainable Development Strategy (SCA2D) and particularly the PCE 2030, which calls for the acceleration of the structural transformation of the economy, sustainable management of the environment, and consolidation of good governance, including the investment climate.

- **Ensure that CSA, land restoration, and agricultural innovation programs are carried out through a participatory process involving local communities and especially women and young Comorians.** This would allow the prioritization of activities supported by the villagers based on their emerging perceptions and needs and make communities more aware of land-related environmental challenges and opportunities. Engaging women in such programs would be crucial in terms of female empowerment as, despite their importance in the matrilineal Comorian society, they are primarily involved in subsistence agriculture and are particularly vulnerable to food insecurity and climate change. Involving young Comorians in agricultural activities would also be beneficial in terms of unemployment reduction.

13 Other agricultural institutions include the Ministry of Agriculture, Fishing, and the Environment, in Charge of Energy, Industry, and Handicrafts (MAPEEIA), rural economic development centers, NGOs, community-based organizations, and village development associations.

Box 13. Pilot Project: Land Security

"Land Security," a pilot project supported by the National Programme for Sustainable Human Development (PNDHD) and PREFER projects with IFAD financing, has been implemented since 2010 in the village of Hamavouna in Mwali. The project is based on the following approach:

- A landowner makes his land available to a group of farmers for 15 years through a framework agreement sponsored by local authorities.
- During this period, farmers may not plant any illicit crops that impair soil fertility and farmers should ensure viable management of the plot, using techniques that are known to be adapted to the environment where the plot is located.
- In return, a notarial deed is issued to the owner, identifying the owner as the "possessor" of the land.
- An intersectoral Land Commission is set up by the governor of Mwali to facilitate the implementation of the agreement and ensure respect for the commitments of the stakeholders.

The pilot was successful in increasing agricultural productivity, resilience to climate change, incomes, and food and nutrition security for the farmers involved. As such, lessons learned could be drawn to prepare potential scale-up as a short-term option to yield quick and effective results, including in terms of disincentivizing land abandonment and potentially increasing investment in land ownership whenever possible. However, it would be important to set up adequate mechanisms beforehand to prevent instances of elite capture or corruption.

- **Support the simplification and decentralization of the land tenure regime, to enhance legal certainty and strengthen social cohesion while ensuring transparency.** Ensure that the adjusted regime operates at the municipality level, leaving the established village land committees and the cadi[14] in charge of customary and religious rights. The decentralization of tenure securitization should be envisaged in the short term, complemented by adequate capacity building of technical staff and sufficient funding. In addition, reduce the costs of land registration to create incentives to use land productively and invest in long-term land conservation.
- **Promote capacity enhancement, coordination in and between relevant land management institutions, and participatory approaches**. This component should be embedded as part of future land-management and agricultural support programs, to enhance results and their long-term sustainability. Special attention should be paid to staff and budget allocation. Participatory approaches toward sustainable land management involving local communities, authorities, and other stakeholders is key to developing a collective vision of sustainable land management and restauration and achieving sustainable outcomes.

5.2. Forests

Key Features

- Forests are important habitats of biodiversity and for CO_2 storage for the Comoros. They represent an essential source of livelihood and food security for rural communities and have the potential to contribute more significantly to gross domestic product (GDP) if sustainably managed.
- Natural and planted forests, currently accounting for 17.7 percent of the total land in the Comoros (World Bank 2020a), provide many important ecosystem services for the Comorian population.
- In 2020, the Comoros lost 266 hectares of tree cover, equivalent to 136 kilotons of CO_2 emissions.
- The forests of the Comoros are declining due to extensive and uncontrolled deforestation and unsustainable forest management. Illegal and unreported deforestation and slash-and-burn agricultural practices are also contributing factors, although no specific data on this exist.
- The consequences of deforestation are soil erosion, land degradation, and watershed degradation. Additionally, deforestation leads to loss of biodiversity, increased impacts of

14 Local Muslim judge (also spelled "qadi").

climate change, higher GHG emissions, and reduced resilience of rural livelihoods.

- Although Comorians are generally aware of the damaging consequences of deforestation, many are forced to overexploit forest resources due to high levels of poverty.
- On Mwali, forests are protected in Mwali National Park. Two other areas of forest protection, Karthala National Park on Ngazidja and Mount Ntringui National Park on Ndzuwani, are under development.

5.2.1. Sector Characteristics

As part of the Madagascar and Indian Ocean Islands biodiversity hot spot, the Comoros harbors rich terrestrial flora and fauna with high levels of endemism (Ibouroi et al., 2021; Myers et al., 2000). The three islands were formally covered with evergreen tropical forests, extending from the coast to 1,800 meters in altitude. Although the lowland forests up to 500 meters have been mostly cleared, patches of relatively intact montane forest remain above 800 meters in elevation, especially on the southern slope of Mount Karthala on Ngazidja, the Maya Forest on Ndzuwani, and Mount Mlédjélé on Mwali. Endemic species include more than 500 plant species, 21 bird species, nine reptile species, and two fruit bat species (WWF, n.d.).

Forests support the livelihoods of a large share of the Comorian population. For instance, they provide both timber products for construction and firewood for household cooking, and nontimber forest products such as ylang-ylang. Forests also stabilize the soil, thereby preventing erosion, reducing the risk of flooding, and protecting the land from degradation. Despite these numerous benefits, it should be noted that forests currently only account for 1.8 percent of the natural wealth of the Comoros (World Bank 2021d).

Women working in the forest in Ndzuwani
Photo Credit: Deltares

Box 14. Deforestation

The president of the Comoros recognized deforestation as a major issue for the country. During the COP26, he announced to the international community his willingness to promote the reforestation of the country, intending to reforest 10 percent of the country's territory and designate 25 percent as a protected area by 2030 (MAPETA 2021).

5.2.2. Deforestation, Forest Degradation, and Their Drivers

During the past decades, the Comoros has experienced severe deforestation and forest degradation. While little intact forest remains, most of the remaining forest is severely degraded, except at higher elevations where the terrain is rugged. Between 1990 and 2020, the Comoros lost approximately 13,000 ha of forest area (from 24.75 percent to 17.69 percent of the total land), corresponding to a decline in forest natural capital per capita of approximately 20 percent (World Bank 2020b, 2021f). In 2010, the Comoros had 132,000 ha of tree cover, extending over 79 percent of its land area. In 2020, it lost 266 ha of tree cover,[15] equivalent to 136 kilotons of CO_2 emissions (Global Forest Watch 2022).

Forest habitat degradation and fragmentation differ across the islands because of the specific habitats, ecological systems, and human demographics of each island. Deforestation and forest degradation are more significant in Ndzuwani and Ngazidja, primarily because of their higher population density compared to Mwali (Goodman et al., 2010). Another reason for lower forest loss in Mwali is the presence of Mwali National Park which, because of its protected status, is less exposed to deforestation.

15 "Tree cover loss" includes change in natural and planted forest and is not necessarily caused by human activities, whereas "deforestation" results from human activity (Global Forest Watch, 2022).

In the Comoros, deforestation and forest degradation are primarily caused by clearance for agricultural expansion (see section 5.1), underpinned by deep-rooted rural-based poverty, climate change, and natural disasters, which further exacerbates the deforestation process, as more frequent extreme weather events and climate hazards add additional pressure to the country's forests. Comorians are generally aware of the ongoing process of forest degradation and its consequences, but many have no alternative but to rely on forests for their livelihood (Ibouroi et al., 2021). It was found that Comorians with sufficient income (for example, nongovernmental organization [NGO] staff, professors, agricultural engineers, and other public officials) are less dependent on forests and natural resources than vulnerable groups, especially women, who are forced to sustain their livelihoods by overusing forest resources (Ibouroi et al., 2021). Thus, there is a strong link between deforestation and the subsistence activities of the rural-based poor, who are induced to harvest forest resources to sustain their livelihoods.

Another major driver of deforestation in the Comoros is wood harvesting, which occurs in a context of limited awareness, lack of alternatives, and inadequate control mechanisms. A large share of the harvested wood is used for household cooking, as 93 percent of the population relies primarily on fuelwood for cooking (World Health Organization 2019a). The distillation process to produce ylang-ylang essence also contributes to wood harvesting, especially in Ndzuwani and Mwali (MAPETA 2021b). In the PCE 2030, the Government of the Union of the Comoros (GoC) states its intention to reduce the share of wood as an energy source by 60 percent by 2030 (Union des Comores 2019b). One of the obstacles to limiting the use of wood for cooking is the high costs of alternative energy sources such as renewable energy (solar, geothermal energy) (MAPETA 2021b).

5.2.3. Costs of Inaction and Opportunities for Change

Annual loss due to deforestation in the Comoros is estimated at US$2 million (Annex 2). It should be noted that both loss resulting from forest degradation and biodiversity loss are not included in the calculation; therefore, the real value is likely to be higher. Besides the direct economic costs of ecosystem service losses, deforestation could result in indirect losses for the tourism sector as well. The current rates of deforestation are threatening the islands' biodiversity, which is one of the main assets

Box 15. Terrestrial National Parks

The Comoros currently enjoys one operationalized national park, Mwali National Park, which was expanded in 2015 to include approximately three-quarters of Mwali's land area. In addition to three marine parks (see section 5.4), two additional terrestrial parks are under development: Karthala National Park on Ngazidja and Mount Ntringui National Park on Ndzuwani. The decision to create additional national parks is in line with the National Park Strategy launched by the government in 2017. In addition to this strategy, the GoC signed the Law on the National System of Protected Areas of the Comoros in 2018, and established the Comoros National Park Agency, although the decrees for the individual parks still need to be signed. Mwali National Park represents an important source of income for local communities due to staff jobs and increased tourism, making local people less dependent on the exploitation of natural resources for their livelihoods (Ibouroi and others 2021).

Despite their status, even in protected areas, the rate of deforestation remains high due to the growing demand for wood and arable land (World Bank 2020d). Besides strengthening the enforcement of the ban on harvesting wood in protected areas, conservation efforts may benefit from (1) maintaining sustainable production of forest products to enhance livelihoods, (2) establishing local markets to sell forest products, and (3) setting up an awareness campaign and initiatives for reforestation (Ibouroi and others 2021).

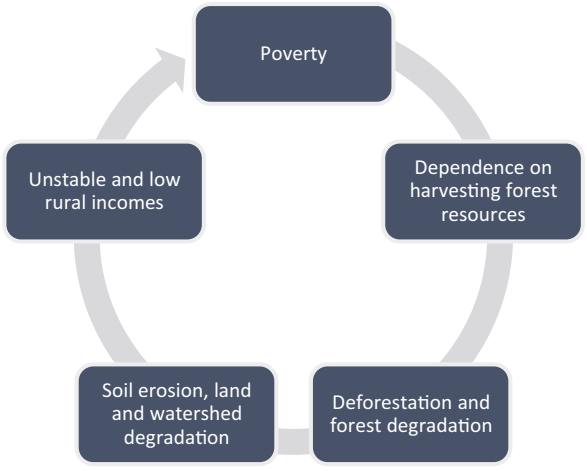
Protected areas are an effective means to protect the ecosystem and biodiversity of the Comoros, provided that they are sustainably managed and enforcement capacities are in place. Between 1995 and 2018, the per capita value of protected areas has increased, indicating the positive development of natural parks and efforts expended to protect natural resources (see also Box 22 on marine national parks).

for the potential of the tourism sector (C3-Comores 2008; Palerm 2007).

Deforestation is also a major cause of soil erosion and land degradation. Soil erosion leads to increases in runoff and flooding, thereby reducing soil fertility and agricultural yields (World Bank 2020d). Moreover, deforestation is known to have major impacts on watershed function. In Ndzuwani, almost 40 rivers that flowed permanently a few decades ago have become intermittent, causing severe issues with water scarcity (World Agroforestry 2019). More information about the impacts on watershed function can be found in section 5.3. Although a large proportion of the Comorian population is dependent on forest resources, this negatively affects their livelihoods, creating a feedback loop (Figure 20) that can only be broken by reforestation and targeted investment that offer alternative livelihoods.

Agroforestry and reforestation can help reduce the effects of anthropogenic activities on vulnerable primary forests and help halt forest degradation. Traditionally, land management involves agroforestry practices that are well integrated with food crops. To prevent erosion and restore watershed functions, reforestation programs should be carried out in strategic locations where the livelihoods of local communities can benefit the most, with special attention to the role Comorian women can play in these activities. Degraded areas should be replanted with local tree species, such as fruit trees, that can be valuable for the economy.

Figure 20. A vicious cycle of poverty and deforestation.



Source: Deltares.

Through the PCE, the GoC aims to promote an agroforestry industry using technologies adapted and accessible to the local population (Union des Comores 2019b). One of the key reasons for farmers to be interested in sustainable forest management is the economic opportunities arising from the sale of products such as fruit, wood, and fodder.To make livelihoods more resilient, it is fundamental to develop a range of climate-resilient local varieties capable of providing different environmental services as well as diversifying income (Tschora and Cherubini 2020). The International Council for Research in Agroforestry (ICRAF) identified several options of species suitable for cultivation by different types of farmers depending on the varying socioecological conditions, which will serve as a useful resource (Dumont, Bonhomme, and Mohamed 2021). In addition, reforestation activities took place in the past but failed to protect reforested areas from further degradation. Therefore, future reforestation programs should be accompanied by strategies aimed at sustainably protecting replanted trees (MAPETA 2021b), as well as by awareness-raising campaigns and capacity building on the benefits of sustainable forest management and use.

To limit further deforestation, a forest zoning plan should be incorporated into islands' land-use plans. Such plans should recommend agroforestry, reforestation, and protection of natural forest resources. Buffer zones could be created around primary forest areas to better protect them and facilitate effective participatory management with local communities. In buffer zones, agroforestry can help to provide sustainable livelihoods and create protection for the more vulnerable inner zone of protected forest. Outside the buffer zones, more intensive yet sustainable land-use practices can be stimulated.

The Comoros has developed a land-use plan for the island of Mwali. This territorial planning document aims to determine major direction over the next 20 years (MAPETA 2021b). Building on Mwali's land-use plan, the GoC should develop similar plans for each island. For example, the planting zones for ylang-ylang plantations should be restricted to the lowlands below 200 meters in altitude. Between the plantations, sufficiently large pockets of protected dry forest should remain in critical areas to prevent erosion and sustain watershed functions. Between altitudes of 200 meters and 300–400 meters, diverse agroforestry practices can be expanded because they benefit the environment through the conservation of soil and

water supplies, as well as the livelihoods of the people who depend on the forest through diversifying their income sources (World Bank 2019b). Above 300–400 meters, the natural forests should be protected in national parks managed by trained rangers.

Reforestation would benefit from integrating both scientific and local knowledge. It would be critical to enhance scientific knowledge by improving forest inventories, data collection, and site monitoring to better understand the ecological functions of trees at the landscape scale in the Comoros. At the same time, local forest communities often have sophisticated knowledge about, and experience with, their local environment (World Agroforestry 2019). Moreover, given the aforementioned link between deforestation and subsistence activities carried out by rural poor, the National Environmental Policy (PNE) attaches great importance to involving vulnerable groups in decision-making processes regarding the management of forest resources, both in terms of exploitation and preservation (MAPETA 2021b).

Reforestation in the Comoros could provide several benefits and incentivize people to support and contribute to reforestation actions. Reforestation can trigger benefits in terms of protection and conservation of water supplies, fuelwood and timber, nontimber forest products, and increased crop yields. In particular, access to water has been identified as a key ecosystem service, especially on Ndzuwani (Doulton et al., 2016). Through community-level reforestation programs, farmers and other stakeholders can contribute to improving the drinking water supply through reforestation around rivers and water collection points. Based on their experience, farmers demonstrated detailed knowledge about how different tree species affect water cycles.

5.2.4. Institutional and Legal Context

The Forest Management Law (12-001/AU of 2012) dictates the parameters of sustainable management and conservation of forest resources. It governs forests both at the public and private levels. However, the law has not yet been finalized, and the existing texts do not adequately integrate sustainable forest conservation and management considerations.

Although forest conservation and management fall completely under the mandate of the GoC (General Directorate of Environment and Forests [DGEF]), numerous other actors are involved in forest conservation and management, although their roles and mandate are not clearly defined. The forest department of the DGEF suffers from a lack of adequate capacity, as well as of financial and human resources. In addition, the absence of an operational technical department of forests in the DGEF hampers the implementation of planned measures. At the municipal level, the lack of capacity and human and financial resources is a consistent constraint. During recent stakeholder consultations conducted in the development of this CEA, the relationship between the GoC and NGOs was mentioned as a liability to some extent for sustainable forest management.

There is currently no practical and operational framework or control system for wood harvesting, and no administrative structure is empowered to monitor this activity. Although there are bans on wood harvesting in the national parks and restrictions on wood harvesting in some areas, there is no legal follow-up that can lead to convictions of offenders who cut down trees without authorization. Although some local communities and municipalities have successfully taken responsibility for imposing restrictions on wood harvesting, these restrictions are often not enforced.

Even though forests represent such an important aspect of Comorian livelihoods, there have been no major projects from international donors with a specific focus on forests. Instead, forests have comprised only a small component of projects relating to agriculture or water ecosystems. To better incorporate sustainable forest management in future development plans for the Comoros, it is strongly recommended to consider forests as a central aspect and treat it within the context of an integrated landscape management approach (see chapter 6).

5.2.5. The Way Forward

- **Develop and implement land-use plans for Ngazidja and Ndzuwani** to protect the natural forest resources and stimulate reforestation. Apply a zoning approach using the following zones: (1) agricultural zones (for ylang-ylang plantations), (2) agroforestry zones for sustainable production, (3) zones for protected dry forests to prevent erosion and sustain watershed functions, and (4) natural forests in national parks. Apply the same zoning approach to the Mwali Land Use

Box 16. One Comorian, One Tree

From 2022 through 2025, the GoC and UNDP, supported by GDF and GEF, launched the "One Comorian, One Tree" project, a broad reforestation program to protect watersheds and accelerate the achievement of the country's NDC objectives. The campaign aims to plant 613,000 new trees on 571 hectares throughout the country. Integrating this initiative through a ridge-to-reef approach could benefit the implementation of the campaign by leveraging interactions between production systems and natural forest areas.

Plan, which was completed and validated by the Government Ministerial Council on May 11, 2022. Combine this strategy with an integrated landscape approach to ensure that all activities in the area work in complementarity and that each specific zone is used for the purpose for which it is designed. Ensure consistency and exchange of data and information between the three land-use plans to stimulate cooperation and efficient use of funding.

- **Officially operationalize two additional terrestrial national parks to enhance the effective protection of the forest cover of the Comoros.** The initiative follows up on the proposal included in the National Park Strategy adopted in 2017 and the pledge made at COP26 to designate 25 percent of the territory as a protected area by 2030. The parks should adopt a participatory co-management approach similar to the one successfully piloted in Mwali National Park. Operationalizing these two additional terrestrial national parks would also contribute to the protection of biodiversity and result in positive spillover effects for the potential of NBT (section 5.6).

- **Restore degraded areas by replanting local trees, particularly trees that offer economic benefits and opportunities to diversify incomes of local communities.** Reforestation programs should be integrated into a sustainable landscape management approach in which local communities are involved in both the planning and decision-making processes. As stated by the president of the Comoros during COP26, where he committed to reforesting 25 percent of the country's territory, reforestation programs could also be envisaged with the objective of fuelwood production, given that 93 percent of the population depends on fuelwood for cooking. Sustainable production of forest products should be promoted (such as nontimber forest products), and the establishment of local markets should be facilitated. In parallel, awareness campaigns should be carried out to sensitize local populations on the benefits of reforestation and sustainable management and use of forests.

- **Improve forest inventories, data collection, and site monitoring.** The data made available will be instrumental in supporting adequate sustainable forest governance and management strategies.

- **Finalize the Forest Management Law and integrate sustainable forest conservation and management considerations in the legislative framework.** Support the implementation of the Forest Management Law specifically via training of inspections and equipment. Focus training on field patrolling and facilitate the acquisition of equipment such as four-wheel drive vehicles, motorbikes, and communication tools.

- **Support the enhancement of the capacity of national and regional directorates to monitor the implementation of environmental and natural resource regulations and policies.** This objective requires supporting an increase in human and financial resources allocated to the directorates, as well as improving their technical and operational capacities.

5.3. Water

Key Features

- Water is an essential contributor to the Comoros economy and livelihoods.
- Water availability varies among the islands. Ndzuwani and Mwali depend on surface runoff from perennial or intermittent rivers and groundwater in coastal areas. Ngazidja relies on the collection of rainwater inland and groundwater in coastal areas, as there is no surface water.
- Although, in theory, water is an abundant resource in the Comoros (World Bank 2021c), current levels of water supply are insufficient

to meet the needs of the Comorian population, particularly given increasing demand for water driven by population growth.

- Water quantity and quality have distinct challenges. In Nzwani and Mwali, permanent rivers are becoming temporary, and temporary rivers are becoming ephemeral due to land degradation, reduction in forest conservation and land rehabilitation, climate change, and inadequate infrastructure investments (for example, water storage and conveyance systems).
- Access to safe drinking water in the Comoros is very low, with 2020 levels estimated at 15 percent. Incomplete regulatory frameworks, monitoring systems, and coordination mechanisms are also hampering the development of an efficient potable water network. Improving the drinking water supply is one of the State's key priorities.
- The coordination of different levels of government (national, island, and local levels), across sectors, and with the participation of multiple stakeholders including vulnerable communities, is fundamental to implementing Integrated Water Resources Management (IWRM) in the Comoros.
- The health and well-being of the Comorian people require increased access to safe water and sanitation.

5.3.1. Sector Characteristics

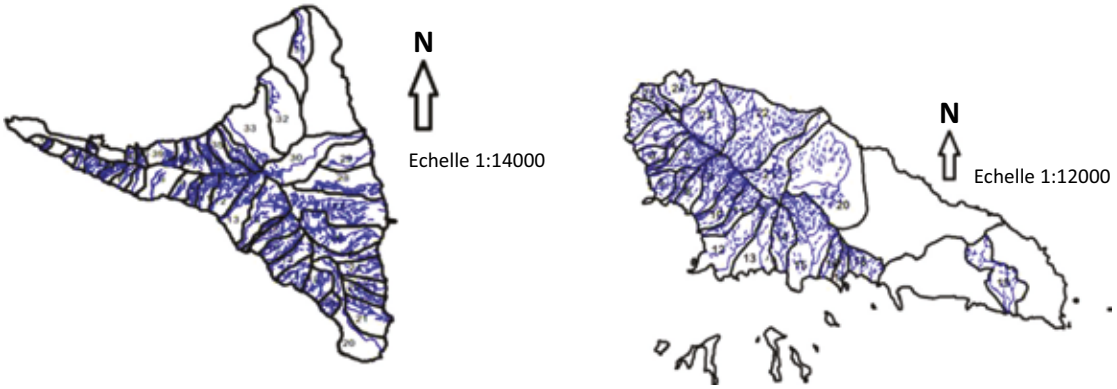
The primary water sources in the Comoros are surface water, rainwater harvesting, and groundwater, though with significant inter-island variation according to each island's characteristics. Rainfall varies considerably from one island to another, as well as within each island, due to differences in altitude and wind (World Bank 2021b). The natural drainage systems on each island depend on their geological characteristics and soil composition. In Ngazidja, 95 percent of the rainfall infiltrates underground due to the high permeability of volcanic soils and associated rock fissures. This results in the absence of a surface hydrographic network and an abundance of groundwater resources. Unlike Ngazidja, Ndzuwani and Mwali have surface water bodies (Figure 21), although many of these rivers have been drying up, as described in more detail below. Lake Dzialandzé in Ndzuwani, classified as a Ramsar site, is considered the main source of several rivers. Lake Dziani Boundouni in Mwali, also a Ramsar site, is the largest freshwater body in the Comoros (AFD 2018). Underground aquifers have been found on all three islands but have not been extensively studied except for Ngazidja, where part of the aquifer is exploited. There are no large dams or reservoirs in the Comoros and no major natural lakes. There is also almost no irrigation on these islands—only 300 ha are irrigated in Nzwani and Mwali islands.

Although in theory water is an abundant resource in the Comoros (World Bank 2021c), current levels of water supply are insufficient to meet the needs of the growing Comorian population. The Comoros is a country with significant water potential from surface water resources in Mwali and Ndzuwani and groundwater resources in Ngazidja, but only about 2 percent to 3 percent of the total water resources are used annually (Table 10). The Comoros is considered a water-stressed country, with 1,474 m^3 of renewable water resources per capita (Figure 22) —below the water-stress threshold of 1,700 m^3 per capita established by the UN.[16] Although the total volume of renewable water resources remained constant from 1962 through 2017, the country experienced a steady decline in per capita renewable water resources. Water scarcity results from a combination of factors, including rising demand driven by population growth, inadequate water management, inadequate human activities, land degradation, climate change, and high operational costs. Water scarcity goes hand in hand with increasing water degradation, which is primarily related to polluting human activities and poor infrastructure. A more detailed description is provided below.

The Comoros presents significant information gaps on key indicators for the development of evidence-based decision-making, investment decisions and, ultimately, sustainable water and sanitation management. This includes data on the availability of surface water and groundwater, the physical and chemical characteristics of the water, and ease of access to drinking water and sanitation services, especially in urban settings. Furthermore, the country has no updated information on the impact of water, sanitation, and hygiene (WASH) issues on health, with the most recent figures dating back to 2004.

16 Aquastat database: https://www.fao.org/aquastat/statistics/query/index.html;jsessionid=BCF25C6FC52B9ED24088E-4D050984E7C

Figure 21. Maps of the 44 watershed basins on Ndzuwani (left) and 25 watershed basins on Mwali as identified in the National Water Strategy and Program.



Source: GCF and UNDP 2018a.

5.3.2. Water Scarcity, Degradation of Water Quality, and Their Drivers

Groundwater

Access to groundwater remains a challenge. The Comoros has small watersheds (less than 4 square kilometers on Ndzuwani, less than 2 square kilometers on Mwali, and on Ngazidja very small but with exact dimensions unknown) and aquifers, which means that the country has little natural water storage capacity. The steep terrain in the islands, particularly in Ngazidja, limits access to groundwater, as the higher elevation requires increasingly deeper drilling to reach the groundwater table, which is generally associated with high operational costs. This constraint is particularly concerning, considering that 90 percent of the total renewable water resources in Ngazidja come from groundwater resources. Regarding Ndzuwani and Mwali, groundwater plays a fundamental role in the water supply to coastal areas, particularly during the dry season. Groundwater abstraction wells occur up to 2 to 3 kilometers from the coast and are prone to saltwater intrusion. In addition, despite their high salinity, they continue to be used for irrigation, livestock, or washing (Comte et al., 2016). Groundwater is exploited on an ad hoc basis and there is currently neither an active groundwater management program to monitor salinity and pollution risks nor a plan for the sustainable use of groundwater resources. However, there are ongoing initiatives to increase understanding of groundwater resources in Ndzuwani and Mwali. For example, the University of the Comoros is working with the national company for water distribution, Société Nationale chargée de l'Exploitation et la Distribution des Eaux aux Comores (SONEDE), to monitor groundwater salinity levels in pumping wells. The national university hosts the national water quality laboratory and is the main knowledge base for groundwater in the country (GCF and UNDP 2019b).

Surface Water

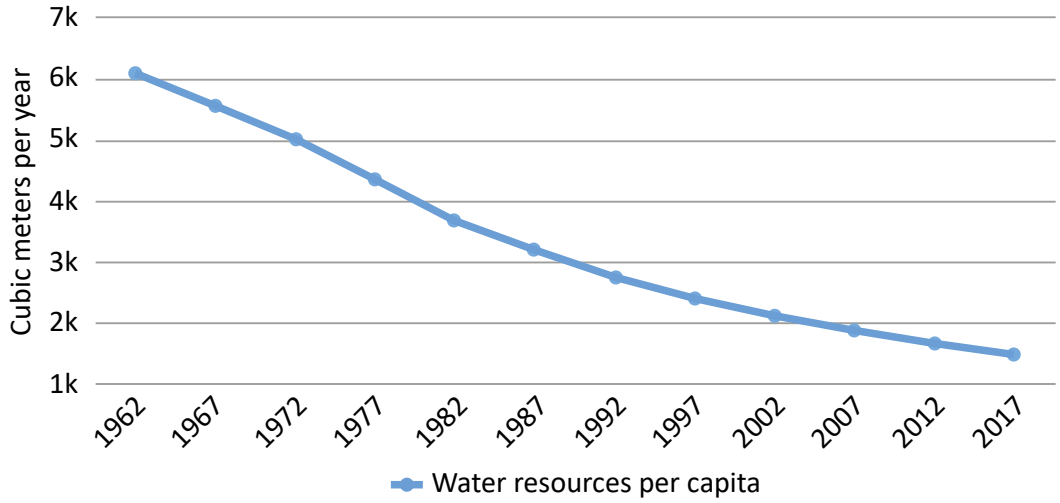
There are no surface water bodies in Ngazidja, which makes the island primarily dependent on groundwater and rainfall harvesting, but Ndzuwani and Mwali have perennial and temporary streams. For its water supply, Mwali relies on the availability of perennial variable rivers and has a clear river network divided into three zones: an upstream, torrential zone with rapid flow; an intermediate piedmont zone, with a lower slope and medium or slow flow;

Table 10. Volumes of renewable water resources and their exploitation rates per island

Island	Total Renewable Resources (billions m^3/yr)	Renewable Surface Water (billions m^3/yr)	Renewable Groundwater Resources (billions m^3/yr)	Surface Water Exploited (%)	Groundwater Exploited (%)
Ngazidja	1.254	0.124 (10%)	1.130 (90%)	1.9	0.5
Ndzuwani	0.514	0.213 (42%)	0.299 (58%)	2.3	0.6
Mwali	0.117	0.078 (67%)	0.038 (33%)	1.2	0.5

Source: Tshimanga 2015.

Figure 22. Trend in renewable water resources per capita (cubic meters/inhabitants) in the Comoros from 1962 to 2017.



Source: World Bank Group 2022.

and a more or less extensive delta zone, where the flow is slow to stagnant and mangrove vegetation sometimes develops. Ndzuwani is currently facing the serious problem of the disappearance of its surface water resources resulting from climate-induced and human-related factors (Figure 23). While 49 perennial watercourses were listed in 1950, in 1970, only about 30 remained. By 2005, data indicated that this number had decreased to about 10 watercourses (Trenchard 2020). This was due to a combination of factors, including changes in rainfall patterns, increasing temperatures, and extensive deforestation and degradation of watersheds (see section 5.1) that have disrupted waterways and caused soil erosion (Charmoille 2013). There is minimal water storage within the surface water distribution systems, and water supply is located far from instantaneous flow schemes (GCF and UNDP 2018b). The shores of Lake Dzialandzé in Ndzuwani and Lake Dziani Boundouni in Mwali are used by breeders and farm livestock, resulting in higher pollution of these water bodies (AFD 2018). Despite these challenges, the existing surface water resources on Ndzuwani and Mwali have sufficient excess capacity to meet the needs of the population and sustain their livelihoods.

Rainwater Harvesting

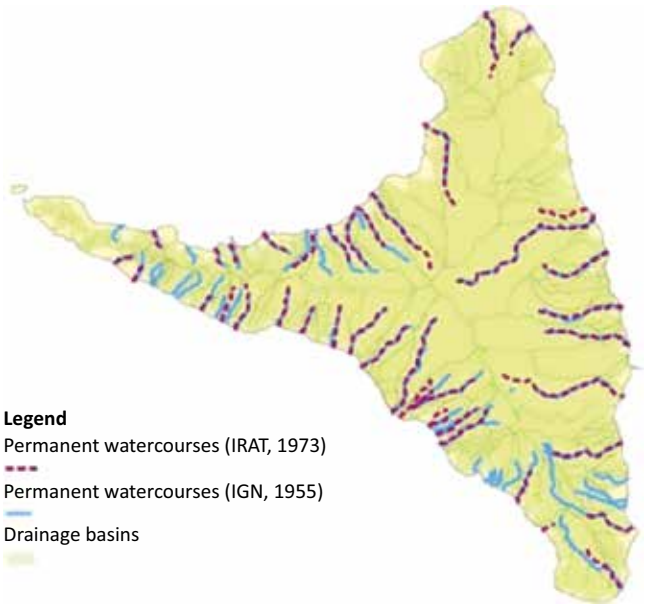
While rainwater harvesting is reportedly minimal in Ndzuwani or Mwali, the inland communities in Ngazidja, which account for half of the island's population, depend primarily on rainwater harvesting due to the absence of surface water bodies and limited access to groundwater on the island (GCF and UNDP 2018a). In Ngazidja, approximately 60 percent of households use private and/or public rainwater tanks. While during the wet season rainwater harvesting is enough to meet the needs of Ngazidja's population, during the dry season, water use tends to be rationed. Changes in rainfall and temperature patterns, such as prolonged dry seasons, are affecting the availability of rainwater resources available to end users. In addition to fluctuations in rainfall and temperatures, rainwater harvesting is subject to non-climatic hazards. For instance, the volcanic ash fallout from the Mount Karthala volcano is an ongoing threat to the quality of harvested rainwater.

Drinking Water

Although access to basic drinking water supply services was at the relatively high rate of 80 percent in 2019 and above the Sub-Saharan African average of 75 percent, the Comoros is still far from achieving safely managed standards, as only 65 percent of the population has access to drinking water on their premises (63 percent in rural areas against 71 percent in urban areas) (WHO and UNICEF 2021). While access to basic drinking water is relatively high, access to basic sanitation services lags behind and appears to be a neglected area for investments. Current access to sanitation services is 36 percent, which is above the Sub-Saharan African average of 28 percent but far behind the world average of 78 percent (WHO and UNICEF 2021).

Water consumption is mostly limited to the strict minimum for daily needs (drinking, cooking, and washing for hygiene). The household survey

Figure 23. Map showing permanent waterways in 1955 and 1973 in Ndzuwani.



Source: Astudillo 2012.

conducted by Comte et al. (2016) in Ngazidja estimated that 45 percent of households surveyed (mean household size of six people) used 20–100 liters per day per household (4–16 liters per day per person), falling short of the basic water requirements of 20 liters per person per day recommended by the World Health Organization (WHO). A further 18 percent used 120–200 liters per day per household (20–33 liters per day per person); although this might be considered "reasonable access," is still below the WHO guidelines of 50–100 liters of water per person and far below the optimal accessibility of 100 liters per person per day on average. Water consumption for half of the population of Mutsamudu in Ndzuwani was reported to be as low as 11 liters per day per person (Tshimanga 2015). For households that can afford it, fresh water from 54 wells on Ngazidja is distributed by water trucks to approximately 20 localities (or 35 percent of the population) (Comte et al., 2016). This service has been on the rise during the last decade and has become a highly lucrative business.

Although access to water is generally higher in urban areas than in rural areas (2019 access to basic water was equal to 77 percent in rural areas against 88 percent in urban centers), cities are not equipped with water and sanitation facilities to keep up with the needs of the growing population, further contributing to environmental degradation as well as to the likelihood of diseases. Because of the limited availability and, consequently, higher costs of residential land in the capital, 56 percent of urban migrants have set up in vulnerable settlements, where land is leased to them informally, often without connections to water or sanitation networks. While 84 percent of Fomboni and 80 percent of Mutsamudu residents have access to water from their houses, only 29 percent of households are connected to the water grid in Moroni. In the capital, public fountains are the main source of water (over one-third of households use them), while in the rest of Ngazidja, households rely primarily on private tanks and reservoirs for their water supply.[17]

Acknowledging the importance of the urban dimension to water and sanitation management, the "urbanization reimagined" structuring project of the PCE 2030 has a strong focus on developing municipal infrastructure to improve rainwater sanitation, mobilize deep-water resources, and promote drinking water at the national level. In particular, consistent with the National Drinking Water Supply and Sanitation Strategy (AEPA), the PCE envisages the development of a master plan for rainwater sanitation, the implementation of rainwater sanitation projects in Moroni, and the deployment of alternative rainwater management techniques based on infiltration and storage of weather-related water in all other agglomerations of 5,000 or more inhabitants. In addition, drilling will be carried out and drinking water systems will be strengthened or built in cities and villages to expand access to drinking water.

17 World Bank, 2021c.

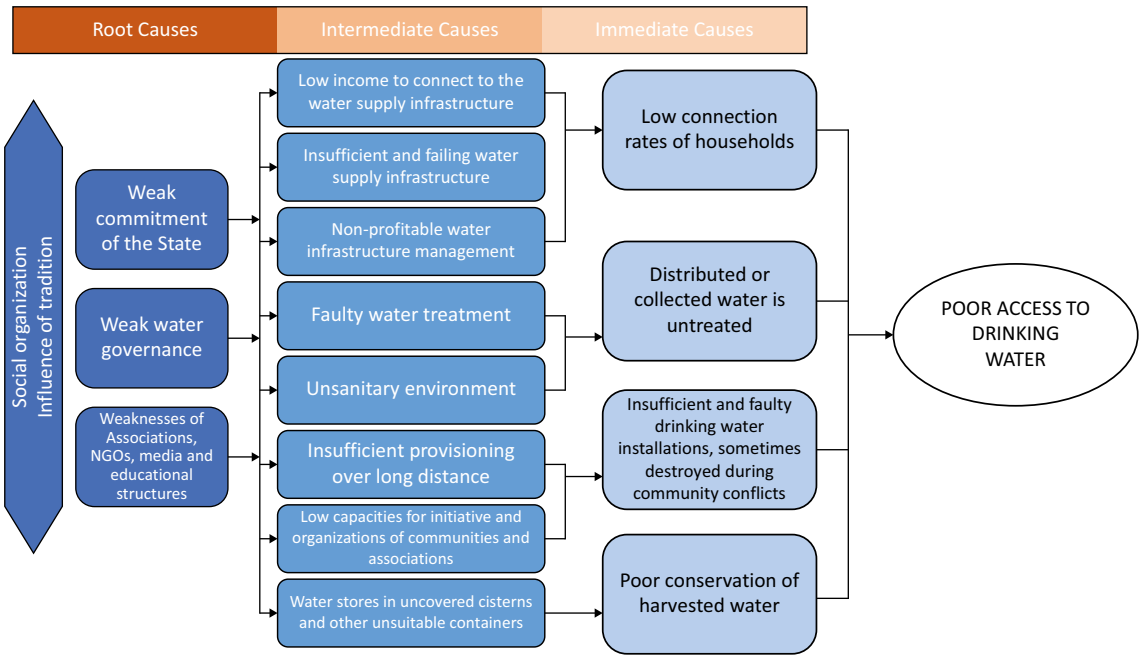
The underlying causes of the lack of drinking water are multiple and varied, ranging from inadequate water infrastructure to insufficient storage capacity, poor water management, inadequate financing, and weak sectoral governance (Figure 24). In addition to the factors already discussed in chapter 4, the impact of limited public financial resources is compounded by the lack of interest by the private sector in investing in water supply, as well as by the current water tariff system, which fails to achieve sufficient recovery returns to maintain and upgrade water infrastructure (GCF and UNDP 2018b).

Furthermore, the country lacks protected water intakes and efficient distribution systems, both from an infrastructural and technological standpoint. The water supply service providers are currently unable to guarantee adequate levels of operation and maintenance of the existing water supply infrastructure. In the urban and peri-urban region of Ngazidja, only 34 percent of the water volume is metered. Water leakage from the supply network is not sufficiently monitored but is estimated to be approximately 50 percent on Ngazidja and Ndzuwani. Furthermore, because of the volcanic nature of the islands, the high cost of exploring and exploiting underground sources reduces the return on investment and limits access to water for the poorest.

In addition to having limited availability, drinking water in the Comoros is of poor quality. In fact, water storage, whether individual or collective, has often proved to be unsafe due to bacterial contamination, the proliferation of mosquitoes, and the presence of waste and dust, among other contaminants, thus increasing the risk of waterborne diseases. According to the vulnerability study conducted by AFD (2018), the main climate-induced risks for water resources do not concern water quantity, but rather the deterioration of water quality through the impacts of storms on watershed damages. Issues of water quality are compounded by the lack of adequate and frequent monitoring of physicochemical and microbiological levels, which are often limited to once per week and in only a few locations.

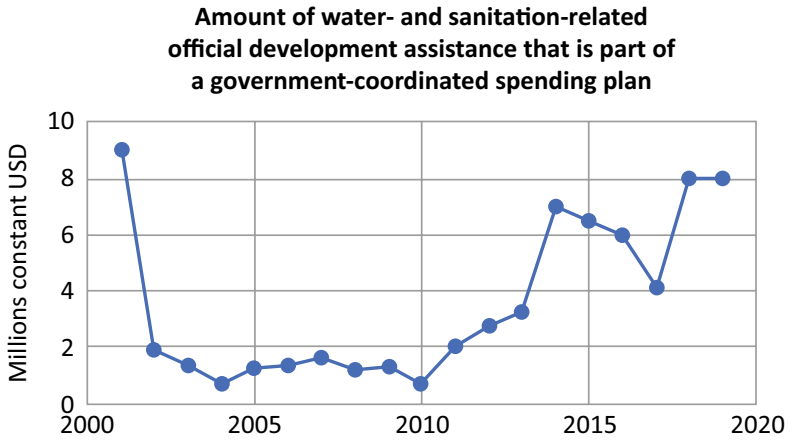
A major constraint for improving drinking water in the Comoros lies in the inadequate financial resources allocated to investments in drinking water distribution, maintenance of infrastructure, and wastewater treatment. To date, most projects addressing the drinking water supply have been financed by international donors. The amount of official development assistance (ODA) disbursed by donor agencies for water- and sanitation-related projects from 2001 through 2019 accounts for US$68 million (Figure 25). According to Accelerated Growth and Sustainable Development Strategy (SCA2D), the costs of implementing the drinking water supply program were estimated at 30 billion KMF (US$64 million), 400 million KMF (US$0.85 million) for strengthening the monitoring and regulatory mechanisms for hygiene and sanitation; and 1,600 million KMF (US$3.42

Figure 24. The causal chain analysis of "poor access to drinking water".



Source: Adapted from DGEME 2014.

Figure 25. Trend in the amount of water- and sanitation-related official development assistance as part of a government-coordinated spending plan from 2000 to 2020.



Source: UNSTATS 2022.

million) for the installation of a drainage system for wastewater and rainwater. This amounted to a total of 32 billion KMF (US$68 million) for 2018–2021. The SCA2D indicated that 40 percent of the costs of the drinking water supply program (12 billion KMF) were secured through the national budget, a further 11 percent (3.3 billion KMF) were covered by technical and financial partners and public-private partnerships (PPPs) collectively, whereas the rest (14.7 billion KMF, equivalent to 49 percent) was unsecured. In addition to insufficient financial resources, other key challenges for water management in the Comoros are related to the limited coordination of donor aid, which is the result of insufficient human, technical, and financial resources on the government side and lack of representation in the country on the donor side. Indeed, interventions in the water and sanitation sector, whether through community initiatives, associations, NGOs, local authorities, the State, private operators, or development partners, remain modest and largely uncoordinated.

The GoC has recognized that the collection of increased water tariffs will be a socially sensitive issue until the population starts receiving water of improved quality. While populations pay by volume in the Moroni region, on Ndzuwani and Mwali, the water user associations (WUAs) charge a fixed tariff of 1,000 KMF (US$2.2) per month for water that is not potable. In the dry season, rural villagers obtain water from the town's water supplies: a container of 20 liters of non potable/nonsterilized water costs 250–500 KMF (US$25–US$50/m^3) in Ngazidja and 25 KMF (US$2.5/$m^3$) in Ndzuwani. The difference in cost reflects the higher quality of water in Ngazidja and the greater degree of poverty in Ndzuwani (UNDP 2022). The GoC has committed to co-fund the operating and maintenance costs for water supply for 15 years, during which time water quality monitoring and water supply delivery will be demonstrated to the beneficiaries and tariffs will be introduced in a staged approach. In this regard, awareness raising among Comorians will be needed about the costs required for water services, transportation, cleaning of reservoirs, and other cost-related factors.

To date, improvements to drinking water supply and sanitation have been marginal. According to the WHO and UNICEF Joint Monitoring Program to Water Supply, Sanitation and Hygiene, a decrease in access to at least basic water supply was observed during the last two decades from the highest level of 91 percent in 2000 to 80 percent in 2019.[18] This decline is partially linked to the limited investment to extend the service to a rapid growing population, which increased from 542,000 to 851,000 during that period. However, access to basic sanitation (improved and not shared) services increased from 29 percent in 2000 to 36 percent in 2019. The Voluntary National Report on the progress of the implementation of the Sustainable Development Goal (SDGs) (Comoros Ministry of Foreign Affairs 2020) confirmed that in terms of access to sustainably managed water supply and sanitation services, the situation remains problematic, especially in rural areas, thus jeopardizing the achievement of the objectives of SDG 6 (Table 11). The main challenges to ensuring full access to safe water supplies

18 World Health Organization and UNICEF Joint Monitoring Program to Water Supply Sanitation and Hygiene, 2022. Comoros. Available at: https://washdata.org/data/downloads#COM

include the mobilization of groundwater resources and safeguarding proper water storage. In urban areas, drinking water supply relies on the refurbishment and extension of the distribution networks, whereas in rural areas, access should be ensured through water points (for example, public fountains, wells, boreholes) in villages.

5.3.3. Costs of Inaction and Opportunities for Change

Water scarcity and degradation of water quality, compounded by natural factors that limit water access, impede economic growth. Since approximately half of water use is for agricultural purposes (Figure 26), water scarcity, alongside increasing aridity and soil degradation, has a dramatic impact on agricultural productivity, given an agricultural water deficit that can last up to six months (GCF and UNDP 2018a). Given the Comoros' mainly rainfed agriculture, changes in weather patterns significantly affect agricultural productivity, while also increasing the risk of uncontrolled forest fires. Water scarcity also has implications for women and girls, traditionally in charge of collecting water, who must travel long distances to access safe water resources (GCF and UNDP 2019a), resulting in a reduction in the time they are available to actively participate in the labor market or attend school. It is estimated that women and girls spend up to two hours a day fetching water, implying a 25 percent reduction in time available for work (based on an eight-hour workday).[19] Other impacts include reduced fish production caused by polluted freshwater influxes, health issues related to waterborne diseases, and threats to political stability resulting from the spillover effects of competition over water resources, as occurred in May 2022 in the village of Hoani in Mwali.[20]

While demand for drinking water has grown considerably as a direct result of population growth, water and sanitation infrastructure has not kept up with growth. Access to water and sanitation services in the Comoros remains problematic, particularly in rural areas, resulting in higher health risks for the population. Indeed, limited access to clean and potable water, hygiene, and sanitation is a primary cause of child mortality as it is associated with health issues and diseases such as typhoid fever, diarrhea, and various water-borne diseases. The mortality rate attributed to exposure to unsafe water, sanitation, and hygiene services was 50.7 per 100,000 population in 2016 (WHO 2019a).

Unsafe WASH is directly linked to sanitation-related diseases (primarily diarrheal diseases). Disability-adjusted life years (DALYs) attributable to WASH issues in the Comoros were approximately 8,750 in

Box 17. Access to Drinking Water as a High Priority

Ensuring the supply of drinking water to the population has been a priority of the government development policy for nearly 20 years. As part of the Drinking Water Supply and Sanitation Project (DWSSP) (2010–2016) funded by the African Development Bank, the AEPA was developed in 2014 to provide the institutional, organizational, and financial framework for addressing the challenge of "establishing an efficient, accessible and equitable water management system, meeting the needs of the population in terms of drinking water and sanitation, in particular of the most vulnerable such as small-holder farmers that rely on rainfed agriculture," by 2030 (Programme Solidarité Eau 2022). This is in line with the main targets of SDG 6, mainstreamed in the Strategy for Accelerated Growth and Sustainable Development (2018–2021) and the PCE (2020–2030).

To achieve these objectives, the national program proposed by the SCA2D aimed to:

- Review the institutional, regulatory, and financial framework of the drinking water supply and sanitation (DWSS) sector to enhance efficiency
- Mobilize, protect, and monitor water resources
- Improve drinking water infrastructure to provide access to drinking water to the entire population
- Promote sanitation to raise the level of hygiene
- Strengthen the capacities of stakeholders and partners for efficient and sustainable DWSS services

The SCA2D also proposed to establish a realistic policy of cost recovery to ensure the economic viability of drinking water supply and public services, and to support local authorities and community organizations in their efforts to set up the local water supply and sanitation systems.

19 UNICEF, 2016. Annual Report Comoros. Available at: https://sites.unicef.org/about/annualreport/files/Comoros_2016_COAR.pdf

20 La Gazette des Comoros, 23 May 2022, N. 4129.

2004 (WHO 2013). In children under five years, WASH-attributable DALYs were approximately 5,700 in 2004. More recent data are not available. The total cost of measures to advert DALYs attributable to unsafe WASH is US$40.8 million (see Annex 2). In addition to the impact on human well-being and health care costs, WASH issues result in higher costs for other sectors as well, although no specific estimates are available. Unsafe water results in high water treatment costs and more time spent by households to treat drinking water.

If managed sustainably, the water resources of the Comoros can play a crucial role in the ecosystem, livelihoods, economy, and reduction in gender inequality (Comoros Ministry of Foreign Affairs 2020). Water balance estimates show that on the islands of Ndzuwani and Mwali, the existing surface water resources have sufficient excess capacity to meet the needs of the population and its growth. This indicates that under proper management, the country's available water resources would be sufficient to meet the per capita water need.

Another important opportunity for improvement may arise from increasing the frequency and effectiveness of water quality monitoring. An inventory of the drinking water resources and groundwater aquifers should also be carried out by national authorities in coordination with island and local authorities. An important step in this direction is represented by a new laboratory reportedly currently under construction as part of INRAPE.

In addition, despite recent progress, the effectiveness of the implementation of water management programs could be further enhanced through better coordination. Solid public communication campaigns are also required to sensitize local populations on the importance of consuming safe drinking water, the benefits of paying for consumption, the value of water as an economic good, and the costs associated with the development of water infrastructure.

Adoption of an integrated water resource management (IWRM) approach would create opportunities for change. An integrated approach would bring about the coordinated development and management of water, land, and related resources to maximize economic and social welfare in an equitable manner without compromising the sustainability of vital ecosystems. IWRM is also crucial for the Comoros to address climate impacts on both water and food security in an interconnected way, although the lack of data and information on water resources limits sound planning. The dissemination and adoption of the IWRM approach are being proposed in the Comoros (MAPETA 2021a). Box 18 provides an overview of three recent projects that have adopted an IWRM approach.

5.3.4. Institutional and Legal Context

Water is a cross-sectoral issue that is embedded in the mandate of multiple ministries and regional and local institutions, which makes the Comoros institutional framework for water resource management more complex. The General Directorate for Energy, Mines and Water (DGEME) is the main state institution responsible for water resource management. The National Water and Sanitation Directorate (DNEA) under DGEME is responsible for designing and implementing national water resources and water supply and sanitation policy, regulation, and sectoral planning. At the regional level, each island has its Regional Directorate of Water and Sanitation (DREA), which is supported by the DNEA in regulating the water sector.

As part of decentralization, water competences have been transferred to the 54 municipalities of the three islands. In Ndzuwani and Mwali, water management has been gradually shifted to the village communities which have federated around the WUAs; however, they are constrained by limited capacities in maintaining and operating water infrastructure or equipment. In the rural areas of Ngazidja, there is no structure similar to that in Ndzuwani or Mwali, greatly limiting progress on water management. Against this backdrop, the absence of a regulatory framework clearly defining the roles and responsibilities between the GoC, and the island entities adds another layer of complexity to the water-management architecture of the Comoros (UNDP 2022). This calls for national- and island-level agencies to improve the coordination of planning, programming, and budget allocation, and to overcome the existing institutional fragmentation.

The Water Code of 1994, which established the founding principles of the Comorian water policy, was revised in 2020. The newly revised water code lays out the necessary reforms to improve water resource management, in particular the harmonization of procedures across all islands, the extension of the authority of SONEDE to the urban areas of Ndzuwani and Mwali, and the adoption of a more effective and efficient institutional arrangement for delivering more reliable water supplies. It addresses gaps related to access to high-quality water, agricultural use of water, and IWRM, setting the course for more equitable use,

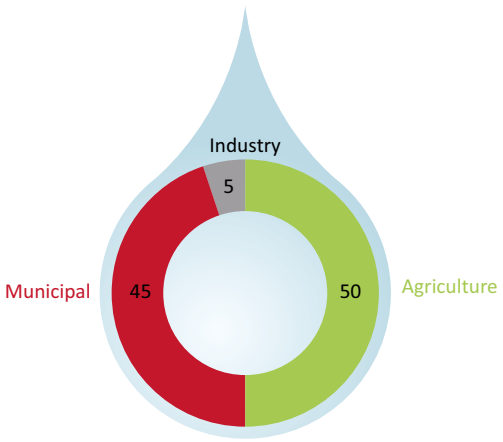
Table 11. Progress on SDG 6 indicators

SDG6 – Clean Water and Sanitation				
Population using at least basic drinking water services (%)	80.2	2017	●	↓
Population using at least basic sanitation services (%)	35.9	2017	●	→
Freshwater withdrawal (% of available freshwater resources)	0.8	2009	●	●
Anthropogenic wastewater that receives treatment (%)	0.1	2018	●	●
Scarce water consumption embodied in imports (m^3/capita)	NA	NA	●	●

■ Major challenges ■ Significant challenges ■ Challenges remain ■ SDG achieved ■ Information unavailable
↓ Decreasing → Stagnating ↗ Moderately improving ↑ On track or maintaining SDG achievement ● Information unavailable

Source: Sachs et al., 2021.

Figure 26. Water use in the Comoros (2016).



Source: AMCOW 2018.

the protection of water resources, and allowing for decentralized and participatory development of water resource management.

The newly revised water code mandates tariff reforms for the service providers of water supply as part of the ongoing reform of water governance, which aims to improve the sustainability of the water sector. Nevertheless, this process is still in its very early stages, and it is difficult to foresee the magnitude, timing, and reliability of revenues from water tariffs. The code also envisages the creation of a National Fund for the Development of Water and Sewage Infrastructure (FNDIEA), although it offers only broad indications of the sources of funds and the management and supervisory structure (UNDP 2022). In 2015, the GoC also planned to transfer the mandate and responsibilities for managing water resources and distribution from villages to municipalities as a step toward greater efficiency. The government is considering the revision of the AEPA 2013-203014 and the Strategic Framework document to align with the PCE 2030 and the new Water and Sanitation Code.

The updated water code is a step in the right direction, but the Comoros still has room to further improve the institutional and legal context. Strategic prioritization at the national level for the water resource, water supply, and sanitation sectors with a focus on hydroclimatic risk management can guide development and help operationalize important reforms and coordination among the different agencies at the national, island, and local levels. Master plans at the island level can help identify and prioritize concrete infrastructure investments, enable land stewardship, and coordinate surface and groundwater resource management. A strengthened water resource monitoring system would better inform planning and programming and support building resilience in water resource management.

Box 18. Projects in the Comoros That Have Adopted an IWRM Approach

The Adapting Water Resource Management in the Comoros to Increase Capacities to Cope with Climate Change project (2011–2016; US$3.7 million) financed by GEF and supported by UNDP-UNEP focused on increasing the climate resilience of drinking water and irrigation water supplies on all islands. The primary activities included water management, reforestation, land-use planning, and the construction of small rural water mobilization infrastructure. The project also included awareness-raising activities among community members on the benefits associated with reforestation activities and, conversely, the costs associated with deforestation. Watershed committees were established in pilot areas and training was provided on the shared uses of water resources in the context of increasing scarcity due to climate change.

The Regional Integrated Water Resources and Wastewater Management Project (IWRM or GIRE) in the Atlantic and Indian Ocean Small Island Developing State (SIDS) project (UNDP-UNEP; concluded in 2018) developed a national IWRM plan to improve river and watershed management and provide a strong foundation for watershed ecosystem-based climate adaptation responses. The project made important progress in the establishment of a watershed committee and water resource management committees in pilot municipalities and provided training in IWRM. The introduction of IWRM to the regional water directorates has fostered improved coordination. The GIRE project implemented a watershed and wastewater management program in the Mutsamudu River Basin of Ndzuwani and supported the Ndzuwani water-user association (Union of Water Committees of Ndzuwani [UCEA]) to improve water management, for example, by setting water tariffs to cover the costs of water production and transmission. A network of hydro-meteorological stations, flow, and sediment measurement stations was also installed.

The ongoing Green Climate Fund (GCF)-financed project Ensuring Climate-Resilient Water Supplies in the Comoros Islands (2019–2027; US$60.8 million) was commissioned by UNDP in partnership with the Comoros Ministry of Agriculture, Fisheries, Environment, Territory Planning and Urban and partners. It aims to strengthen water resource management, including groundwater management and the participation of local populations, expanding monitoring infrastructure, regulating stream flow, and protecting ecosystems. It focuses on improving IWRM in 32 watersheds and works to achieve a national paradigm shift in water resource management. The objectives are to increase water supply to achieve full coverage of the population by 2030 and to provide all farmers with access to irrigation water. An important component focuses on capacity building for water planning, involving all relevant stakeholders and integrating traditional knowledge with modern technologies, in line with the principles of IWRM.

5.3.5. The Way Forward

- **Strengthen further climate-resilient IWRM.** Strengthened IWRM will enable the Comoros to adequately address the increasing demand for water for drinking and for environmental and agricultural uses. The approach should focus on (1) the identification and prioritization of infrastructure; (2) the promotion of watershed protection and restoration as one of the most effective solutions to improve water retention, increase dry season flows, and reduce storm erosion; and (3) the integration of groundwater sources within more holistic water-management frameworks (Comte et al., 2016). This should also include the development of a robust investment program addressing the requirements of a strengthened monitoring framework, vulnerability and risk-assessment study, and island water master plans.

- **Scale up WASH programs and improve quality standards and quality control of drinking water.** WASH programs should include the construction and equipping of the new laboratory facilities for regular analyses of water quality, in conjunction with the national health authorities. In parallel, capacities of laboratory technicians and other staff will need to be developed through dedicated capacity-building activities. In this regard, it would be important to operationalize the INRAPE.

- **Develop and enhance water infrastructure.** The GoC should step up its commitment under the AEPA to rehabilitate or establish collective drinking-water

supply networks and energy-efficient systems (incorporating renewable sources). At the same time, it is crucial to strengthen water treatment systems as well as expand water purification in areas without access to safe sources of drinking water. Authorities should also enhance the protection of water tanks through means that comply with the standards of collection and storage of drinking water, in particular the rehabilitation of tanks in impluvia at both the community and family levels. Furthermore, given water source limitations and the high leakage of water from the supply network, it would be extremely beneficial for the country to monitor water losses and improve infrastructure to reducing non-revenue water.

- **Increase investments in sanitation.** Given the critical lack of access to sanitation services in the country, it is critical for the GoC to bridge the investment gap in the sector to develop the infrastructure for collective and autonomous sanitation and strengthen technical, material, and organizational capacities.

- **Enhance the urban dimension of water and sanitation management.** Acknowledging the growing urban population, it will be crucial to prepare technical studies for upgrading water and sanitation infrastructure in urban center to enable targeted investments to improve supply networks of drinking water and increase access to sanitation services, in line with what is envisaged under the PCE 2030. To be effective, these investments need to be based on preliminary spatial planning policies and a corresponding focus on urban planning aimed at designing functional cities, promoting smart urban growth, and counteracting urban sprawl. Another key aspect includes gathering data and mapping city boundaries to have information on informal settlements that are home to the most fragile and segregated urban dwellers and have limited access to water and sanitation infrastructure.

- **Clarify the roles and mandates under the decentralization process in alignment with the 2018 constitution.** For a robust water management institutional framework, it is crucial to overcome the existing institutional fragmentation and improve coordination between national and island-level agencies in terms of planning, programming, and budget allocation. Implementing the Water and Sanitation Code operationalizing the establishment of the FNDIEA is another step in the right direction.

- **Facilitate the development of water master plans at the island level.** Building on the action plan presented in SCA2D (2018-2021), the master plans will help identify and prioritize a progressive investment plan for the development of water resources and the delivery of a resilient supply of drinking water, taking into account the different water sources, uses, and hydro-climatic vulnerabilities on the three islands. They should also provide mechanisms to enhance coordination of interventions between rural communities, users (for example, agriculture), associations, NGOs, local authorities, the DNEA, SONEDE, private operators, and partners. Master plans should also ensure strengthened participation and inclusion of local communities and women's organizations in sustainable water and sanitation management.

- **Conduct a vulnerability and risk assessment study for all water sources.** The study will enable evidence-based strategic prioritization in water resource management, focusing on hydro-climatic resilience. The study will also inform island-level master plans and investment programs.

- **Strengthen the water resource monitoring system.** A strengthened water resource monitoring system is fundamental to inform programming, planning, infrastructure investments, and rehabilitation, with particular emphasis needed on flood and drought monitoring and early warning systems. Capacities should be enhanced to allow for proper monitoring of rainfall, groundwater, stream flow, waterways at risk of flooding, and water quality at the island level. An inventory of the drinking water resources and groundwater aquifers should also be carried out by national authorities in coordination with island and local authorities.

- **Conduct solid public communication campaigns to sensitize local populations on the importance of consuming safe drinking water, as well as to assess and increase public awareness of sanitation and hygiene issues.** Such campaigns should stress the benefits of paying for consumption, the value of water as an economic good, and the costs associated with the development of water infrastructure. Improved awareness about the costs required for water services, transportation, and cleaning of reservoirs would facilitate the effort by the GoC to introduce water tariffs in a staged approach and promote the uptake of commercial water-distribution services.

5.4. Fisheries, Coastal, and Marine Ecosystems

Key Features

Fisheries

- Domestic fisheries make up 7.5 percent of GDP; however, seafood production does not cover national demand, making imports necessary.
- Fishery laws and decrees are in place, but implementation remains a key challenge.
- Fisheries remain threatened by IUU fishing, including in the domestic small-scale segment, due to limited monitoring, control, and surveillance (MCS).
- Co-management has proven to be successful in managing fish stocks and other environmental resources more sustainably. However, the full potential of fishery unions, associations, and cooperatives has not been fully harnessed.

Coastal and Marine Ecosystems

- The coastal ecosystems of the Comoros harbor rich biodiversity and natural assets, including mangroves and seagrass beds.
- While trends on habitat cover and quality are for the most part not available, qualitative analyses show that coastal ecosystems are being degraded due to coastal erosion, pollution, extraction of natural resources, natural disasters, and climate change.
- The marine environment of the Comoros is characterized by coral reefs and rich biodiversity, including many demersal and pelagic fish species, such as snapper and grouper, as well as neritic and tropical tuna.
- Marine and coastal assets are pressured by unsustainable practices and the impacts of climate change.
- The establishment of Mwali National Park and the co-management of marine resources was successful in reducing the degradation of fish stocks, protecting coral reefs, and increasing mangrove cover. However, sustaining these results proved challenging.

5.4.1 Fisheries Sector

The fisheries sector in the Comoros supports livelihoods and jobs, contributes to food security, and generates revenue. The sector consists of three segments: (1) subsistence, (2) artisanal, and (3) industrial fisheries. Subsistence and artisanal fisheries are quite similar in the Comorian context and are both considered "small scale" for the purposes of this document.

The fisheries sector, which consists of small-scale fisheries, is an important asset for the Comoros, accounting for 7.5 percent of GDP (Table 12). The exclusive economic zone (EEZ) of the Comoros is 86 times the size of the country's land and offers productive waters fueled by the presence of high-biodiversity coral reefs, lagoons, mangroves, and seagrass beds around the islands (World Bank 2020j). Because of the limited availability of agricultural land, fisheries play a vital role in providing nutrition for the Comorians, especially in densely populated Ndzuwani. According to a 2017 small-scale census on Ndzuwani, 23 percent of men and 34 percent of women were involved in fishery practices, either as a first or second source of income (Freed et al., 2018). In addition, women play an important role in sales activities at the national market and are also involved in octopus fisheries and postharvest operations, including preservation, transformation/processing, marketing, and sales (Youssouf 2010). Export of fish products is almost nonexistent, and seafood production does not cover the national demand, which is supplemented by imports from Mayotte and Madagascar (Soilihi 2017). In 2020, the Comoros imported fish (especially sardines, mackerel, tilapia, and flatfish) in the amount of US$3.3 million.

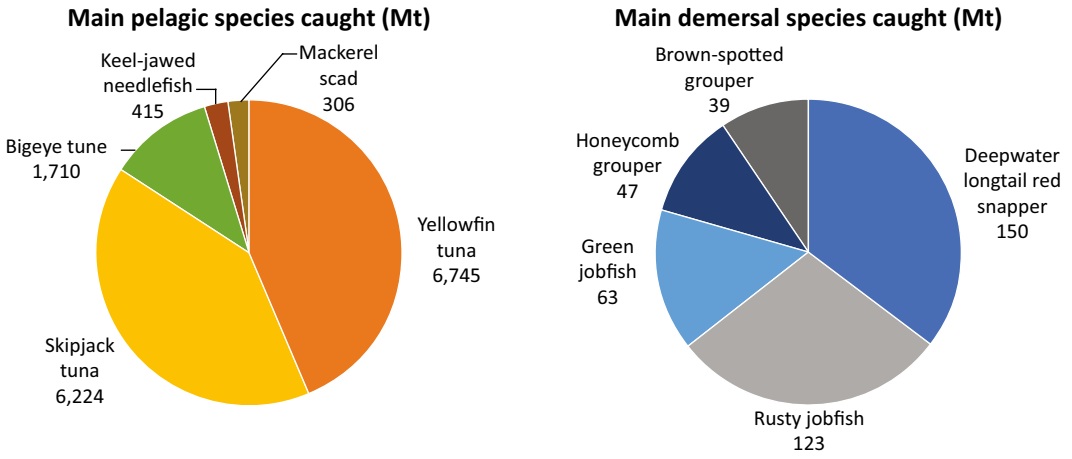
Table 12. Importance of the fisheries sector for the economy of the Comoros

Indicator	Value
Fisheries GDP in 2020 (of total GDP)	7.5 %
Fisheries GDP in 2020	US$1.19 billion
Fisheries GDP in 2020 (of total agriculture GDP)	24 percent
Direct and indirect employment in 2020	8,500 persons
Percentage of the labor force in 2020	4.2 percent
Total fisheries production in 2020	13,089 metric tons

Sources: World Bank 2020c; World Bank Database 2021; DGRH 2021; FAO 2020.

Note: Exchange rate of KMF 1=US$0.00224 (June 2020), calculated with InforEuro (https://bit.ly/3Nw1TkQ).

Figure 27. Main pelagic and demersal species caught in domestic fisheries in Mt in 2020.



Source: DGRH 2021a.

Fisheries are an important source of livelihood for the Comoros. Domestic fishing in coastal areas is traditional and subsistence and artisanal in nature (Breuil and Grima 2014). The census documented approximately 9,000 Comorian fishers operating on various types of fishing vessels. Under the SWIOFish project, more than 5,000 of these fishers were registered and delivered an official fisher card.

In addition, a large number of on-foot fishers (more than 10,000), including a large proportion of women, target octopus and small fish in shallow areas of the lagoons. Small-scale fishers use traditional wooden canoes powered by sails, paddles, or small engines, or motorized glass-reinforced plastic (GRP) boats.

The small-scale sector is transitioning to a more modern fleet. The proportion of nonmotorized boats in the fleet has been consistently decreasing from 2014 to 2020 (DGRH 2021a). The increased use of small, motorized boats (30 percent of the fleet) allows fishers to go farther offshore and fish on pelagic species, particularly tuna, and increase catch. A small number of artisanal fishers also target fishing grounds farther offshore, outside of the EEZ of the Comoros (especially the Glorieuses and the Lazarus banks) for high-value demersal species (DGRH 2021a; UNCTAD 2017) (Figure 27). This is a concerning trend, as fishing farther offshore increase risks and requires additional safety measures (FAO 2006) that are often not in place. Thanks to the SWIOFish project, registration of fishing vessels in the Comoros requires a safety visit and/or that vessels be built in accredited shipyards. This trend of fishing farther offshore also indicates that coastal resources are not in good condition and cannot sustain the increasing demand.

Industrial fishing in Comorian waters is being exclusively conducted by foreign tuna fleets without landings in the Comoros (Breuil and Grima 2014). The main fleet is the tuna fleet from the European Union (EU) and associated countries, which mainly operates out of the Seychelles in the Western Indian Ocean. Foreign industrial fisheries are managed based on fish delivery agreements and/or annual licenses which establish several conditions, including payment of fees (Breuil and Grima 2014; Golub and Varma 2014). Non-EU foreign private companies operate under private licenses, and until 2017, the EU fleet operated under a sustainable fisheries partnership agreement (SFPA). This SFPA was used by tuna seiners and surface longliners from Spain (29 vessels), France (30 vessels), and Portugal (three vessels) (Lallemand 2019).

In 2017, fees paid to the GoC for access to the Comorian EEZ by foreign vessels amounted to approximately US$1.3 million per year or 0.7 percent of total government revenues. Approximately US$650,000 originated from the EU SFPA, 50 percent for access and 50 percent for sectoral support. However, this revenue stream ended in 2017 when the EU identified the Comoros as a noncooperating country under the EU Regulation to fight and deter IUU fishing,[21] giving the country a "red card"[22] and later denouncing the agreement. This had

21 European Commission, 2017. Fight against illegal fishing: Commission lists Saint Vincent and the Grenadines and the Comoros as non-cooperating, and issues warning for Liberia. Available at: https://ec.europa.eu/newsroom/mare/items/65987/en

22 Comoros was issued a yellow card warning by the commission in October 2015, but inadequate progress on the agreed-upon roadmap led to issuance of the red card in 2017.

a substantial impact on Comorian institutions[23] that had been receiving sectoral funds for their operations and that were now left with virtually no budget to function (World Bank 2020j).

The industrial segment also includes several Comorian-flagged vessels that have beneficial ownership outside of the Comoros and operate outside of Comorian waters. There is very limited information about the financial and socioeconomic impact of this fleet on the country. However, inadequate monitoring of the fleet triggered EU sanctions. In the last few years, the Comoros has taken several steps to rectify the situation and has cleaned its registry.

The country's fishing potential lies offshore in pelagic fisheries (tuna and tuna-like species) and is estimated at approximately 33,000 metric tons (MT) per year (Breuil and Grima 2014). The total landings from artisanal fisheries were approximately 18,000 metric tons in 2020 (DGRH 2021a), indicating opportunities to sustainably expand the fisheries sector through the modernization of national fisheries for tuna and tuna-like species. However, given the current status of yellowfin as overexploited, any expansion of fisheries should be done in accordance with Conservation and Management Measure of the Indian Ocean Tuna Commission, including the yellowfin rebuilding plan.

5.4.1.1. Degradation of Fisheries and Its Drivers

Coastal communities of the Comoros are dependent on subsistence agriculture and fishing and the proceeds from sales of the surplus in local markets. Small-scale fishing, underpinned by other factors such as unsustainable fishing practices and limited enforcement, have put pressure on the coasts of the main islands, as well as on the reefs of the Comoros, increasing environmental degradation and affecting fish stocks. Overfishing of larger and high-level species is indicated by a high-ranking Comoros Regional Marine Trophic Index (RMI) (Table 13). Most demersal fish stocks in shallow waters are showing signs of either complete or overexploitation. Evidence of high fishing pressure was observed along the island of Ndzuwani, as illustrated by the absence of large fish and abandoned fishing gear (Freed et al., 2018).

23 Comorian institutions that received fees include the Ministry of Agriculture, Fishing and the Environment; the Directorate General for Fisheries Resources; the National Center for Fisheries Control and Surveillance; and other government bodies.

Table 13. The 2020 Environmental Performance Index (EPI) of the fisheries sector of the Comoros

Fisheries	EPI score	10-year change
Fish stock status[24]	23.8	–18
Marine Trophic Index[25]	13.4	–

Source: EPI 2020.

The impacts of unsustainable fishing are visible, especially on the reef habitats at Ngazidja and Ndzuwani. In these habitats, low fish density and limited diversity were observed during a survey in 2018 and confirmed by fishers, who mentioned declines in stocks over the past decade (Samoilys et al., 2018). The decline in the health of reefs not only affects the resilience of the fisheries sector but also directly contributes to the country's increased vulnerability to climate change, as reefs provide essential ecosystem services in terms of coastal protection (Harris et al., 2018).

In the Comoros, enforcement of the legal and regulatory framework of domestic and foreign vessels is limited, and resources thus face the risk of overexploitation (World Bank 2020j). For the IUU Fishing Index indicating the risk of IUU fishing in and by different countries, the Comoros has a high overall score, although it has improved slightly since 2019 (Figure 28) (IUU Fishing Index 2021). These practices represent a challenge for the country's fisheries sector and associated ecosystems, as they threaten local biodiversity, fish stocks, and the livelihoods of fishers and coastal communities. IUU fishing takes place at both the industrial and small-scale levels. For the industrial segment, a case in point is IUU fishing for tuna in the EEZ of the Comoros (Zeller et al., 2021) (Box 20). Because of insufficient efforts to combat IUU fishing by vessels flagged in the Comoros, the European Commission gave a red card to the Comoros prohibiting exports from fisheries to the EU (European Commission 2017).

24 Fish stock status is the percentage of a country's total catch that comes from overexploited or collapsed stocks, considering all fish stocks within a country's EEZ. A score of 100 indicates that none of a country's fish catch comes from stocks that are overexploited or collapsed, and a score of 0 indicates worst performance.

25 A high Marine Trophic Index (MTI) (scale 0–100) is explained by fish catches consisting of taxa from higher trophic levels, while lower scores consist of taxa further down the food web. If MTI decreases over time, this may be due to countries depleting stocks of higher-level fish and resorting to lower-level taxa, also known as "fishing down the food web."

Box 19. SWIOFish1

The First South West Indian Ocean Fisheries Governance and Shared Growth Project (SWIOFish1) was a regional World Bank-funded project active in the Comoros from 2015 through 2021. It followed the Coastal Resources Co-Management for Sustainable Livelihood Project (CoRecSud), which was the first World Bank investment project in the Comoros, and aimed to strengthen capacity to prepare fishery co-management plans and increase access to community-managed infrastructure. The objective of SWIOFish1 was to improve the governance and management of priority fisheries at the regional, national, and community levels. The project supported activities in the Comoros, Mozambique, and Tanzania, as well as regional-level strengthening of the South West Indian Ocean Fisheries Commission (SWIOFC).

In the Comoros, the project achieved the following results:

- Improved governance of fisheries through strengthening the legal and regulatory framework
- Reinforced MCS and enforcement, including with joint fishery patrols conducted by the CNCSP, the coast guards, and marine park rangers
- Improved fishery monitoring by setting up registration systems for fishers and vessels
- Implemented a modern fishery data collection system using a smartphone app and centralized database, with the publication of the first Statistical Bulletins. Six co-management agreements have been developed and implemented for improved fisheries management and improved benefits for participating. Local communities take part in the management of fishery resources, including time-area closures of 100 hectares of octopus fishing sites for four months, resulting in an increase in catch, and participation in reef restoration.
- Provided fish aggregating devices to several local communities to attract fish, including pelagic fish such as tuna
- Expanded fishery infrastructure such as cold storage, ice machine, and markets to support communities and reduce postharvest losses

Continuation of activities developed under SWIOFish1 is needed, in particular about the implementation of co-management, research and fishery statistics, and development of new text for the fishery code.

IUU fishing in the small-scale segment affects the coastal fisheries of the Comoros at least as negatively as in the industrial segment. Strengthening the management of small-scale fisheries was one of the objectives of the World Bank South West Indian Ocean Fisheries Governance and Shared Growth Project (SWIOFish1) project,[26] which contributed to addressing the IUU issue and broadened monitoring, control, and surveillance (MCS) efforts related to both industrial and small-scale IUU fishing, and generated relevant lessons learned. Among other activities, the SWIOFish1 project supported legislation enforcement by the police through co-management activities with local communities and enhanced the small-scale monitoring and surveillance capacity of the National Center for Fisheries Control and Surveillance (CNCSP). Lessons learned from the project should be incorporated into efforts to achieve resilient fisheries in the Comoros.

Initiatives to counter both industrial and small-scale IUU fishing are hampered by multiple constraints. Existing regional instruments have not been successful at effectively addressing this issue, mainly because of limited political will and the lack of adequate human, technical, and financial resources. Enforcement in the small-scale sector is sometimes difficult given the potential impact on livelihoods as well as the community aspects. The lack of available and up-to-date data on the actual scale of IUU fishing in the EEZ is still an obstacle for the development of effective measures. However, awareness raising around the legal and regulatory framework, development of co-management agreements, strengthening the MCS, and cleaning the registry are contributing to the fight against IUU fishing in the Comoros.

5.4.1.2. Opportunities for Change

Policy enforcement and sustainable management are essential to reduce pressure on fish stocks, and

26 http://www.comorespeche.org/index.php

Box 20. Projects Targeting IUU Fishing

In 2012, the regional "FISH-I-Africa" task force was established to help address IUU fishing. FISH-I-Africa aims to combat IUU in eight African countries, including the Comoros, by tracking down illegal operators and sharing information on flagged fishing vessels, license lists, and vessel photographs. FISH-I-Africa works closely together with the IOTC, which played an important role in providing expert advice and information to the FISH-i Africa initiative. Specifically, IOTC contributes to the information-sharing portal of FISH-I Africa to support due diligence checks on vessels. However, FISH-I has lost momentum in the countries of the region.

Currently, the Directorate General of Fisheries Resources from the Comoros, with support from the Nairobi Convention SAPPHIRE project (2017–2023), is supporting policy harmonization and management reforms toward improved ocean governance. In addition, it will create a new sector policy and operational implementation plan to strengthen the capacity of local fishing stakeholders to combat IUU fishing. An important aspect of SAPPHIRE consists of training and leadership workshops focusing on marine policy and ocean governance, with particular attention accorded to the role of women (Nairobi Convention 2021).

Fishing surveillance has been strengthened by the PRSP of the Indian Ocean Commission (IOC) and will be taken over by the IOC-EU ECOFISH project. One of the ECOFISH project components is MCS, which aims to organize joint patrols with the coast guard and patrols in marine parks and to ensure the registration of fishing gear. However, these types of activities are financially challenging, as they require substantial means for purchasing vessel fuel. Monitoring will also be addressed in the recently initiated Oceans 5 project (2021–2024). Planned monitoring programs include coral reef biodiversity, fish catch records and abundance surveys, and turtle, mangrove, and seagrass habitat monitoring inside the country's marine protected areas (MPAs) (Wildoceans 2021).

In 2019, FAO and the Ministry of Agriculture, Fishing and the Environment launched an initiative to improve coral reef fishery production for food security through restoration of fragile ecosystems and assisting fishing communities to better manage their coral reef resources. The results of this initiative include improved fisheries management around coral reefs, higher fish value chains and market access, and reduced IUU fishing.

alternative livelihood options need to be developed to ensure income for communities. The Mwali National Park project (1998–2005) covering 400 square kilometers has been focusing on addressing these challenges with support from international organizations and local communities. Results included benefit-sharing arrangements for local livelihoods such as NBT (see section 5.6) and the increase in live coral cover. Despite the successful results, resources available to consolidate, continue to support, and scale up these activities are lacking, especially now that new marine parks have been created in the Comoros. SWIOFish1 supported co-management activities with selected communities for the Mwali park and in other areas identified for creation of new marine parks (Box 21). As part of these activities, support was provided to develop alternative livelihoods to fishing by creating activities that add value to fishery products and support sales, as well as for activities beyond fisheries such as agriculture and livestock. These type of alternative livelihood options also help decrease direct pressures on coastal species (Dahari 2022), ultimately supporting sustainable management of natural resources.

A sustainable domestic, semi-industrial fishing fleet could be a source of new jobs and income. Developing a domestic semi-industrial fishery, potentially focusing on tuna, would require substantial efforts on many levels. Incentives to engage in the activity need to be developed. Given the current status of infrastructure, port landing and processing facilities are necessary, as well as cold rooms and a quality control laboratory. Investments are needed in upgrading vessels to make them suitable for longline fishing. Capacity building is also needed in many areas, including the safe use of longline gears, safety at sea, and quality control in the case of processing and preservation. In the past, the Comoros had tried to modernize its fisheries with the development of a semi-industrial fleet, but despite investment from the private sector, this has not succeeded, indicating the need for analysis to understand the reasons for these past failures.

Box 21. Co-Management of Marine Resources

The CoReCSuD project sought to strengthen stakeholders' capacity to prepare community management plans for selected priority fisheries and increase access to community-managed infrastructure in pilot sites. As part of the project, community management of fisheries was strengthened in 27 pilot sites. Management plans and the development of alternative sustainable practices were developed (World Bank 2016b). Furthermore, 17 co-management agreements were signed as part of the project on Ngazidja, Mwali, and Ndzuwani (World Bank 2020f) and have been implemented. Successful examples of co-management in fisheries include seasonal closure of octopus fishing sites.

The outcomes of the project have been streamlined with the subsequent SWIOFish1 project. Eleven co-management agreements including sustainable fishing practices have been revised and signed, and the implementation of six has been supported. Seasonal closure of octopus fisheries allows reefs to recover, stocks to regenerate, and catches to increase. In addition, coastal sheds have been constructed to house local materials. Other initiatives under SWIOFish1 included ice machines, cold stores, storage areas, and the establishment of selling points. (See Box 19 for more information about SWIOFish1.)

Follow-up of the signed co-management agreements should ensure the implementation of plans and activities. An example of a follow-up initiative is the Strategy for the Expansion of the National System of Protected Areas (SNAP, 2017–2021). This strategy aims to facilitate the establishment of at least five protected areas managed by local communities to improve their standard of living. It also aims to establish an environment fund and arrange education and training. Co-management lies at the core of the strategy (GEF and UNDP 2022).

Additional benefits would result from the reduction of post-harvesting losses, the increased value by raising the number of landing sites and cold chain facilities (World Bank 2019c), and enhanced safety at sea. Despite several of these challenges being at least partially addressed by the SWIOFish1 project, ensuring the sustainability of the results is needed, as well as building on the results and enhancing achievements. Key challenges include the lack of stock assessments, cold storage capacity, and processing facilities, difficulties in meeting international food safety standards, and a weak professional training system (Breuil 2018). While SWIOFish1 and other projects have been providing infrastructure to support cold and value chain development, the challenge of these investments in the Comoros has always been ensuring their sustainability given limited capacity to properly manage them and little accountability.

Co-management of fisheries could deliver environmental, social, and economic benefits simultaneously. Co-management agreements have proven successful in managing fish stocks and other environmental resources sustainably. In the Comoros, co-management of marine resources started through the World Bank and Japan Social Development Fund project, Co-Management of Coastal Resources for Sustainable Livelihoods (CoReCSuD) (2012–2017) (Box 21), which helped successfully implement fishery co-management agreements with communities in all three islands. Building on these results, SWIOFish1 supported the establishment of 11 co-management agreements, seasonal closures to allow reefs to recover, stocks to regenerate, and catches to increase (see Box 19 for more about achievements of SWIOFish1). Follow-up to the signed co-management agreements with related plans and activities is essential to ensure benefits for the environment and the communities that depend on it for their livelihoods.

As with terrestrial national parks, the marine park in the Comoros has shown promising results in protecting reefs, marine biodiversity, and coastal ecosystems (Ramadhoini Ali 2021). With the establishment of Mwali National Park in 2001, coral reefs in the protected area have been shown to be in comparatively good condition with healthy hard coral and up to 80 percent cover. In addition, the park saw high fish densities and species richness, in particular among species more vulnerable to fishing (Samoilys et al., 2018). These findings indicate that the ban on destructive fishing in the park is being effectively enforced by the village committee. Violations of regulations are handled directly by the committee and the case is transferred to a national judicial system when local solutions cannot be found (ASCLME 2012). Sharks, however, were not sighted in the park during the study (Samoilys et al., 2018), calling for strengthened efforts to protect threatened species in the region such as sharks. The establishment of additional national parks

similar to Mwali National Park is beginning to protect and increase the resilience of the threatened coastal assets and marine biodiversity. Since support during the creation of Mwali National Park only covered part of the costs and did not generate direct returns, communities have not been particularly motivated to drop their livelihoods. To ensure the success of new national parks, it is crucial to involve local communities through co-management initiatives, with a special focus on engaging women in awareness-raising and leadership roles. To ensure the long-term sustainability of results, the implementation of long-term assessments of the financial needs of protected areas is also key.

Significant opportunities may arise from activities to be funded under the multidonor trust fund PROBLUE, which supports sustainable and integrated development of marine and coastal resources. The activity comprises a set of assessments and gap analyses on selected key topics and aims to increase the knowledge base and capacities of national and international stakeholders to deliver transformational results for the development of the blue economy. The blue economy in the Comoros holds significant potential for balancing conservation objectives with socioeconomic development.

PROBLUE consists of four key components: (1) boosting the blue economy agenda, (2) fisheries and climate change, (3) marine litter and plastic pollution, (4) NBT (see Box 23). In particular, PROBLUE aims to contribute to reducing gender inequalities and gender-based violence by providing analyses highlighting the importance of including gender considerations in climate change mitigation and adaptation actions for more sustainable fisheries management. In addition, PROBLUE aims to identify circular economy opportunities to be developed around marine litter management, as well as to improve knowledge about how to increase private sector engagement through the identification of innovative financing approaches to blue carbon projects.

The potential of fishery unions, associations, and cooperatives is not being fully harnessed. The key function of unions and associations is to represent the interests of fishers, whereas cooperatives have the function of improving economic performance through group purchases, such as for equipment. In addition to the National Fishermen's Union (NFU), there are regional unions for the three main islands. According to the NFU, there are approximately 121 cooperatives/associations in the Comoros, representing approximately 7,600 fishers (Breuil 2018). In recent years, fisherwomen associations have also been formed,

Box 22. Marine National Parks and Protected Areas

In 2017, the GoC approved the National Parks Strategy, which lays out the government's intention to manage more than 25 percent of the national territory using a community approach and to establish three new national marine parks. The development of additional national parks is in line with the objective of the Blue Economy Strategic Framework to "protect coastal aquatic and marine ecosystems" (Union des Comores 2018). In this regard, the National Protected Areas System Law (2018; No. 18-005/AU) was adopted, as well as the Presidential Decree of Protected Areas (2019; No. 19-129/PR). The GoC established RENAP, the institution in charge of the creation of these marine parks, and developed the National Parks Strategy, 2017. A trust fund (Fond Environnemental des Comores [FEC]) was set up in 2017 with the objective of raising funds for the upcoming national parks. However, the fund is not yet functional to date, and a replacement for the Executive Director is still being recruited.

The planned national parks for the protection of the coastal and marine environment of the Comoros are:

- **Coelacanth National Park in the south of Ngazidja**

  The proposed site is a marine and coastal area of 7,572 ha with 200 meters of beach and mangrove coastline. The marine area harbors many whales and dolphins and features a coral reef that is in good condition.

- **Mitsamiouli Ndroude National Park in northern Ngazidja**

  This park aims to protect the marine turtles which populate the island in particular, as well as to develop ecotourism. The park would include coral reefs and seagrass beds that are frequented by Dugongs and endangered green turtles.

- **Shissiwani National Park in Ndzuwani**

  This park includes the Bimbini reserve area which covers 3,025 hectares of the marine environment and a 200 meter coastal strip. The area includes mangroves, coastal reefs,

beaches used by turtles as nesting sites, seagrass beds, and an agroforestry strip.

The decrees for the creation of these new parks are pending signature (GEF and UNDP 2022). With the FEC currently not functioning, direct financial support to RENAP is required to advance the creation of these three national parks. Furthermore, development of the parks should capitalize on the lessons learned from Mwali National Park, replicating the successful co-management approach, while paying specific attention to women, which was lacking during the Mwali National Park co-management activities (UNDP 2012).

specifically related to octopus fisheries. Within these associations, women can receive training to self-organize and strengthen their collective capacity to better manage and protect marine resources. Women are also trained in association management skills and drying techniques (CEPF 2018). The main challenge for fishery unions, associations, and cooperatives is to overcome the lack of a well-structured organization. This stems from the fact that the roles and responsibilities of unions, associations, and cooperatives are not clearly defined, resulting in a lack of legitimacy and subsequent conflicts of interest. SWIOFish1 invested in a series of initiatives aimed at improving the structure of these associations, including co-management, safety at sea, and capacity-building activities (Breuil 2018). During stakeholder consultations carried out during the development of the CEA, participants were asked to identify the pending priorities for unions, associations, and cooperatives. Suggestions included scaling and improving capacity building within the cooperatives/associations to enhance sustainable fishing methods, leveraging the success of the fish aggregating device (see Box 19 on SWIOFish1), and further improving fish conservation through increasing the use of ice machines.

Enhanced regional cooperation through projects and intergovernmental agencies could enhance results and ensure sustainability. Tackling challenges at both national and regional levels is key, considering the intrinsically regional dimension of issues such as sustainable fishing or IUU fishing. There are several intergovernmental agencies active in the Western Indian Ocean such as the Indian Ocean Tuna Commission (IOTC), the Southwest Indian Ocean Fisheries Commission (SWIOFC), the Indian Ocean Commission (IOC), and the Indian Ocean Rim Association (IORA). Surveillance of large fishing vessels operating offshore takes place through the Regional Fisheries Surveillance Program (PRSP) and was embedded in the EU ECOFISH program.[27] The EU ECOFISH program (Box 20) also aims to build synergies in fisheries management and the prevention of IUU across the Southwest Indian Ocean region. For more than 10 years, the Regional Plan for Fisheries Surveillance (PRSP) has supported the organization of regional joint patrols with other countries in the Indian Ocean.

The limited financial sustainability and follow-on of completed projects pose significant constraints for their effectiveness; for example, SWIOFish1 achieved successes during the project that are at risk of deteriorating after the project ends. Insufficient funding following the completion of projects has resulted in reduced management effectiveness, activities, and levels of enforcement. Eco-guards have left projects once financing ceases and salaries are no longer paid. In addition, means of defense against armed poachers have been inadequate (UNDP 2012). AFD has stepped in to support the marine park, but to ensure effective longstanding co-management, financial and human capacity is required, in particular to improve the organizational capacity of local communities. From the perspective of MCS, local communities can be of added value if trained to collect local field data.

5.4.1.3. Institutional and Legal Context

The GoC has taken significant steps to enhance the regulatory legal framework for fisheries, in line with SDG 14.4 to effectively regulate overfishing, IUU, and destructive fishing practices to rebuild fish stocks (Comoros Ministry of Foreign Affairs 2020). The Department of Fishing of the Ministry of Agriculture, Fishing and the Environment is the body responsible for domestic fishing policies. The sector is governed through Law No. 07-011/AU of 2007, which was updated in 2019 by Law 19-05/AU (see Annex 4 for an overview of fisheries laws and regulations). To complement this law, several implementing texts have been published in decrees and orders (Annex 4). Decree No. 15-050/PR of 2015 implements the code and established the requirement for artisanal fishers to hold a license. It also provides the legal basis for a vessel register, boat marking, development plans, and bans of unsustainable fishing gear (Breuil 2018). In 2020, another update was published to fight IUU fishing (Decision 20-051/PR).

27 https://www.ecofish-programme.org/

Box 23. PROBLUE

PROBLUE seeks to address key data gaps associated with the potential for the Comoros related to the blue economy. In line with this CEA, it aims to provide policy makers and other relevant national and international stakeholders (for example, private sector, CSOs) with the data required to inform decision-making and the prioritization processes for developing an effective blue economy in selected key areas.

Component 1: Boosting the blue economy agenda

- Analysis of the current MPA framework, management structures, and effectiveness in the Comoros, including as they relate to international commitments, and development of recommendations for strengthening MPA management (including through alternative management arrangements) and the benefits of and potential for increasing MPA surfaces
- Assessment of potential for blue-carbon offset in the Comoros (mangroves, seagrass)
- Analysis of coastal degradation induced by erosion, river siltation, unsustainable land management, sand mining, and climate change, as well as other factors, and development of proposed recommendations to increase coastal resilience, including through NBS

Component 2: Fisheries and climate change

- Conduct in-depth study of the impacts of climate change on the fisheries of the Comoros
- Analysis of opportunity for the development of a semi-industrial fisheries fleet in the Comoros
- Collate lessons learned from fishery co-management rolled out in other African countries

Component 3: Marine litter and plastic pollution

- Strengthen the analytical base on marine litter
- Implement the Circular Economy Opportunities Assessment for the Comoros

Component 4: Nature-based tourism

- Implement a combination of activities to promote sustainable and inclusive NBT in marine and coastal areas
- Analysis of policies and best practices for sharing benefits from protected area tourism with Comorian local communities

While the improvement of the legal framework has been a remarkable first step toward achieving sustainable fishery practices, several gaps remain. A comprehensive sustainable fisheries policy does not exist, and the updated Fishing Code still needs additional implementation texts, for example, on management of straddling stocks (such as tuna) of deep-sea and artisanal fisheries. These texts have been signed but have limited enforcement.

Fisheries management is hindered by institutional limitations and a chronic lack of funding, which has made the Comoros very dependent on external funding. This is illustrated by the fact that DGRH and the CNCSP[28] received US$90,500 and US$271,400,[29] respectively, for their annual budgets, resulting in frequent salary arrears (Breuil 2018). To overcome such constraints, international donor projects have focused on addressing the key challenges in the implementation of fisheries laws and decrees. One example is the SWIOFish1 project (Box 19), which contributed significantly to improving MCS, among other project achievements. Other international donor projects such as FISH-I-Africa, SAPPHIRE, and ECOFISH focused on addressing the IUU fishing challenge.

Data collection on fish landings takes place in the Comoros, but the assessment is conducted at the Indian Ocean Tuna Commission (IOTC). Data are collected on the landing sites of the three islands and, as such, constitute important indicators of fishing. In total, 23 different stocks are reported, including demersal and pelagic fish (FAO 2019). Through SWIOFish1, data collection efforts improved, resulting in the publication of annual Fisheries Statistics Bulletins, which explain the data collection methods and report the production data for the artisanal and traditional fisheries (DGRH 2021a). Given that SWIOFish1 closed in 2021, ensuring continued and enhanced data collection is essential to inform decision-making in the country's fisheries management.

The GoC has adopted several legal texts with provisions for the protection of coral reefs, such as Decree No. 15-050 prohibiting harpoon fishing and

28 The CNCSP was established in 2007, as part of a regional EU project through Order N° arreté 07-31/MAPE-CAB.

29 Exchange rate of KMF 1=US$0.00226 (April 2022). Calculated with InforEuro (https://bit.ly/3Nw1TkQ).

Sandy beach along the coast of Ngazidja
Photo Credit: Deltares

foot fishing in coral reefs, but their application remains limited. A concept note is currently being developed by the GoC and the Green Climate Fund for the restoration of coral reefs and associated ecosystems (see Box 25).

5.4.2. Coastal and Marine Ecosystems

The coastal and marine environment of the Comoros consists of many rich but fragile ecosystems including sandy beaches, rocky shores, mangroves, seagrass, and fringing coral reefs. These ecosystems give rise to rich biodiversity, including many emblematic species such as dugongs, humpback whales, and green and hawksbill turtles (World Bank 2020j), but are under threat of degradation because of both natural and anthropogenic drivers.

Rocky Shores and Sandy Beaches

The shoreline of the Comoros is characterized by rocky shores and sandy beaches. All islands of the Comoros are of hot-spot volcanic origin, and morphological characteristics and soil type vary depending on the age of volcanism. As a result, the coastline ranges from coral sand to white beaches, basaltic rocks, black volcanic sand, mixed, and muddy sand beaches (Sinane 2013). The rocky shores are well preserved and protected from coastal erosion and harbor a diversity of plant and animal species. The 10 islets of the Comoros, mostly along the south of Mwali, are surrounded by coral sand beaches, which are considered important assets for tourism development. All country's beaches provide nesting sites for sea turtles, especially in Mwali, where the protection of sea turtle nesting sites was a prime motivator for the creation of Mwali National Park (ASCLME 2012).

Mangroves

Along the Comorian coast, mangrove ecosystems are limited and found at the southern coast of Mwali, Ngazidja, and Ndzuwani (Table 14) (Global Climate Change Alliance [AMCC] 2019b; ASCLME 2012). Although they are present in limited cover, mangroves provide key ecosystem services for the Comoros such as providing nursery habitats and food resources for many fish species, influence the surrounding environment by stabilizing sediments and attenuating wave energy, and protect the coastline, mitigating the impact of flooding and preventing coastal erosion. Additionally, mangroves promote the establishment of offshore coral reefs by retaining sediments that would otherwise limit their growth. In recent years, mangroves have been increasingly recognized for their role in mitigating the contribution of the Comoros to climate change because of their high rates of carbon sequestration, exceeding the carbon storage rates of terrestrial forests (World Bank 2017b).

Seagrass Beds

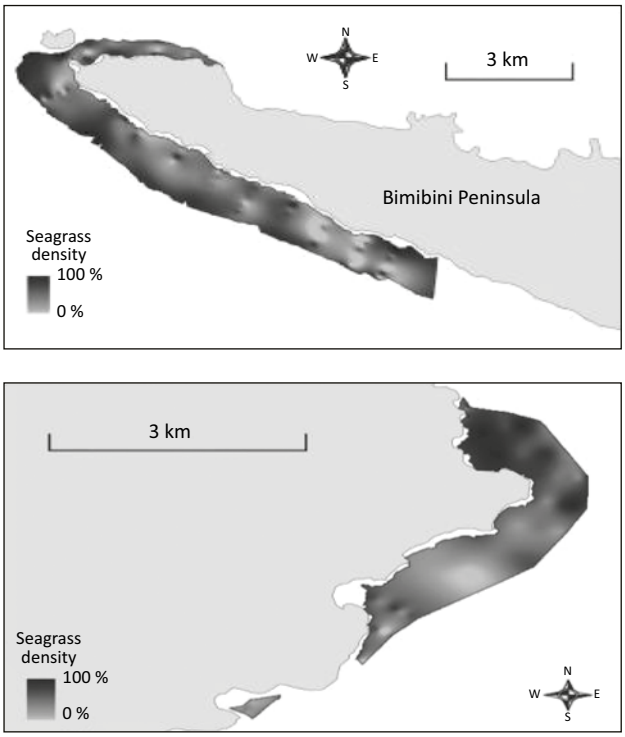
The Comoros has several seagrass beds, which are extremely important for the conservation of its biodiversity and the protection of its coastal environment (Figure 28). The seagrass of the Comoros is highly important, supporting the enormous wealth of the islands' associated fauna such as dugongs and green turtles, and playing a significant role in blue carbon storage. Seagrass around the Comoros experiences strong seasonal variation. During the rainy season, the beds are heavily affected by sedimentation resulting from terrestrial soil erosion. Seagrass beds expand

Table 14. Overview of cover (ha) of coral reefs and mangrove ecosystems (2018)

Island	Coral Reef (ha)	Mangroves (ha)
Ngazidja	2473.38	86.78
Ndzuwani	4057.93	23.15
Mwali	3917.23	102.94

Source: AMCC 2019b.

Figure 28. Distribution and density of seagrass beds around western Ndzuwani island (upper image) and the south of Ngazidja (lower image).



Source: Poonian, Tuharska, and Hauzer 2016.

during the southern winter due to more favorable environmental conditions (ASCLME 2012).

Coral Reefs

The marine ecosystem of the Comoros is characterized by fringing reefs that have a narrow platform extending from the steep volcanic shoreline. While a full inventory of the reefs does not exist, 250 species have been identified in Mwali National Park (ASCLME 2012). Coral reefs surround 100 percent of the Mwali coastline (3,917.23 ha), 80 percent of Ndzuwani (4,057.93 ha), and 60 percent of the Ngazidja coastlines (2,473.38 ha), for a total of approximately 10,447 ha. This surface area corresponds to 16 percent of the total land area of the Comoros. The condition of reefs varies spatially; more than half of the Comorian coral reefs (60 percent) are considered dead, including as many as 80 percent to 90 percent in some sites (ASCLME 2012). Given the protection status of Mwali National Park, its coral reefs are significantly less degraded than those outside of the park and along Ndzuwani (Figure 29). In addition, Mwali's shallower reefs have been found to be more degraded relative to the deeper reefs of Ngazidja and Ndzuwani.

5.4.2.1. Coastal and Marine Ecosystem Degradation and Its Drivers

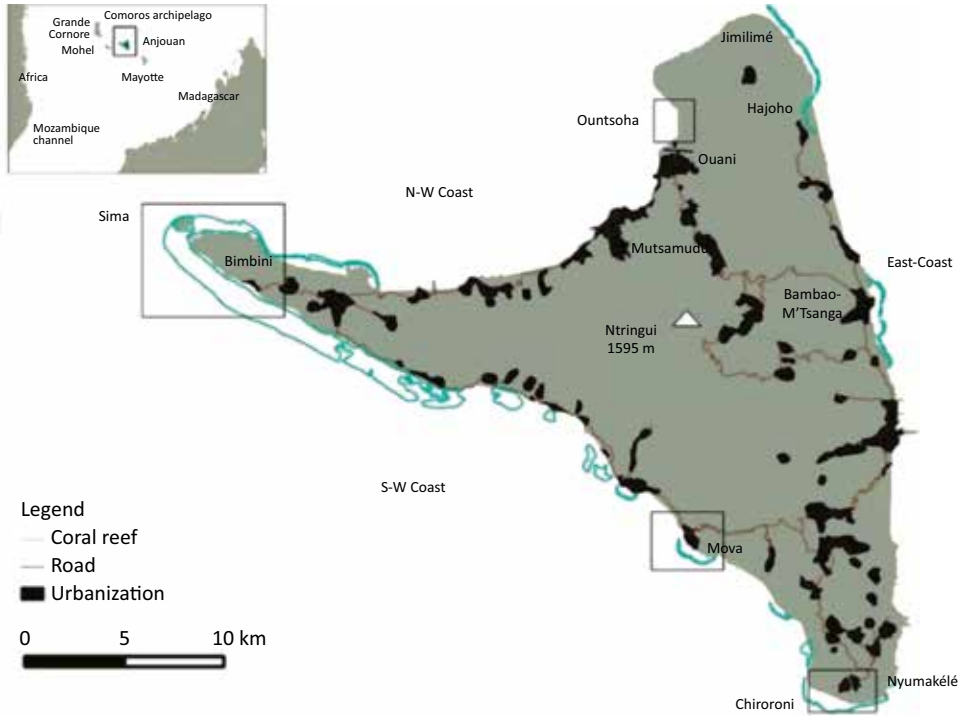
Rocky Shores and Sandy Beaches

Coastal erosion of beaches that results from natural factors is caused by a combination of natural phenomena, the local bathymetry, and climate variation. Swells, coastal currents, and tides directly affect the natural erosion of the coasts and beaches. The impacts of climate change may amplify this process, as sea level and heavy rainfall are expected to become more frequent in the coming decades (see section 3). The strength of cyclones and tropical storms is also predicted to increase, putting additional pressure on the coastline of the Comoros. Coastal erosion is also exacerbated by the coral bleaching of adjacent reefs. Because of insufficient funds, the cost of maintenance to seawalls has not been budgeted; as a result, most sites are now exposed to coastal erosion once again. This raises the issue of the need for international support to build seawalls, especially considering that the average loss from flooding alone is approximately $2.0 million per year.

Anthropogenic activities such as the mining of sand and rock material has put additional pressure on the beach systems. Sand and gravel extraction from beaches is driven primarily by growing urbanization which, in turn, has led to the increase in the demand for construction materials (Sinane 2013) (see Box 24). For instance, 54 percent of Mwali's beaches (469 ha) was lost between 1950 and 1998 (Abdou, n.d.) and, more recently, in the 2010s, up to 14,000 m^3 of sand was extracted monthly in Ndzuwani for construction purposes. Sand extraction causes not only degradation of beaches, but also threatens ecologically important habitats such as coral reefs, seagrass beds, and mangroves and increases the country's vulnerability to cyclones, heavy rainfall, and rise in sea level. The progressive loss of the protective role of the beach affects infrastructure close to the coastline such as coastal roads, airports, and villages, while jeopardizing opportunities to develop the nascent NBT sector (see section 5.6). Sand-mining activities have led to severe depletion of sand, especially on less frequented beaches, while the most frequented beaches close to urban areas have been preserved from this activity thanks to self-regulation by local communities, an attitude which highlights the environmental benefits of co-management in the Comoros.

Another stress on the Comoros marine environment is the lack of solid waste infrastructure. Because of the small land surface, activities on land strongly and

Figure 29. Coral reef locations along Ndzuwani.



Source: Ratter et al., 2016.

directly affect the shores of the Comoros, and the lack of waste and sewage management infrastructure, compounded by the absence of a comprehensive national waste management strategy, results in large amounts of waste dumped on beaches and ending up in the sea and reefs (see section 5.5 on waste management).

Mangroves

Although mangroves are small in the Comoros, the reduction of mangrove cover is driven by the combined impacts of natural and anthropogenic factors, underpinned by the lack of appropriate management (Malterre et al., 2018). The country's mangroves are primarily threatened by waste dumping, deforestation for heating and construction purposes, sand mining, and the expansion of urban infrastructure and villages. Natural mangrove degradation results from sedimentation following coral bleaching events, coastal erosion, and the drying of rivers.

Mangrove restoration projects have taken place with promising results along the coast of Ndzuwani, where it was found to be an effective nature-based flood-defense measure to combat erosion (Sinane 2013).

Litter on a beach in Ngazidja
Photo Credit: Deltares

Mangroves in Ngazidja
Photo Credit: Deltares

Box 24. The Case of Coastal Sand Mining

The demand for construction materials has increased since the 1950s due to urbanization, leading to growing extraction of coral stone, coral lime, and sand. Coral lime was replaced by imported mortar following the ban on beach sand and coral mining in 1989. Consequently, coral extraction activities significantly reduced in the 1990s. However, illegal sand extraction from beaches continues as the demand for construction material increases and enforcement remains low (Sinane 2013).

Sand extraction is a subsistence activity for the poorest livelihoods. It takes place on Ngazidja and Ndzuwani during the dry season when the agricultural sector employs fewer people (Sinane 2013). Truckers purchasing directly from extractors pay approximately US$34 per cubic meter on Ndzuwani. The materials are sold on the markets for approximately US$39 to US$45 per cubic meter.

Illegal sand extraction does not meet the national demand for cement. Therefore, the Comoros is highly dependent on imports, representing about 150,000 tons/year at an estimated cost of US$15.2 million in 2020 (OEC 2020). The volume of extracted sand on both Ngazidja and Ndzuwani as of 2022 is not known. In the early 2010s, the volume was estimated at 14,000 cubic meters/year for Ndzuwani (Sinane 2013).

The production sites on Ngazidja and Ndzuwani were mapped as part of the Global Climate Change Alliance (GCCA [AMCC in French]) project implemented from 2014 through 2019 (see Annex 6). The project enabled the Comoros to take part in the global effort to mitigate climate change, which can contribute to reducing poverty (AMCC 2019).

Law No. 89-020 of 1989 and Decree No. 06-019/PR forbid sand mining. In addition, the 1994 Framework Law requires that any development project have environmental authorization through an EIA. Violation is sanctioned with imprisonment and/or a fine. However, enforcement is nonexistent and should be enabled via sufficient (remote sensing) monitoring and surveillance resources within the Ministry of Fisheries, Environment and Agriculture.

To address environmental challenges due to sand extraction, affordable alternative livelihoods need to be developed, such as through NBT. Involving local communities in the co-management of coastal resources is key. Awareness among these communities can be increased by leveraging initiatives such as the United Nations Educational, Scientific and Cultural Organization (UNESCO) Sandwatch Program. Although not the ultimate solution, offshore seabed mining can reduce the pressure on the coastline. The growth of this sector is one of the blue economy ambitions in the PCE (Comoros Ministry of Foreign Affairs 2020).

Restoration can be highly effective when biophysical conditions are favorable for mangroves and local communities are sensitized on the importance of the sustainable management of mangroves (Deltares 2016). A positive trend was seen in Mwali, where the decrease in wood harvesting led to a reported increase in mangrove cover in 2017. The decrease in wood harvesting was driven by the introduction of protected areas, which restricted access to mangrove forests. About 30 forest eco-guards were recruited by the Island Governorate in February 2013, approximately 25 of whom are assigned to the territory where the extension of the protected area is planned. Their mandate is to enforce the regulations concerning the prohibition to cut wood on the coastline, along rivers, and in forests (except by permit) and to contribute to reforestation actions (Roby 2014).

Seagrass Beds

Although Mwali National Park has the largest cover of seagrass (up to 90 percent) (ASCLME 2012)seagrass beds and coral reefs, over the past two decades it has experienced a progressive decline (Ahamada 2021; Poonian, Tuharska, and Hauzer 2016). The exact extent of the decline is unknown, making recurrent mapping of seagrass essential for the Comoros to properly quantify the trend and thus improve management. The decline in seagrass cover is mainly characterized by the disappearance of an abundant key species (*Thalassodendron ciliatum*) because of coastal erosion and sedimentation from erosion upstream (Ahamada 2021). Given the lack of specific data, it would be beneficial to conduct a regional study on the distribution of this species to provide more insight on the causes of this decline.

In contrast, seagrass beds around Ndzuwani, located mainly along the Bimbini Peninsula (1,419 ha), are expanding due to terrigenous deposits from freshwater streams (Malterre et al., 2018).

While some patches of seagrass are expanding, such as along Ndzuwani, several pressures on the habitat could cause degradation. Among these stress factors are sedimentation resulting from soil erosion, various types of pollution, overexploitation, urbanization, and destructive fishing activities, such as foot fishing (Malterre et al., 2018). Restoration of the most threatened species, as well as conservation pilot sites of the existing seagrass beds around the islands, can help protect the habitats and ward off further decline, while supporting the NDC ambition to increase net CO_2 absorption.

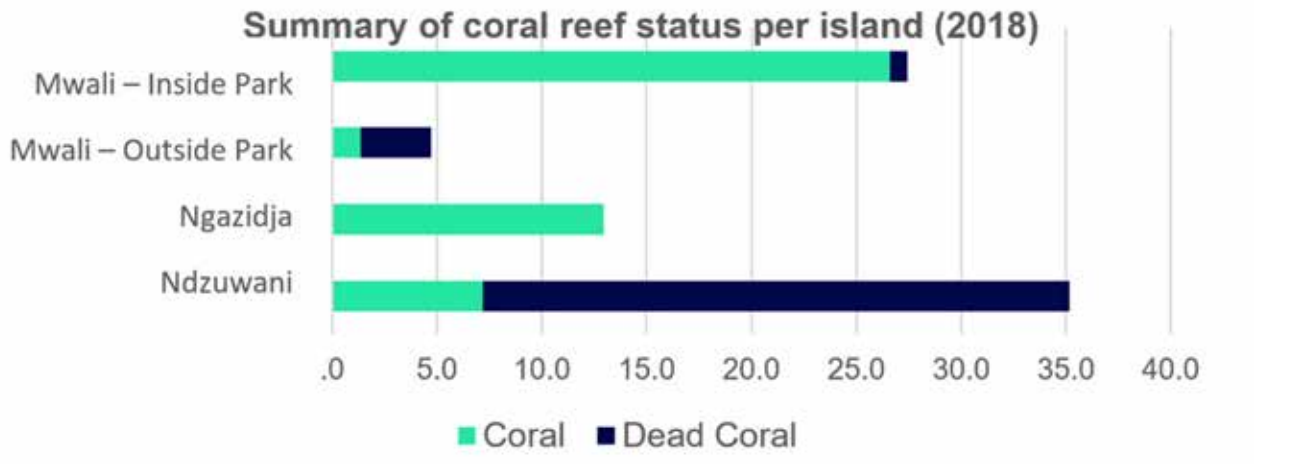
Coral Reefs

The coral reefs of the Comoros have degraded during the past 40 years because of a combination of human-related factors, natural events, and global bleaching (Breuil and Grima 2014; Obura et al., 2017). Pressures related to human activity include illegal practices such as dynamite fishing, the release of toxic products into the water, and the use of mosquito nets that physically harm the coral. Informal interviews with fishers revealed that nets are often set on the reef, resulting in degradation as illustrated by coral debris (Harris et al., 2018). Dynamite fishing was found to have degraded reef sites around Ngazidja (Freed et al., 2018). Erosion and sedimentation of the reef resulting from deforestation and sand mining have been observed along the coast of Ndzuwani (Freed et al., 2018). Finally, both sewage and solid waste contribute to further degrade the reefs of the Comoros: plastic pollution has been accumulating on both deep and shallow reefs of Ndzuwani (Samoilys et al., 2018) and solid waste has been evident on the beaches of Ndzuwani (Freed et al., 2018).

Reefs are further degraded by coral bleaching (Cowburn et al., 2018). Bleaching is caused by warming waters as a consequence of either climate change or natural events. During the more recent coral bleaching event in 2016, reefs were found to be affected with 10 percent to 60 percent bleaching. The mortality of live hard coral was estimated at less than 20 percent, and declines were present for Comoros reefs as well (Obura et al., 2017). Bleaching events are predicted to occur more frequently in the future because of the increase in extreme IOD events (FAO 2018). Furthermore, increasing sea surface temperatures, together with ocean acidification resulting from rising CO_2 levels, lead to further degradation of these marine habitats. An analysis of the vulnerability of reefs in the protected Mwali National Park to future coral bleaching events found that they are resilient to the ongoing human-related pressures, though they might not be able to withstand future climatic effects Cowburn et al. (2018). Nevertheless, other coral reefs outside protected areas could face more intense pressures and become more degraded.

Other natural events that affect coral reefs include tropical storms. In 2019, Cyclone Kenneth resulted in the physical degradation of coral habitats in several locations along the coasts of the three major islands, also affecting the associated fish and shellfish

Figure 30 Coral reef status in the Comoros by island in 2018.



Source: Ramadhoini Ali 2021.

species. Since these natural hazards are expected to become more frequent because of climate change, it is foreseeable that coral reefs in the Comoros will be exposed to increasing pressure.

5.4.2.2. Costs of Inaction and Opportunities for Change

In 1998, the Regional Program for the Environment of the Indian Ocean Commission estimated that the economic value of coral reef ecosystem services for Mwali National Park alone was approximately US$2.8 million, equal to 1.3 percent of the national GDP at that time (Malterre et al., 2018). Assuming that the size and status of the reefs of the different islands have not changed over time and given that Mwali's reefs make up 38 percent of the country's total reefs, this equates to an economic value of US$7.2 million for all of the reefs of the Comoros, equal to 0.58 percent of GDP in 2020.

Protection and restoration of coastal and marine ecosystems are fundamental to develop the Comoros tourism sector, whose potential is far from being fully harnessed (see section 5.6). Specifically, tourism on Mwali is quite dependent on the presence of the rich coral reefs, though to what extent this is illustrated in income is unknown. To better understand the implications of coral reef degradation for tourism, fisheries, and overall resilience, additional studies should be conducted.

The physical connectivity between coastal ecosystems (fringing coral reefs, seagrass meadows, and mangroves) offers more ecological benefits than the sum of each ecosystem's benefits. The ecological benefits of one ecosystem extend to adjacent ones and increase the capacity of each ecosystem to recover from stress. Interrupting the physical interaction between mangroves and seagrass by increasing land reclamation, for example, may lead to a cascade of negative effects that will significantly increase the cost of maintenance of the overall Comoros marine environment.

Thus, an integrated approach to coastal management is needed to minimize the cost of ecosystem restoration. The development of a sustainable blue economy as suggested by the PCE 2030 could serve as a tool to achieve such an integrated approach, for example, through the development of an integrated coastal management plan and a blue economy roadmap (based on Strategic Framework for a National Policy on the Blue Economy [BESF]), and supporting the Marine Spatial Plan initiated by the General Planning Commissioner, with technical and financial assistance from IOC-UNESCO beginning in November 2021.

5.4.2.3. Institutional and Legal Context

Sustainable management and conservation of coastal and marine habitats and the protection of their biodiversity are included in the PNE (93-214/PR, in the process of being updated) and the Framework Law of the Environment (FLE) (Decree No. 94-018/AF, also in the process of being updated). This includes the management and protection of mangroves, beaches, coral reefs, and seagrass beds, and their associated biodiversity. Order No. 01/033/MPE/CAB provides the list of protected species. The regional directorates are responsible for the implementation of these environmental policies. As with most environmental legislation in the Comoros, implementation and enforcement remain a challenge. With the adoption of the National Protected Areas System Law (2018; No. 18-005/AU) and the Presidential Decree of Protected Areas (2019; No. 19-129/PR), there is more specific legislation in place for the protection of habitats (see Box 22).

5.4.3 The Way Forward

Fisheries

- **Scale up the implementation of fisheries co-management with local communities, providing livelihoods support to ensure effective management.** The recommendation should capitalize on the successful experiences carried out under CoReCSuD, SWIOFish1, and SNAP, as well as by local actors, and build on lessons learned to scale up the positive results achieved in terms of sustainable management of the sector and improved livelihoods.
- **Intensify efforts to combat IUU fishing.** The Comoros needs to be enabled to sanction IUU fishing, at the industrial but particularly the small-scale level, given the significant, documented impact of illegal artisanal fishing on coastal fisheries and the ecosystem more broadly. IUU fishing in the small-scale segment can be addressed by building on SWIOFish1 achievements and integrating lessons learned, including by training the staff of unions, associations, and cooperatives who can, in turn, train fishers. For the industrial segment, the Comoros should have its own IUU register, for example, building to the IOTC IUU vessel list, as well

Box 25. Global Fund for Coral Reefs Investment Window

As part of the Green Climate Fund private-sector program in the blue economy, the Global Fund for Coral Reefs Investment Window will create a private equity fund to encourage investments in the blue economy, protecting coral reefs (Green Climate Fund 2021). The Comoros is one of the 17 countries where this program will be implemented. The program aims to mitigate or eliminate existing local stressors on the coral reefs. Investments will be made in the following sectors:

- **Sustainable ocean production:** These efforts will focus on supporting fishermen to adopt more sustainable fish capture techniques, helping fishermen manage stocks or transport more sustainably, and facilitating growth in mariculture and aquaculture.
- **Sustainable ecotourism:** Measures include supporting sustainable hotel and tourism activity businesses that incentivize the protection of coral reef ecosystems upon which the tourism industry is dependent.
- **Sustainable infrastructure and waste (pollution) management:** This includes improved plastic waste management from new business models and technologies, improved treatment of sewage and wastewater, and the adoption of organic fertilizers, among other efforts.

These interventions will strengthen adaptive capacity, reduce exposure to climate risks, increase reef resilience, and enhance the protection and restoration of reefs. Delays have occurred in implementation as a consequence of the COVID-19 pandemic.

The Ministry of Agriculture, Fisheries, Environment, Tourism and Handicrafts is responsible for the realization of projects under the fund, through the National Designated Authority and the Green Climate Fund National Focal Point. An accredited entity will need to be appointed to accredit the fund. The size and the content of the projects in the Comoros are currently unclear. Thus, the Ministry of Agriculture, Fisheries, Environment, Tourism and Handicrafts, and the NFP for the GCF would benefit from support in the development of the project terms of reference, as well as in assuring the involvement of local communities in the restoration efforts.

as procedures to quickly address IUU events when they are identified. Better participation in international and regional coordination efforts would also support efforts against IUU fishing and potentially offer opportunities to mobilize resources.

- **Improve the availability of data on the status of fish stocks**. Data collection and analysis should be improved to inform policy making that supports effective monitoring, enforcement, and management of fisheries resources.
- **Identify opportunities for private sector engagement** through the identification of innovative financing approaches to blue carbon projects.
- **Adopt a sustainable fisheries strategy to improve consistency among fishery decrees and help address the key challenges**. The strategy should provide a range of options for how best to address key challenges (such as IUU fishing, unsustainable fishing practices). The strategy should also include recommendations to support sustainable fishing, ways to enhance international/regional cooperation, and strengthen co-management of the resources.

Coastal and Marine Ecosystems

- **Restoration of mangroves and seagrass should be promoted, accompanied by the development of an integrated coastal management plan and supported by improved local capacities.** Mangrove restoration efforts should be underpinned by recurrent mapping of mangroves to enhance the understanding of current and future trends. The potential for mangroves to attenuate waves through nature-based flood defense should be assessed to incentivize mangrove protection and restoration.
- **Support the development of coral reef restoration projects, possibly under the Global Fund for Coral Reefs Investment Window.** Technical and operational assistance should be provided to the Ministry of Agriculture, Fisheries, Environment, Tourism and Handicrafts and the Comorian NFP for the GCF in the development of such projects. Also recommended is a special focus on co-management principles, gender aspects, and sustainability of activities beyond project closure, for example, by identifying diversified and sustainable income sources (such as tourism activities) and by improving capacity adequately. For climate-smart interventions, a focus on the restoration of coral reef species that have shown resilience to higher temperatures is recommended (see Morikawa and Palumbi 2019).

- **Strengthen financial support for the creation of the three national marine parks.** Given that the creation of the parks is pending signature and the Comoros Environmental Fund (FEC) is not functional, this process could be supported with more investment to enhance the capacities of National Network of Protected Areas (RENAP).

5.5. Solid Waste Management

Key Features

- In spite of the relatively limited amount of waste generated on a per capita basis (0.32 kilograms) per day, open-air landfilling and open burning are widespread practices.
- Limited available space, a growing population, and changing consumption patterns represent major challenges to the development of sustainable integrated solid waste management (ISWM).
- Ineffective solid waste management threatens the health of the Comorian population through marine litter and its impacts.
- Litter-polluted rivers, coasts, and seas damage natural assets, including beaches, coral reefs, and marine life, and can hinder the development of NBT.

Solid waste management in the Comoros remains a major challenge, and no significant improvements have been achieved in recent years. Compared to the assessment made by the Indian Ocean Commission in 1996, which noted a "virtual absence of public or private waste management and no waste treatment facilities" (Indian Ocean Commission, 1996), the current situation has not changed significantly aside from some minor improvements in the larger towns (Jaglin, Debout, and Salenson 2018). Despite several initiatives, the responses of the State, local authorities, village associations, and international partners continue to be limited and ISWM, which combines precollection, sorting, transport, treatment, recycling, and disposal measures, remains severely underdeveloped (Union des Comores 2019a).

5.5.1. Sector Characteristics

Most of the waste generated in the Comoros is mismanaged, and waste generation is expected to increase in the coming years. According to the World Bank (2018), the Comoros generates 0.32 kilograms of solid waste per capita per day. While this rate is lower than the global average and the Sub-Saharan African region rates, studies indicate that most of the waste generated (83 percent) is inadequately managed (Jambeck et al., 2015). In addition, with regard to plastics in particular, mismanaged solid waste is projected to increase significantly in the coming years (Jambeck et al., 2018).

Organic waste constitutes the largest fraction (60 percent) of household waste, followed by organic waste produced by markets.[30] As an example, Figure 31, which shows the composition of household waste in Mutsamudu Bay,[31] Ndzuwani (Fouqué and Durand 2018), clearly illustrates that a large fraction of the waste is, in theory, recyclable and therefore could be recovered in lieu of being disposed of in unsanitary ways.

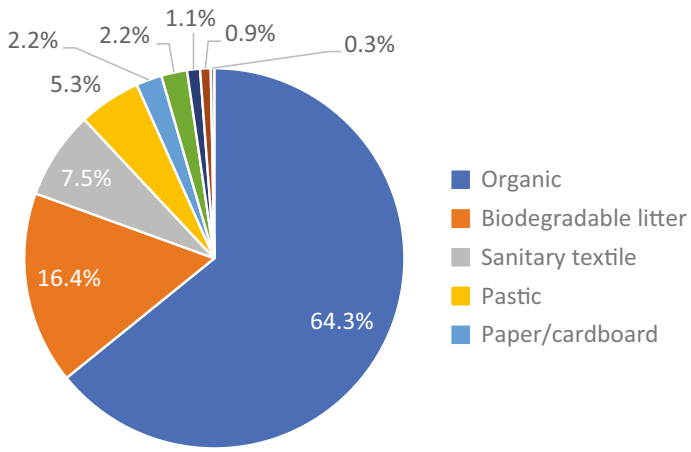
In spite of the relatively limited amount of waste generated, household collection services and coverage are currently nonexistent because of technical, financial, and organizational challenges. Much of household-generated solid waste in the Comoros is not collected, severely affecting the environment. With no public collection services, households turn to the private sector for waste collection or find other alternatives which negatively affect both the environment and health (Figure 32). For example, in Ndzuwani, household rubbish is often illegally dumped or burned, while in Mwali and NGazidja, more than 56 percent and 40 percent of households, respectively, illegally dump trash on the side of the street or along the coast (World Bank 2021c). Only in Moroni does public waste pick-up cover the majority of households (approximately 60 percent), while private operator coverage is relatively low. Beach disposal is a critical issue, especially in Fomboni and Mutsamudu.

Aligning the development, improvement, and operation of appropriate landfill sites with the required environmental standards is a main challenge. On Ngazidja, the Itsoundzou landfill site is currently being operated and accommodates the waste in the municipality of Moroni, although significant improvements are needed. On Ndzuwani, the commune of Domoni has a landfill site under development located in Hacharifou. Other sites are currently being evaluated in Mwali and in Ndzuwani (Union des Comores

30 Markets in Moroni produce, on average, 1 ton of waste per day, 68 percent of which is organic waste (Commissariat général au plan 2019).

31 Waste composition data were only available for Mutsamundu Bay.

Figure 31. Composition of household waste in Mutsamudu Bay, Ndzuwani in 2014.



Source: Fouqué and Durand 2018.

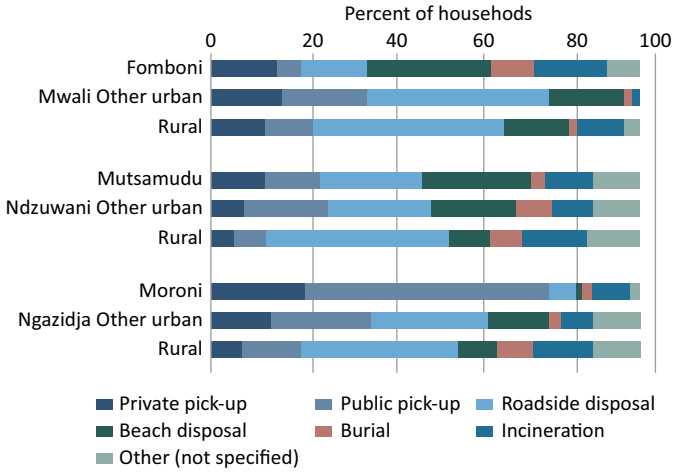
Solid waste along the coastline of Ngazidja
Photo Credit: Deltares

2019). Technical analyses, environmental impact assessments, and additional studies on the capacity and coverage of landfills that are operational, under development, and projected are needed.

Recycling systems are largely undeveloped, and recycling activities are mostly informal and occurring at the local level. Many informal initiatives are implemented by Comorians, such as making recycled bags from recovered paper and fabrics, recycled rope from plastic sacks, carpets using the remains of plastic sandals from informal dumping on the coast, pots out of aluminum cans, and tablecloths created by groups of women from used textiles, as well as the use cardboard bricks for fireplaces (World Bank 2021c). Construction waste is often reused for embankments or for new construction, supporting the potential for a viable recycling market; however, the ways it is currently used tend to decrease the structural integrity and, thereby, the resilience of buildings. Iron, copper, bronze, and batteries are reported to be exported to Tanzania, where they are recycled or reexported (Jaglin, Debout, and Salenson 2018). The significant amounts of waste thrown on roads, beaches, and illegal dumping areas could potentially be recovered for local recycling. The establishment of the first waste recycling and sorting center opened in 2018 by the Municipality of Moroni currently treats 1 ton of recyclable waste per month and is a step in the right direction, if a modest one.

Hospital waste is a pressing issue for the Comoros, especially in the aftermath of the COVID-19 pandemic. The majority of this waste is not properly collected and ends up in the environment including rivers and the ocean, threatening public health and highly affecting air, soil, water, and wildlife. Treatment and disposal of the waste that is collected are unsafe, and this waste ends up in uncontrolled dumpsites because of the lack of appropriate infrastructure,

Figure 32. Household solid waste disposal in the Comoros by method and island in 2017.



Source: World Bank 2021c.

certified companies, and specific guidelines on hospital waste. It is estimated that hospital and health centers in the Comoros generate nearly 230 tons of waste per year, 45 percent of which is biomedical waste. Approximately 73 percent of the 230 tons are produced in Moroni, and only half of what is produced in Moroni is estimated to be collected and disposed of in the official dumpsite. This means that approximately 84 tons of hospital waste including toxic and infectious waste leak into the environment and ocean. Additional studies and analyses on other hazardous wastes, such as construction or chemical wastes, are needed to properly quantify how much waste is generated per island, as well as to assess the collection and final disposal procedures, to ensure the availability of sufficient information and reliable data to develop ad hoc policy interventions and investment plans.

5.5.2. Unsustainable Waste Management and Its Drivers

Allocation of appropriate landfill sites in alignment with the required environmental standards is a main challenge (Union des Comores 2019a). The island's mountainous terrain and limited space makes difficult for the GoC to identify and allocate adequate landfill sites that respect the required environmental standards. Furthermore, inhabitants near landfills fear the harmful effects on their health that result from the poor conditions of the landfills and the accumulation of waste. On Ngazidja, some improvements are being made to the Itsoudzou landfill site, which has been recently developed and will soon be used for waste disposal. However, the combination of the growing population and new consumption and production patterns makes these efforts inadequate to properly manage the rising amount of solid waste generated.

Insufficient budget, inadequate access to technology, and limited solid waste management skills further complicate the implementation of ISWM strategies. Since the ISWM system cannot be financed and supported by the municipalities alone, the private sector and international donors are key partners to ensure the feasibility of such a significant structural change. The participation of the private sector in solid waste infrastructure and service provision, if done properly, can leverage investment and greatly improve service provision and support economic development. At the same time, the commitment from international donors is crucial, as indicated by the decision made at the Conference of Partners for Development Conference to finance a waste management structural project under the PCE.

Awareness of waste-related risks and challenges among the population is insufficient, whereas the commitment of users paired with high social and fiscal citizenship is fundamental for sound integrated waste management. For a country like the Comoros, where oral tradition is dominant, effective communication and awareness-raising campaigns could play a key role in supporting integrated waste management. They could remind public waste service users of their rights, raise awareness of waste management issues and their impacts on both health and environment, and promote individual and collective good practices and, ultimately, behavior change.

Growing urbanization poses an additional pressure on solid waste management. Cities do not have the required financial resources and infrastructure to keep up with growing urbanization, pushing more urban dwellers to live in informal settlings with very limited or no access to solid waste services. This trend is exacerbated by the morphology of the archipelago: the islands' mountainous terrain limits the areas available for new settlements, contributing to increased population density and a concentration of the household waste generated within a limited area—which is also an opportunity to establish an effective waste collection system covering a limited area. In comparison to urban areas, rural areas have a higher share of waste that is not collected and is left on the roadside, lower levels of public waste pick-up coverage, and an equally strong contribution to environmental degradation.

Efficient ISWM and strategic planning in the Comoros are also constrained by the lack of good data. Reliable and updated data are essential to allow robust analysis of development scenarios for the sector, while supporting the monitoring of progress against targets set forth in the PCE and providing the basis for ongoing strategic planning. The availability of good data is also essential to conduct environmental impact assessments for landfill sites. Evidence-based projections to anticipate future changes in the sector are also lacking but are crucial for planning efforts to address the challenges linked to growing urban waste generation, as well as to maximize recycling opportunities. Data collection and analysis are also needed to properly assess the impact of the potential increase in tourists on the already fragile waste sector.

5.5.3. Costs of Inaction and Opportunities for Change

The lack of appropriate solid waste management services and infrastructure leads to unhealthy solid waste-handling practices and environmental degradation. As in many other low- and middle-income countries lacking in solid waste management capacity, the population without access to solid waste collection services often resorts to open and uncontrolled fires to burn solid waste, including plastic. This results in the release of chemicals and fine particles, which pose serious risks to public health and the environment (Velis and Cook 2021).

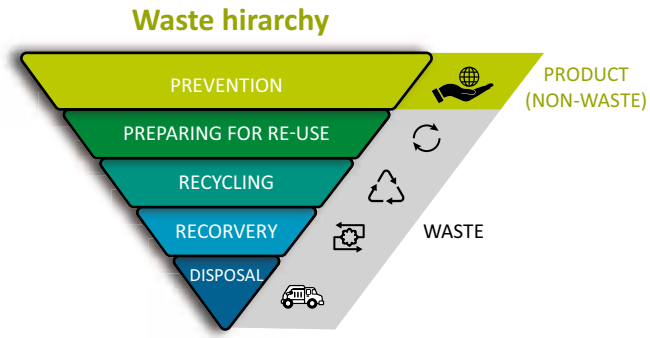
Unsanitary final waste disposal affects the environment of the Comoros and affects the living conditions of the population, while also increasing the risk for social unrest. Unauthorized landfills have become a major source of pollution of natural resources such as water, land, and air, contributing to the proliferation of disease pathogens. Furthermore, fly-tipping and open-dumping sites constitute major sources of leakage of plastic waste, polluting both the terrestrial and marine environments (see section 5.4). As a result, both air pollution and unsafe WASH are among the most important risk factors accounting for the high disease and death burden in the Comoros. In addition, near cities and large villages, dumping sites are more abundant and are occasionally the cause of disputes.[32]

Against this backdrop, it would be crucial for the Comoros to develop a comprehensive strategy for ISWM, considering interventions in waste prevention, collection, disposal, and recycling. The importance of ISWM for the Comoros is clearly illustrated by the PCE, which has identified integrated waste management as one of the six structural projects to be implemented, allocating €35.575 million (US$39.320 million). The project will allow the establishment of an operational system for the sustainable management of waste, while contributing to the strengthening of the logistical and operational capacities of the public waste management service. The overall objective of the project is to reduce waste-related environmental impact and economic losses by contributing to the development of better integrated management of household and special waste. The project has three specific objectives: (1) provide the country with the necessary infrastructure for the waste management sector, (2) promote good practices on integrated waste management, and (3) establish an institutional and regulatory framework for waste management.

Strengthening waste prevention policies is an important step to steer the country toward a sustainable consumption and production pattern (Figure 33). Indeed, prioritizing waste prevention is key, especially in a small island state such as the Comoros, where space for landfill infrastructure is physically limited. In other countries in the region such as Zanzibar and Seychelles, for instance, certain types of items, particularly plastic such as for plastic bags, are being restricted, repurposed, or reused. In this regard, an assessment of the most problematic waste products would be useful to inform decision-making to restrict their circulation (for example, bans of or fees for plastic bags), incentivize design for reuse, and/or promote alternative materials. If adequately implemented, this strategy could also enhance small community-based

32 La Gazette des Comores, May23 2022, n0 4129.

Figure 33. Waste hierarchy as part of an integrated solid waste management strategy.



Source: European Commission.

businesses, thus generating benefits that go beyond a reduction in waste volume.

In addition to waste prevention, opportunities exist to expand waste collection services and increase voluntary collection points. These are already foreseen in the sixth structuring project of the PCE (Component 2) as critical measures to prevent less sustainable and more harmful handling practices, such as open burning or illegal dumping. Another major opportunity lies in the development of community-based "waste banks," which would encourage citizens to sort and deliver recyclable waste items (for example, plastic bottles, aluminum cans, glass bottles, paper), especially if these products are exchanged for household items or food.

Against this backdrop, it would be extremely beneficial for the Comoros to increase private sector engagement in waste services, which remains limited. A case in point is the city of Moroni, where the level of collection services provided by private operators is relatively low and the management of facilities financed by public subsidies remains unsatisfactory. To step up the role of the private sector, it is fundamental to strengthen the financial sustainability of the waste sector, gradually implementing a fee for waste collection and setting up a professional private operator with clear specifications and performance-based compensation (World Bank 2014). An increase in local solid waste taxation would strengthen the sector's self-financing capacities and sustainability and reinforce the PPP framework, which would create a favorable environment for much-needed private sector investments. Indeed, given that public expenditures alone would fail to address the challenge of waste management, the participation of the private sector is pivotal to leverage investments and trigger a positive path toward a sustainable and efficient waste management system in the Comoros, while contributing to economic development.

Final disposal facilities need to be upgraded, and further opportunities for circularity exist from waste energy recovery. As mentioned in the sixth structuring project of the PCE (Component 3), energy recovery through the production of biogas is one of the three recovery/recycling schemes for household waste and has translated into the deployment of three bioreactors (for Ngazidja, Ndzuwani, and Mwali) (Union des Comores 2019a). Therefore, investments should be made in well-managed final disposal sites and to upgrade/contain existing landfills, especially those close to the coast to prevent leakage into the sea/coastal areas. For each island, an EIA should be carried out to determine whether the proposed sites are feasible.

Another key component revolves around opportunities that may arise from improving waste composting and recycling. The large fraction of organic and food waste provides a great opportunity for the Comoros to diminish the volumes of waste for disposal, reduce the pressure on landfills and, in particular, produce high-quality compost for local farmers. The sixth structuring project of the PCE (Component 3) foresees two schemes for recycling: (1) installing compost production units and (2) setting up composting platforms at the national level. Additionally, a waste recycling center should be set up on each island to support the optimal exploitation of recyclable waste (Union des Comores 2019a). Against this backdrop, the Comoros would need to improve waste separation at the source, a key component for recycling, which is still marginal with only 19.3 percent of households concerned with home sorting (Ali et al., 2018). The PCE 2030 aims to improve sorting systems at the source, while organizing garbage bins and garbage cans to receive sorted waste and transport the collected waste to the waste treatment centers according to their source.

In addition to these key areas, it would be extremely beneficial for the Comoros to uphold any efforts in making waste management more sustainable through more intense and targeted communication between the institutions and population of the Comoros. More responsible behavior by Comorians could represent a key enabler for an effective ISWM. This could be achieved, for instance, by carrying out awareness-raising campaigns on waste prevention and handling practices in schools and local communities. To create support from the population for the establishment of ISWM, priority should be given to (1)

making all practical information available to users, (2) supporting awareness-raising campaigns to promote more responsible behavior in waste management, and (3) obtaining greater commitment from target populations.

5.5.4. Institutional and Legal Context

Since there are no specific legal texts on solid waste management, this sector is broadly governed by the 1994 Framework Law of the Environment, which is currently in the process of being updated (see chapter 4). Apart from the 2011 law on plastic waste (Article 33 of Framework Law 11-006/AU of May 2, 2011), which was issued with the objective to halt plastic litter, there currently are no specific laws rooted in an overall vision for solid waste treatment or reforms aimed at encouraging the development of a circular economy (Jaglin, Debout, and Salenson 2018).

Hazardous and hospital waste also lack a sound legal and regulatory framework. Several articles of the 1994 law concern the management of chemicals and hazardous waste, integrating the definition of hazardous waste included in the Basel Convention, but implementation would require further scale-up. In addition to the ratification of the Basel Convention,[33] the Comoros also ratified the Bamako Convention[34] and Stockholm Convention.[35] The 1994 law does not specifically address biomedical and hospital waste, which are not covered by an ad hoc legal framework.

Acknowledging this critical gap, the Ministry of Health, which is responsible for hospital waste management, adopted the five-year National Hospital Waste Management Plan (Plan National de Gestion des Déchets Médicaux [PNGDM]) in 2018. This plan identified five strategic pillars: (1) strengthening the legal and regulatory framework, (2) standardizing medical waste management practices, (3) building the capacity of medical facilities with regard to medical waste management, (4) involving local communities, and (5) enhancing the evaluation framework. In April 2020, with the support from the World Bank via the COMPASS Project, the GoC revised the plan to include

33 The Basel Convention, adopted in 1989 and entered into force in 1992, is a treaty on the control of transboundary movements of hazardous wastes and their disposal.

34 The Bamako Convention, adopted in 1991 and entered into force in 1998, prohibits the importation of hazardous waste into Africa as well as dumping or incineration into the oceans and inland waters, including radioactive waste.

35 The Stockholm Convention, adopted in 2001 and entered into force in 2004, aims to protect human health and the environment from persistent organic pollutants.

Box 26. Overview of PCE Structuring Project 6: Integrated Waste Management

Component 1: Final waste treatment

- Development of three final waste treatment centers
- Installation of three bioreactors at sites for 30 to 80,000 tons of waste/year

Component 2: Waste collection and transport

- 243 voluntary waste disposal points
- Acquisition of rolling stock: 60 waste skips, 486 dumpster trucks, 1,000 trolleys and wheelbarrows, 1,500 waste bins, spare parts
- Acquisition of outfits and 2,500 cleaning kits for community staff

Component 3: Waste recovery

- Three biogas and compost units for 30 to 80,000 tons of waste per year
- Three waste recovery centers
- 20 prefectural composting platforms
- Three engine oil refineries

Component 4: Institutional and regulatory framework

- Revision of texts, particularly the Environmental Code
- Implementation of the National Integrated Waste Management Agency (ANAGID), development of business plan and sector financing plan
- Capacity building through continuing training and graduate training (license and masters pro "Waste Management and Recovery")
- Development of impact assessments and a national waste management policy and associated implementation documents

Component 5: Information, communication, and good practices

- Organization, management, and dissemination of useful and practical information

(ANAGID reception service, free phone number, website, and social networks)

- Communication on waste management issues (radio broadcast, awareness campaign, communication media)
- Promotion of good practices (events, labeling, and annual awards)

Source: Union des Comores 2019.

specific COVID-19 considerations and a budget plan for implementation during 2019–2024.

The current fragmented and decentralized institutional setting represents another major challenge for the implementation of ISWM, as the decentralization process has resulted in redundant and unclear roles and responsibilities. Although local authorities have the mandate to collect, treat, and dispose of waste, the country is still in a transition toward the full delegation of competencies to local authorities and is in urgent need of developing and implementing sustainable waste management (World Bank 2021c). The National Agency for Integrated Waste Management (ANAGID) is not yet fully operational and lacks structural funding. A minimum operating budget is provided through a subsidy from the State, providing ANAGID funding for three projects currently being launched: (1) the DECOR project financed by the government of Italy for the establishment of a biogas and compost production center, (2) a project on the management of chemicals and hazardous waste financed by UNDP, and (3) a recycling project to manufacture paving stones from plastic and metal waste in collaboration with a South African company.

Improving the institutional and legislative framework is a crucial enabler to adequate implementation of the ISWM. From a legal perspective, it would be important for the Comoros to close this legislative gap by following up the update of the Framework Law with the development of comprehensive legislation for solid waste management. From an institutional perspective, although the establishment of the ANAGID was an important first step, the Comoros still needs to clearly define the responsibilities of all actors involved in waste management, as well as to strengthen the technical and institutional capacities of all stakeholders. In addition, it would be important to combine such reforms with the development of market-based instruments (for example, environmental, tourist taxes, and levies) that can help finance waste management services, as well as setting opportunities for investments by the private sector and integration of the informal sector.

5.5.5. The Way Forward

- **Develop a comprehensive strategy for ISWM, considering interventions in waste prevention, collection, disposal, and waste recycling.** This should be in line with the PCE 2030, structuring ISWM. An implementation roadmap should be prepared for infrastructural development, taking into account the implementation capacities of national, regional, and local governments, as well as societal parties.
- **Invest in services and infrastructure capable of ensuring adequate waste collection, recycling, and disposal.** Expand and enhance waste collection services to households that are not yet covered, minimize collection losses, and increase voluntary, community-based collection points, including those for recyclable materials ("waste banks"). Improve recycling by setting up recycling, biodigesters, and composting platforms. Finalize the landfill sites already identified in the PCE and identify new final waste storage sites.
- **Reduce generation of solid waste by incentivizing designs for reuse and using alternative materials.** To facilitate this process, a life-cycle assessment of the most problematic waste products, in particular those with higher potential for reuse and recycling, should be conducted, followed by a feasibility study for policy and regulatory options to increase circularity (for example, market-based instruments to restrict, substitute, or incentivize reuse of plastic items).
- **Raise awareness on waste-related risks and opportunities, in particular the prevention of solid waste generation and sorting at source.** Communication campaigns, awareness-raising events, and capacity building should be planned to promote behavior change by all stakeholders involved.
- **Improve private sector participation in waste management.** Promote dialogue with the private sector, implement a waste-collection fee, and identify specific PPPs in Comoros cities.
- **Improve data collection and analysis**. To develop effective and sustainable ISWM policies, it is crucial for the GoC to conduct in-depth, sound studies on cost recovery and sustainability aspects, as well as to quantify the environmental and public health footprint of waste in both rural and urban areas. Assessment of the potential impact of tourism-sector development on waste management in the country is also essential.

Implementing such studies would be instrumental for the Comoros to close the gap through informed decision-making across all aspects of ISWM.

- **Support the development of comprehensive legislation and help define the institutional framework for solid waste management.** Adopting specific laws and reforms rooted in an overall vision for solid waste treatment is essential for the country. In addition, it would be extremely beneficial to clarify roles and responsibilities between municipalities and central government to address the gaps resulting from the incomplete decentralization process. In addition, ANAGID should be provided with the required funding and vision to implement its mandate.

5.6. Nature-Based Tourism

Key Features

- The tourism sector is dependent on the natural resource base of Comoros and currently contributes to merely 3.4 percent of GDP.
- The development of NBT is currently hampered by limited tourism facilities, infrastructure (ports, roads, waste management, and freshwater supply), a historical image of political instability, limited connectivity of long-haul flights, and unfavorable conditions for private investors.
- Prior to considering NBT as a key economic growth sector, it is essential to conduct an ex ante analysis to clarify the demand for tourism and define the Comoros target market.
- The natural capital of Comoros could support the NBT sector's growth, contributing to conserving the natural resource base and sustaining local livelihoods.
- The ambitions for the tourism sector are highlighted in the strategic pillars of the PCE 2030 and as its first proposed flagship project.
- Sustainable management of natural capital, and especially protected areas, is an essential prerequisite for NBT strategy and implementation plans.

5.6.1. Sector Characteristics

The current tourism sector of the Comoros is still largely underdeveloped, contributing to only 3.4 percent of national GDP[36] (World Bank 2020j). Especially when compared with neighboring islands such as Seychelles, Madagascar, or Mauritius, the tourism sector of the Comoros is significantly underdeveloped. The number of international tourist arrivals varied between 20,000 and 30,000 per year between 1996 and 2020 (Figure 34).[37] Despite its geographical position as a strategic stopover, the Comoros is neglected as a cruise tourism destination, and only eight cruise ships visited the country between 2008 and 2018. Air connections are also limited, with direct flights only to seven countries.[38] The sector employed approximately 1,600 people in 2018: approximately 1,000 in Ngazidja, 470 in Nzwani, and 140 on Mwali (Union des Comores et al., 2019).

Diaspora tourism has a notable socioeconomic role in the Comoros. Visiting families from the Comorian diaspora, in particular during the "grand mariage" season, represent more than 50 percent of the arrivals, whereas leisure and business travelers account for only 14.3 percent and 23.3 percent of total arrivals, respectively.[39] Moreover, since the French Comorian diaspora travels mainly in July and August, the route becomes particularly costly during the high season, discouraging other travelers from visiting the Comoros (World Bank 2013). France, including French overseas departments and territories as well as the French Comorian diaspora, is the main reference market, representing almost 65 percent of arrivals in the Comoros, including 7 percent coming from Reunion and another 7 percent from Mayotte.

The development of the tourism sector is currently supported by the World Bank through the PIDC project. The PIDC includes a tourism component which focuses on strengthening key tourism sector institutions, policies, and regulations. The activity is working on enhancing the attractiveness of the country, paving the way for a sustained effort to address the long-standing sector constraints, supporting the technical capacities of tourism firms, and upgrading some

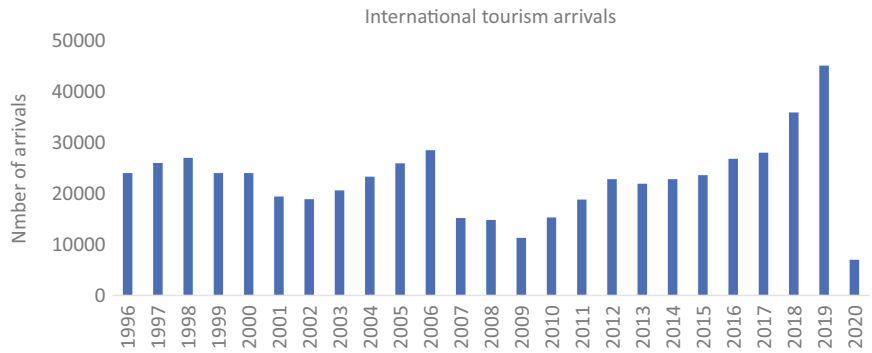
36 The BESF indicates a general lack of reliable statistics on the number of jobs and revenues deriving from tourism in Comoros.

37 This number was fairly stable from 1996 to 2017, with a decline from 2006 to 2011 due to political unrest and insecurity, spiking to 35,000 and 45,000 arrivals in 2018 and 2019, respectively, before the COVID-19 pandemic, which reduced international tourist arrivals to approximately 10,000 or less.

38 As of August 2022, these countries are Egypt, Ethiopia, Kenya, Madagascar, Mayotte, Reunion, and Tanzania.

39 These figures refer to the latest year available, namely 2011 (World Bank, 2013). As further illustrated in this chapter, the lack of updated and reliable data is a constraint for sound development of the sector.

Figure 34. Trend in the number of international tourist arrivals in the Comoros from 1996 to 2020.



Source: World Bank 2020e.

tourism sites. An emerging tourism sector may also be an opportunity for agribusiness development, as more dynamic tourism in the country, especially by foreign tourists, could increase the demand for high-quality local food products, provided that food production is able to meet international standards.

NTB, a tourism segment that includes activities and products that depend on natural resources in a wild or undeveloped form (World Bank 2020l), could develop in the Comoros by leveraging its rich natural asset base. As illustrated throughout this CEA, the "perfumed islands,"[40] as the Comoros is also called, are abundant in natural resources such as forests, coastal and marine ecosystems, and biodiversity. Ngazidja is known for caves, turtles, and the Karthala volcano (Ramsar site). Ndzuwani has the Bimbini peninsula and offers essential ingredients from the perfume industry, as well as highly valued flora and fauna such as lemurs, Livingstone's fruit bats, orchids, and tree fern. Mwali, with its national park, offers exceptional marine biodiversity and is considered the world's leading egg-laying site for sea turtles, with 30,000 per year laying eggs on 45 nesting beaches. The island and its surroundings offer mangroves, islets with nesting seabirds, humpback whales, and coral reefs with their associated species. On land, the Mlédjélé Forest of Mwali offers a habitat to endangered species such as Livingstone's fruit bat, the Eulemur mongoz lemur, and two species of endemic birds (Union des Comores et al., 2019).

Despite its potential, NTB is largely untapped. Main constraints to the development of tourism, and NBT more specifically, include the lack of waste services and sanitation, poor quality of hotel services, and inadequate and unsafe transportation infrastructure (Union des Comores 2019c). Currently, only 65 percent of all roads are paved, and roads are generally of poor quality because of lack of investments, with 80 percent in need of rehabilitation (World Food Programme 2019). Inter-island connectivity, which is specifically important for NBT, comes with safety issues resulting from unsafe boats and is hampered by high costs associated with air transportation (World Bank 2020j, 2020n). Another main hurdle hampering the development of this tourism segment is the lack of adequate port infrastructure, despite the significant (yet insufficient) efforts to improve the main port of Moroni for use as cruise terminal. Importantly, the planning and development of environmentally sustainable NBT is not adequately supported by an upstream analysis on how the sector could position itself at the local and international levels. Sufficient, updated information on current tourism performances, the impact of tourism on the country's ecosystems and biodiversity, and specific guidelines on the carrying capacity of each island are also nonexistent.

Despite the sector's performance and the need for an upstream opportunity assessment, NBT could have potential as a socioeconomic contributor, while helping preserve the rich natural resource base and strengthening climate resilience. The Comoros faces a significant competitiveness gap compared with neighboring Madagascar, Mauritius, and Seychelles, where tourism accounts for 39 percent of GDP in 2019 (World Bank 2020i) and effective marketing strategies toward luxury tourism led to a record 10 times more international tourist arrivals than the Comoros (Commission Économique pour l'Afrique 2017). Despite the sector's challenges, there is nonetheless an opportunity for the Comoros to capitalize on its rich natural endowment, providing livelihoods support and improved well-being opportunities to local communities, while protecting its natural resources,

40 The Comoros archipelago is also referred as the "perfumed islands" for their fragrant plant life and high production of ylang-ylang, valued for the perfume extracted from its flowers and its oil, which is used as a base oil for perfumes.

and ultimately contributing to the economy (Union des Comores et al., 2019). In alignment with the government's vision and ambitions, the development of NBT could represent a significant source of income for otherwise marginalized local communities and, as such, be a suitable opportunity for the Comoros to support socioeconomic growth while protecting its rich natural resource base. The development of the NBT sector could also represent a leapfrogging opportunity for the country to build resilient and low-carbon infrastructure at the core of its development, enhancing the vision of NBT development as an engine for sustainable development.

5.6.2. Government Vision

The GoC's vision and ambitions for the NBT sector are laid out in three key strategic planning documents: (1) the PCE 2030 and its flagship project, which serve as the entry point for the prioritization of accommodation developments as well as targets for the sector; (2) the National Tourism Strategy report and the accompanying Strategic Plan 2019–2035, which provide planning context and specifications with regards to governance requirements, the current offer, and promotion of the sector (Union des Comores 2019c); and (3) the Sustainable Tourism Management Plan, which is still in a draft mode and is expected to highlight the sustainable development and management principles for the sector.[41] However, these strategic planning documents are not fully aligned with one another other, making it difficult to prioritize interventions and allocate financial resources accordingly.

The PCE 2030 envisions the Comoros as a reference tourist destination in the Indian Ocean Region by 2030. Tourism is seen as the potential driving force, as it will lead to increased revenues and GDP, job creation, and livelihood diversification opportunities. Since the tourism sector encompasses many other sectors, including transportation, commerce, energy, fishing, crafts, and telecommunication, the integrated development of the tourism sector is expected to have a trickle-down effect, resulting in reduced dependence on imports and enhanced preservation of the environment. The ambition for the sector is to exceed 200,000 tourist arrivals by 2030, by having an annual growth of 15 percent per year with gradual upscaling. Focusing on NBT, the government envisions the development of a seaside resort in Ngazidja, the creation of a tourism village and agrotourism in Ndzuwai, and the development of an NBT zone around the Nioumachioua park in Mwali. To improve governance, the GoC aims to advance a favorable framework to attract private investors. The GoC's priority for the realization of the ambitions for the sector will be taking place through the PCE 2030's flagship project, "A New Tourist Bub in the Indian Ocean," 2030 (see Box 27), although the required financial resources have not been secured to start planning implementation.

In addition to the PCE 2030, the 2019 National Tourism Strategy report, supported by the Strategic Plan 2019–2035, serves as the basis for planning tourism activities (Figure 35) (Union des Comores 2019c). The strategy describes accommodations and other infrastructure to be constructed. The Strategic Plan 2019–2035 recognizes the importance of NBT, calling for the development of national parks and focusing on proper marketing around the biodiversity and endemic species of the Comoros. The 2019 National Tourism Strategy outlines the first steps toward detailed spatial development plans to be developed by the ministries responsible for tourism, finance, and environment, as well as by local authorities (Figure 36). It suggests the development of land allocation procedures and status, the location of permanent construction and the maximum authorized capacity, and eligibility for tax and financial benefits. The Maison de l'Écotourisme has been put into place as an institution that acts as a bridge for NBT development and activities. However, due to the COVID-19 pandemic, these activities of the National Tourism Strategy have not progressed. Nevertheless, specific guidelines for NBT and spatial planning to ensure activity development within a framework of environmental sustainability are still needed.

5.6.3. Opportunities for Change

Before planning and implementing infrastructural development and investments in NBT, it is critical for the Comoros to carry out an ex ante opportunity

41 The Sustainable Tourism Management Plan was developed in 2021 as part of the UNESCO project "Capacity Building in Sustainable Tourism Development and Management for World Heritage in Comoros." The project sought to strengthen the capacities of key stakeholders in Comoros and develop the Sustainable Tourism Management Plan and an implementation strategy for the promotion of the cultural sector in Comoros. Cultural and natural resources in Comoros were also mapped through the project, trainings were carried out for local tour guides in the Historic Sultanates of Comoros (UNESCO, 2021), and workshops were facilitated using the UNESCO Sustainable Tourism Toolkit (Figure 44). However, the status of the project is currently unknown, the Sustainable Tourism Management Plan has yet to be drafted, and overall results are not yet openly available.

Box 27. "A New Tourist Hub in the Indian Ocean": Flagship Project of the PCE 2030

The GoC considers the development of the tourism sector as a driving force for the transformation of the economy of the Comoros and one of the five pillars of the PCE 2030 (Union des Comores and others 2019). "A New Tourist Hub in the Indian Ocean" is the first flagship project of the PCE 2030 (Table 15).

Table 15. Description of the flagship tourism project of the PCE 2030

Project Description
"A New Tourist Hub in the Indian Ocean" is a flagship project of the PCE 2030, as tourism is the cornerstone of the emerging economy of the Comoros. The natural and cultural characteristics in each island of the Comoros will be highlighted to stimulate the tourism sector and, consequently, the economy of the Comoros by 2030.
General Estimates
1. Number of tourists in 2026: 100,000 2. Number of tourists in 2030: 200,000 3. Number of beds in 2030: More than 4,000 beds (in newly built hotels, eco-lodges, accommodations, existing hotels, and extensions to existing hotels)
Technical Description
1. Construction of three hotels (600 beds) in Ngazidja, one hotel (200 beds) in Ndzwani, and two hotels (400 beds) in Mwali 2. Construction of eco-lodges in Mwali (100 beds), Lac Salé (100 beds), Mount Tringuini (100 beds), around the Karthala volcano (100 beds), and in Chindini, Chomoni, Male, and Bouni (160 beds) 3. Construction of marina in Mitsamiouli 4. Development and sustainable management of Karthala National Park, with tourist relays and tourist site and hiking markings 5. Development of eco-tourism sites at Mwali National Park 6. Support for the development of micro-housing 7. Creation of eco-tourism relays (Mount N'Trigui) 8. Restoration of the Citadel of Ndzuwani 9. Hotel restoration (Al Amal, Sultan MAWANA hotel complex) 10. Development of agro-tourism in Ndzuwani
Total Project Cost
US$0.746 billion
Economic Information
Estimated direct revenue for 2030: US$0.259 billion, equivalent to 10 percent of GDP in 2030

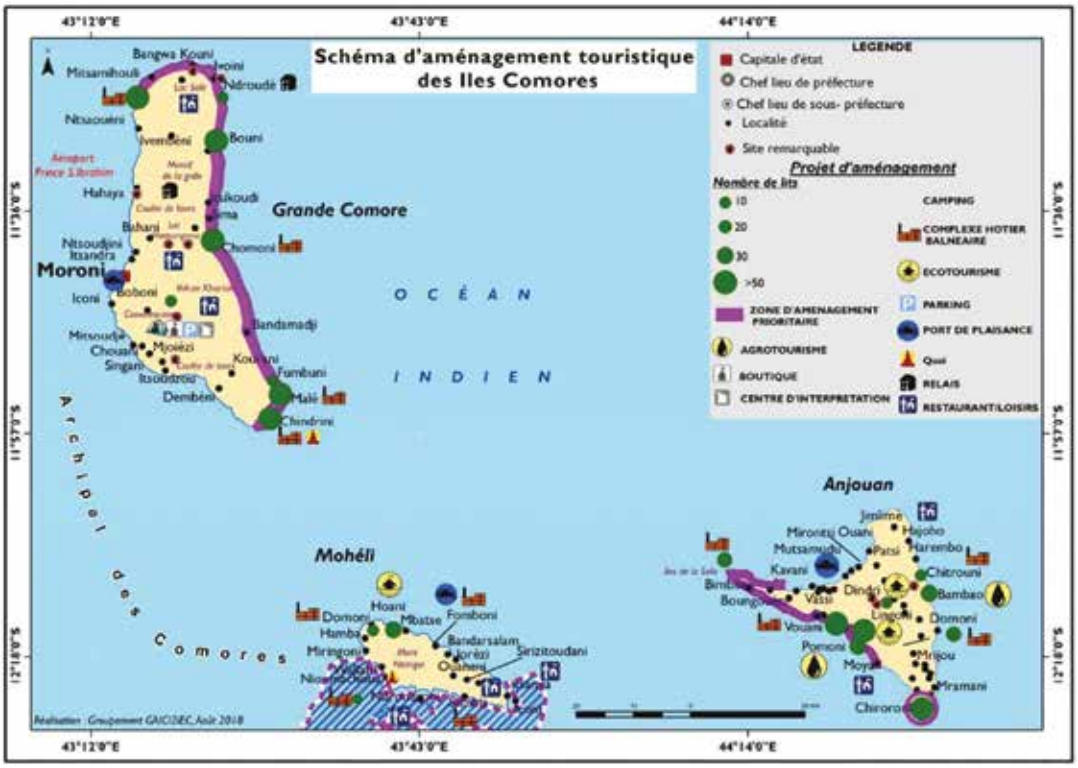
Source: Union des Comores, République Française, World Bank, and UNDP, 2019.

analysis of the sector to identify any comparative advantages of the Comoros in the tourism market and inform the country's development of its own competitive NBT offer. Acknowledging the significant competitiveness gap of the Comoros compared to neighboring tourism hot spots such as Madagascar, Mauritius, and Seychelles, it is fundamental to conduct an upstream opportunity assessment and demand analysis to better understand the demand for tourism in the Comoros and the current tourism performance, assess the real potential for NBT and if and how the subsector could position itself at the local and international levels, and decide upon the strategic direction to take. Given this framework, it would be key to update the 2013 Comoros Tourism Sector Review to provide useful insight into tourism patterns and improve understanding of tourist profiles (for example, motivation for traveling, country of origin, length of stay, and tourism receipts). Such evidence-based analytical studies and updated data are needed to inform the development of realistic and targeted NBT strategies and plans and related marketing strategies, including the improvement of air and maritime access to the archipelago and investments in accommodation facilities.

Conditional to positive results stemming from the proposed upstream opportunity assessment, the sustainability of NBT development should be ensured. Firstly, in alignment with the government's National Park Strategy, the expansion of the country's protected area would need to be formalized. In parallel, it is crucial to ensure sustainable management of the protected area through strengthened capacities of relevant institutions, improved skills in biodiversity conservation and NBT development, and enhanced biodiversity and ecosystem monitoring. Financial sustainability of protected areas is also a key enabler of sustainable management and enforcement capacities and, as such, should be taken into account. There are currently limited data on the management effectiveness of Mwali National Park, including on status of biodiversity. The availability of such data would improve the sustainability of management, provide lessons learned for the new parks to be established, and improve the overall prospects for NBT development. Finally, the development of resilient, low-carbon infrastructure would need to be placed at center stage to boost climate resilience and the prospect of sustainable development.

Protected areas could be at the core of NBT development in the Comoros as a livelihood support asset and potential engine for growth. Building on the successful results of Mwali National Park,

Figure 35. Overview of the proposed locations for tourist infrastructure of the 2019 National Tourism Strategy.

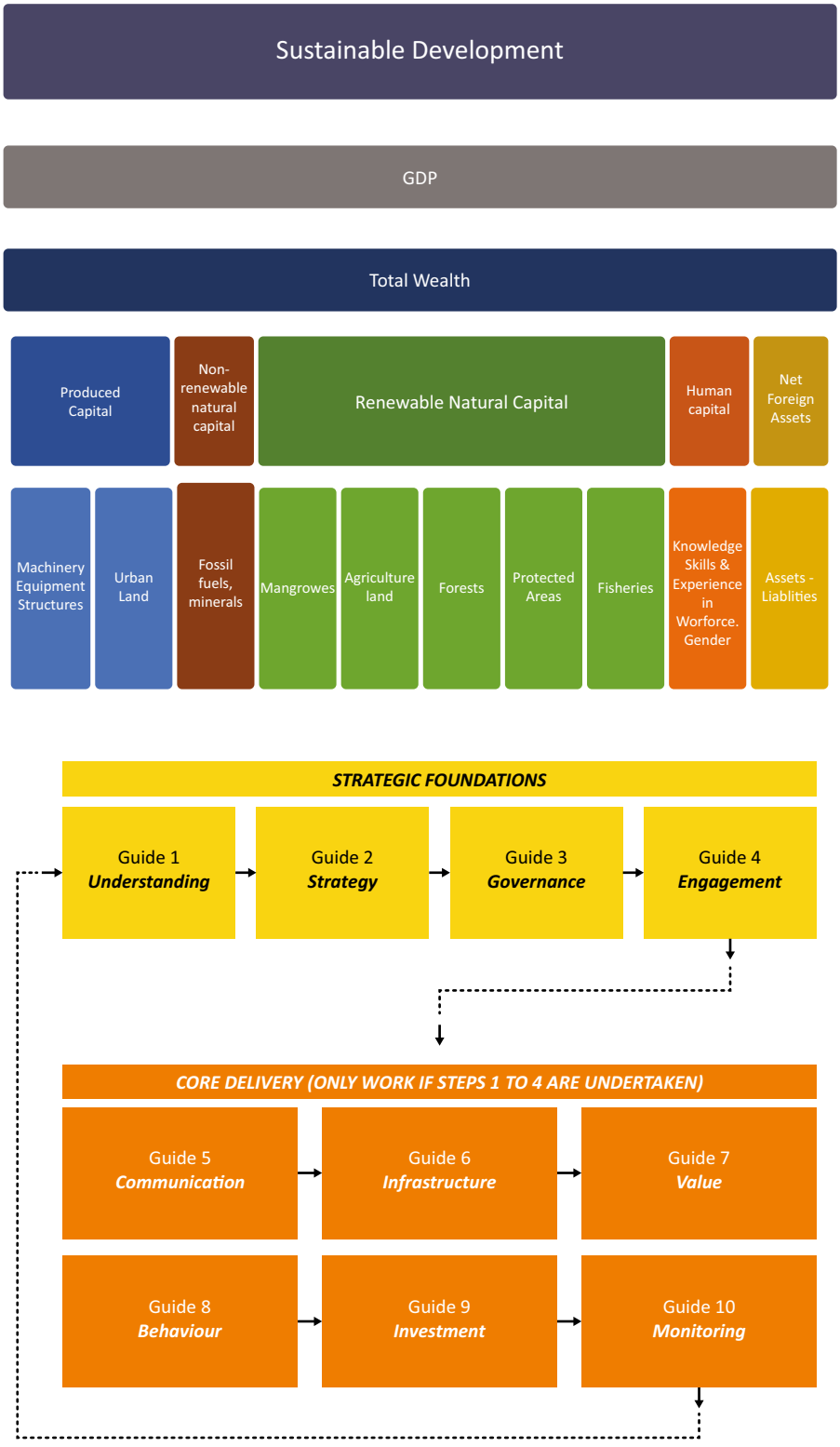


Source: Union des Comores 2019c.

under the National Park Strategy the GoC committed to expanding the protected areas system to 25 percent of the national territory, establishing an additional two terrestrial parks (Karthala National Park on Ngazidja and Mount Ntringui National Park on Ndzuwani) and three marine CAs (Coelacanth National Park in the south of Ngazidja, Mitsamiouli Ndroude National Park in northern Ngazidja, and Shissiwani National Park in Ndzuwani) managed through a community-based approach. As underlined in the Banking on Protected Areas World Bank report (World Bank 2021e), protected areas often get overlooked in economic development plans, because they are often regarded as mere conservation tools with no linkage to economic development. Yet, in a country such as the Comoros with rich natural assets, NBT revolving around protected areas could represent a cornerstone for ecosystem conservation, financial sustainability for protected areas management, economic growth, and improved well-being of local populations. Such an ambitious objective could be achieved in the Comoros by following recommendations from the Banking on Protected Areas report, namely leveraging the attractiveness of sustainably managed protected areas, ensuring the inclusiveness of decision-making processes, and establishing benefit-sharing mechanisms such as co-management agreements with local communities.

The sustainability of NBT development plans would need to be ensured through spatial planning for NBT and specific guidelines on the carrying capacity of each island. This could include, for instance, information on the maximum number of tourists that can be accommodated to avoid environmental degradation and requirements to prevent accommodations from overburdening existing infrastructure and increasing pressure on the natural resource base. This is in line with recommendations from the 2019 National Tourism Strategy (Union des Comores 2019c), which proposes that these guidelines be developed by the Ministry of Agriculture, Fisheries, Environment Tourism and Handicrafts. The spatial planning exercise and guidelines on carrying capacity would need to consider the long-term view to ensure that the natural capital remains well preserved and, as such, attractive (AMCC 2019b; General Secretary of the Presidency and General Planning Commission 2017). The long-term view would also need to include the current and potential impacts of climate change to be able to adequately plan related mitigation and adaptation measures. On the basis of such guidelines and spatial

Figure 36. Overview of components of the UNESCO sustainable tourism toolkit.



Source: UNESCO 2021.

planning analyses, implementation strategies and enforcement plans could then be envisaged and implemented at the island and local levels (Moussa Sambaouma et al., 2017).

The potential of NBT development to deliver results for the local economy hinges on the establishment of participatory approaches in the decision-making process and the establishment of benefit-sharing

mechanisms with local communities, such as co-management of protected areas. Local communities need to benefit directly from the tourism activity, not only through jobs and livelihood diversification opportunities but also through revenue-sharing arrangements and improved access to public goods (for example, schools, roads, and health clinics). Benefit sharing could include direct sharing of fees and other charges, indirect benefits from the generation of employment, and PPPs connected with tourism in protected areas. Capitalizing on the positive experience of the protected area in Mwali, the GoC should ensure involvement of local communities in upcoming protected areas, with a specific focus on youth and women, given that they have the highest unemployment rates. Mobilizing and involving local communities in NBT development plans and opportunities would also contribute to reducing potential social tensions due to controlled use of natural resources and support behavioral change toward the natural asset on which revenue generation and overall wellbeing is based. Awareness raising and capacity building on the benefits of protecting the natural assets and leveraging sustainably its revenue potential would also be needed for local populations to ensure understanding and incentivize participation.

The future of NBT development in the Comoros strongly depends on the availability of appropriate transportation infrastructure on and between islands and at the national level. In line with both the flagship and structuring projects of the PCE 2030, the GoC aims to improve roads, ports, and airports and introduce ferries (Union des Comores 2019a; Union des Comores et al., 2019), with a special focus on investing in safe and fast inter-island transportation. The PCE 2030's "Unifying the Islands by Sea" flagship project foresees the development of an inter-island ferry service, which requires both the development of technical capacity and investments in equipment. It will be crucial to ensure that these plans are designed and implemented within a context of socioenvironmental sustainability.

Accelerated progress in drinking water management, safe sanitation, and waste management is also a key requirement for increasing the prospects of NBT development. Waste and sanitation infrastructure and management of freshwater resources are required to safely and adequately accommodate tourists while avoiding increasing pressure on the country's natural resource base. Accommodations should either be connected to the existing and planned water, sanitation, waste, and energy infrastructure or envisaged to be self-sufficient through, for instance, solar power for energy generation. Circular approaches to waste and sanitation management could be envisaged to support sustainability innovatively while attracting the high-end tourism segment.

Box 28. EU Tourism Co-management Project for Improved Local Livelihoods

Co-management of tourism bungalows has been implemented in villages on Mwali in a project financed by the EU as part of the Programme Pluriannuel de Micro Réalisations (2000–2006). In this €4.4 million project, the local community constructed and co-managed bungalows for tourism. All employees at the bungalows were local volunteers who were elected democratically on an annual basis. Tourists who stayed at the local bungalows could make a positive impact through local revenue generation that was invested in scholarship grants and improvements to health centers. However, following the cyclone in 2019, only one bungalow remained operational, at Itsamia village. Given that the community bungalows were considered successful and beneficial for local investments, similar projects focusing on reinvesting part of the revenue in local villages could be considered in other nature-based touristic areas.

For the Comoros to leapfrog the competitiveness gap in tourism with neighboring countries, a sustainability certificate for hotels and accommodations could be envisaged and the "Vanilla Islands"[42] concept could be leveraged. The certificate aligns with the ambitions laid out in the 2019 National Tourism Strategy report and could mainstream sustainability practices in the country's hotel business, benefiting both the tourism sector and the ecosystem. According to the 2019 National Tourism Strategy report, this certificate should be designed and managed by the Maison de l'Ecotourisme (Union des Comores 2019c). The Sustainable Tourism Label (SSTL)[43] has already

42 The Vanilla Islands is a regional cooperation aiming to promote tourism in Comoros, Madagascar, Mauritius, Mayotte, Reunion, and Seychelles. Vanilla is the common asset of these island nations. More information can be found at https://www.vanilla-islands.org/.

43 The SSTL is a sustainable tourism management and certification program designed specifically for use in Seychelles. It is voluntary, user-friendly, and designed to inspire more efficient and sustainable ways of doing business.

been adopted successfully by Seychelles, which could be used as a reference point in support of the design of the program and establishment of criteria[44] for earning the certificate. To successfully implement the certificate, financial support and technical capacity development would need to be provided to enable the hotels to comply with the requirements. In parallel, the Comoros could leverage the "Vanilla Islands" concept by enhancing marketing and branding opportunities and benefiting from improved integration with the regional tourism market, which currently focuses on neighboring Madagascar, Mauritius, Mayotte, Reunion, and Seychelles. The sustainable expansion of the port at Moroni would have to be prioritized to facilitate cruiseship stopovers and would need to be done within the framework of socioenvironmental sustainability.

Finally, NBT development needs to be embedded in a sound and effective institutional framework. Currently, the PCE 2030, the National Tourism Strategy report, and the Strategic Plan 2019–2025 are not fully aligned. Therefore, it would be crucial for the GoC to increase coordination between these strategic documents to ensure a common strategic direction, effective prioritization of interventions, and adequate financial resource allocation.

5.6.4. The Way Forward

- **Conduct an upstream opportunity analysis and data gap analysis to understand the demand for NBT, its potential, and the best-suited market for NBT as a prerequisite to development of sector strategies and plans.** This should include updating the 2013 Comoros Tourism Sector Review to provide an evidence-based understanding of how the Comoros could position itself in the NBT market. *Conditional to positive results stemming from the above analysis, the following are suggested*:
  - **Value the key role of sustainably managed protected areas as effective conservation tools but also as livelihood support assets and potential engines of growth through NBT.** The Comoros would need to formalize the expansion of the country's protected area cover in alignment with the government's National Park Strategy, ensure sustainable management, adequate biodiversity, and ecosystem monitoring, and envision mechanisms that may ensure financial sustainability.
  - **Improve data availability and monitoring on biodiversity and ecosystems in protected areas.** Regular assessments of the status of biodiversity and ecosystems in protected areas are recommended to inform the shaping of policies, improve NBT services, assist local communities effectively, and ensure proper conservation of the natural capital of the Comoros.
  - **Adopt specific guidelines on the carrying capacity of each island to ensure that NBT planning and development are sustainable.** The carrying-capacity guidelines would need to consider the long-term view to ensure that the natural capital remains well preserved and, as such, attractive.
  - **Ensure participatory approaches in decision-making processes, upscale co-management opportunities, and ensure the establishment of benefit-sharing mechanisms with local communities.** Successful co-management pilots such as the community bungalows established in Mwali National Park ensure local benefit sharing of tourism revenues and provide an incentive for behavioral change of local communities toward the value of environmental conservation. Awareness raising and capacity building on sustainable tourism management and the benefits of environmental conservation are also recommended to ensure understanding and incentivize participation.
  - **Develop safe and sustainable transportation infrastructure, ensuring that plans are designed and implemented within a context of socioenvironmental sustainability.** Many infrastructural improvements are required to facilitate NBT development, including for tourist transportation on and between islands. As inter-island transportation is currently unsafe and/or costly, priority should be given to the development of a ferry service, as proposed in the PCE 2030 flagship project "Unifying the Islands by Sea."
  - **The development of the NBT sector needs to be supported by accelerated progress in drinking water management, safe sanitation, and waste management.** The development of waste and sanitation infrastructure and the management of

44 SSTL criteria could include systemic sustainable management of health and safety; waste reduction, recycling, and circularity; reducing the amount of fresh water used through rainwater collection, water reuse, and recycling; reducing energy expenditure; fair treatment of staff and providing opportunities to local people; conservation by making a positive contribution to the local community and conservation initiatives; receiving and displaying gestures of recognition by the community for conservation practices; and recognition of guest satisfaction with the sustainability of the business.

freshwater resources are required to safely and adequately accommodate tourists, while avoiding increasing pressures on the environment.

- **Leverage existing regional opportunities to improve branding of the Comoros as a tourism destination.** This may include developing a sustainability certificate for accommodations and promoting the "Vanilla Islands" concept used by neighboring tourism hot spots like Mauritius, Madagascar, and Seychelles. The sustainability certificate, which could follow the criteria identified by the Seychelles SSTL, could increase the attractiveness of the NBT offer while contributing to conservation of the natural resource assets on which the offer would be based.
- **Ensure alignment between government strategy documents for the sustainable achievement of the GoC's ambitions for the NBT sector.** This would include supporting alignment of the PCE 2030 with the National Tourism Strategy report and Strategic Plan 2019–2025. The draft Sustainable Tourism Management Plan should be aligned with the previously mentioned strategies, finalized, and adopted.

6. Looking Ahead

The Comoros has abundant and valuable but fragile natural resources on which the Comorian people are greatly dependent for their livelihoods. The sustainable potential of this natural resource base is not fully harnessed and could contribute much more to economic development if properly managed. Agriculture and fisheries are key for the Comoros economy as well as for Comorians' food and nutrition security. Forests are important habitats and an essential source of livelihood for rural communities. The country's coastal and marine ecosystems provide not only protection to the islands from extreme meteorological events but also harbor rich biodiversity that sustain the livelihoods of coastal communities. The tourism sector, which holds great promise for diversification and structural transformation of the economy, is heavily dependent on the Comoros natural resource base.

The main challenges related to the sustainable exploitation of the country's natural resource base include low enforcement capacity, poor governance, and inadequate financing. Enforcement capacity at all governmental levels is needed, especially given that environmental challenges such as overexploitation, deforestation, soil and coastal erosion, water degradation, and waste management are closely interlinked. Although a decentralization framework is in place, the devolution of competencies and associated financial resources is not yet clear, exacerbating a disconnect between the State and local traditional authorities. A chronic lack of financing at all governmental levels makes the country dependent on international donors for the implementation and enforcement of environmental laws and regulations.

The Government of the Union of the Comoros (GoC) acknowledges the pivotal role of a healthy natural resource base for the development prospects of the country. In this regard, important institutional frameworks are in place such as the (soon to be) updated National Environmental Policy (PNE) and Framework Law of the Environment (FLE). Attention to the environment is also outlined in the Comoros Emerging Plan (PCE) 2030, which envisions strong, inclusive, and equitable growth of the emerging economy without compromising natural resources and the environment. Three pillars of the PCE 2030 are relevant for this country environmental analysis (CEA): (1) modernized agriculture for food security, (2) an established blue economy, and (3) tourism and entrepreneurship. Against this backdrop, to avoid fragmentation, it is crucial that any new program or project be aligned with the PCE 2030.

The PCE 2030 lays the foundation for the structural transformation of the national economy by improving drinking water, sanitation, and water resource management. In addition, the objective of the 2018 Blue Economy Strategic Framework (BESF) is to integrate the Comorian maritime space and resources into a long-term sustainable socioeconomic development policy. Implementation of the BESF must be achieved through the accompanying action plan. In addition, in its nationally determined contribution (NDC), the GoC pledges to reduce its net greenhouse gas (GHG) emissions by approximately 23 percent in 2030 (excluding LUCF), comprising USD 1,005 million for mitigation measures and US$445 million for adaptation measures. On the international donor side, the World Bank's Country Partnership Framework (CPF) 2020–2024 has on two focus areas: (1) crisis response and building resilience and (2) economic recovery and inclusive growth. All key recommendations in this chapter aim to bring the implementation of the above-mentioned institutional frameworks to the next level, with the PCE 2030 as the lead program.

To trigger effective, deep, and lasting changes, it is key for the Comoros to adopt an integrated approach to natural resource management, addressing issues at the landscape scale, promoting sustainable fisheries and marine and coastal management, and

advancing integrated waste management. In this way, the country will be able to optimize the development of each sector without compromising the others in the process and can capitalize on the interactions between the core elements of its natural capital and the ecosystem services they produce. This integrated approach requires a participatory and inclusive process that places local communities at the core of the government's action. Special focus should be accorded to the poor and vulnerable, whose livelihoods are highly dependent on natural resources and thus under growing threat from disasters, the impacts of degraded ecosystems, and climate change. Additionally, for an effective integrated natural resource management, the Comoros would need to adopt a long-term perspective to ensure lasting impact, foster local ownership of the initiative, and enhance the commitment to continue investing in these efforts.

This CEA presents five key recommendations to support the country in this sustainable, inclusive, and climate-resilient development. For every recommendation, the connections with the institutional framework are explained.

The following enabling conditions are relevant for all key recommendations:

- **Organize capacity building at all levels** (ministries, regional directorates, municipalities) with technical and governance assistance. Focus specifically on the integrated nature of both the opportunities and challenges related to sustainable management of upland, lowland, and coastal and marine resources.
- **Pay particular attention to inclusiveness,** engaging locally based nongovernmental organizations (NGOs) and associations, local communities, young people, women, and the diaspora.
- **Assess financing mechanisms such as international donors and public-private partnerships (PPPs) for each recommendation**, and identify entry points to increase private sector engagement.
- **Focus on longer-term projects (greater than five years), and use phased approaches.** Each project should build on the results and lessons learned from previous projects, and planning for the continuation of results following project completion is essential.
- **Focus on economic diversification and development of entrepreneurship skills** in each program or project to ensure sustainable alternative livelihoods beyond the project.
- **Strengthen data collection and gap analysis.** The lack of adequate data on major natural resource management issues is a key constraint for the development of effective evidence-based policies and strategies and prioritization of interventions.

Recommendation 1: Strengthen Environmental Governance and Support Institutional Capacity

This recommendation aligns with the Strategic Framework for a National Policy on the Blue Economy (BESF) (adapting the institutional framework) and Country Partnership Framework (CPF) focus area 2 (improving governance).

- **Strengthen the capacity of general and regional directorates to fulfill their mandate by mobilizing human, technical, and financial resources**. Develop targeted continuous professional development programs for technical staff at different levels as well as capacity building for other stakeholders. Carry out a human resource needs assessment to ascertain the specific level of support needed for the directorates to carry out their functions and increase service delivery. Align environmental expenditure with priorities and use results-based agreements to improve effectiveness and efficiency in the use of public resources. The Comoros may benefit from a dedicated environmental expenditure review to provide more clarity on the specific challenges and needs in each sector.
- **Approve the updated FLE and PNE to upgrade environmental priorities, incorporate emerging issues and lessons learned, and facilitate the implementation of ambitious environmental management objectives.** Accompany the updates with a monitoring system that allows tracking of the implementation of the FLE and PNE. Environmental monitoring systems to evaluate the implementation of environmental law, policies, and programs can help inform decision-making in a variety of aspects, from program performance management to the setting of environmental priorities. Ensure access to collected data and associated analyses to strengthen transparency and accountability from environmental institutions.
- **Boost law enforcement capacity with targeted livelihood support and community empowerment programs.** Strengthen enforcement capacity of laws related to key environmental challenges such as overexploitation, deforestation, pollution, water

supply, and illegal, unreported, and unregulated (IUU) fishing. Dedicate targeted efforts to enhance law enforcement capacity by providing human, technical, and financial resources for the implementation of environmental and natural resource regulations and policies. Enforcement needs to be coupled with a co-management approach that involves and empowers local communities in the management of natural resources and livelihoods. Co-management creates a framework for dialogue and consultation among the various stakeholders concerned about the exploitation of natural resources. The involvement of local communities in the decision-making process ensures more effective implementation and enforcement of the management measures that are adopted.

- **Ensure that the environmental implications of projects and actions are taken into account by the Government of the Union of the Comoros (GoC) before the decisions are made.** Enhance the technical capacity of enviornmental institutions to evaluate the environmental impacts of a proposed project or development plan, taking into account both the beneficial and adverse socioeconomic and human health impacts. Update the environmental impact assessment (EIA) regulatory framework and management system by (1) strengthening the capacity of the EIA committee, (2) enhancing the capacity of the EIA unit and monitor the implementation of management plans, (3) reviewing and approving existing and new EIA sectoral guidelines, (4) establishing a transparent environmental management information system, and (5) operationalizing a dedicated financial system. Develop and strengthen the institutional capacity for Strategic Environmental and Social Assessment (SESA) implementation.

Recommendation 2: Promote Sustainable Land, Forest, and Water Management

This recommendation aligns with the PCE 2030 (modern agriculture for food security), the Accelerated Growth and Sustainable Development Strategy (SCA2D) (mobilize, protect, and monitor water resources), the BESF (protect coastal aquatic and marine ecosystems), and CPF focus areas 1 and 2 (resilience and inclusive growth).

- **Adopt an integrated landscape approach** to promote sustainable use and conservation in an equitable manner, enabling the country to maximize productivity, improve livelihoods, enhance natural capital while reducing negative environmental impacts, and generate co-benefits such as jobs and income opportunities, reducing widespread poverty, and fostering synergies between mitigation and adaptation in the country.
- **Develop and implement land-use plans for Ngazidja and Ndzuwani to protect the natural forest resources and stimulate reforestation**. Apply a zoning approach to identify the usage for different zones, including agriculture, agroforestry, protected dry forests, and natural forests in national parks. Support the Mwali Land Use Plan that is currently being developed and build on the same zoning approach. Combine this strategy with an integrated landscape approach to ensure that all activities in the area work in complementarity and that each specific zone is used for the purpose for which it is designed. Ensure consistency and exchange of data and information between the three land-use plans to stimulate cooperation and efficient use of funding.
- **Promote reforestation and soil fertility and strengthen climate-resilient Integrated Water Resource Management (IWRM).** Conduct reforestation by planting native trees that offer economic benefits and opportunities to diversify incomes for local communities. Reestablish soil fertility and soil health and improve the yields of food crops that are essential for food security on low-lying plots where soil fertility was lost because of unsustainable agricultural practices. IWRM should focus on (1) the identification and prioritization of green and grey infrastructure, for example, to transition from rain-fed agriculture to irrigation; 2) watershed protection and restoration as one of the most effective solutions to improve water retention, increase dry season flows, and reduce storm erosion; and (3) the integration of groundwater sources within more holistic water management frameworks.
- **Upscale the simplification and decentralization of the land tenure regime to enhance legal certainty and strengthen social cohesion while ensuring transparency.** Ensure that the adjusted regime operates at the municipality level while leaving the established village land committees and the cadi in charge of customary and religious rights. The decentralization of tenure securitization should be envisaged in the short term but requires capacity building of technical staff as well as funding. Reduce the cost of land registration to create incentives to use land productively and invest in long-term land conservation.
- **Protect terrestrial, coastal, and marine ecosystems and biodiversity.** Officially operationalize

the five additional national parks proposed under the National Park Strategy adopted in 2017 and the National Protected Areas System Law adopted in December 2018.[45] Adopt a participatory co-management approach in the parks with a central role for local communities, capitalizing on the successful experience of Mwali National Park. Empower the Agency of National Parks with adequate technical assistance and financial support.

- **Reduce rural communities' vulnerability to the impacts of climate change and improve sustainable and climate-resilient agricultural capabilities.** Establish a climate-resilient agriculture plan, building on successful projects such as the Global Climate Change Alliance (AMCC), Enhancing Adaptive Capacity for Increased Resilience to Climate Change in the Agricultural Sector (CRCCA), and Family Farming Productivity and Resilience Support Project (PREFER). Improve the irrigation system as part of the Agriculture Plan. Develop a sustainable irrigation strategy that includes investments in nature-based solutions such as natural water retention measures. In line with the revised NDC (2021), strengthen the resilience of the agricultural sector to extended periods of drought and reduced rainfall and improve response readiness against increased risk of forest fires and reduced water availability. This could include providing access to irrigation and increasing sponge functioning specifically in the upland areas, but also in the lowland areas where possible, depending on the topography and soil characteristics of the terrain. Involve local communities from the start and focus on co-management of water resources while establishing sustainable irrigation and natural water retention measures. Integrate climate-smart training for farmers into the Agriculture Plan to increase the sector's resilience against the effects of climate change and improve yields and soil fertility.
- **Scale up water, sanitation, and hygiene (WASH) programs and increase investments in sanitation infrastructure to ensure improved drinking water quality and higher sanitation standards and to increase access to sanitation services in both rural and urban areas.** The Comoros has higher mortality rates than its neighboring countries because of unsafe WASH, and the percentage of Comorians with access to sanitation services lags far behind the world average. Urgent efforts are needed to address this situation.

45 The decrees of the two terrestrial and three coastal and marine national parks are pending signature.

Recommendation 3: Promote Sustainable Fisheries and Integrated Marine and Coastal Management

This recommendation aligns with the PCE 2030 (Blue Economy), BESF (enhancement of key sectors, protect coastal aquatic and marine ecosystems, adapting the institutional framework and regional cooperation), the NDC (mitigation and adaptation measures), and CPF focus area 2 (inclusive growth).

- **Support the development of a sustainable fisheries strategy.** Ensure consistency among fishery decrees to address related key challenges such as sustainable fisheries, IUU fishing, international/regional cooperation, and co-management of coastal and marine resources, providing livelihoods support to ensure effective management. Include a fisheries management plan in the strategy, where science and research on the status of fish stocks inform decision-making. Ensure that the fisheries management plan is built on an assessment of coastal and marine resources,[46] fisheries, and key issues in fisheries. The results from South West Indian Ocean Fisheries Governance and Shared Growth Project (SWIOFish1) can be used as a stepping stone to develop the fisheries management plan. Combine co-management efforts with capacity building at multiple levels, while strengthening fishery unions and associations with a train-the-trainer approach. Improve the sustainability of fisheries via trainings and investment, including sustainable fishing gears, product development, the use of fish aggregating devices, the use of safety equipment, engine repair, troubleshooting, conservation of fish, and the use of ice machines.
- **Intensify efforts to combat IUU fishing.** The Comoros needs to be enabled to sanction IUU fishing, at the industrial but most especially at the small-scale level, given the evidenced large impact of artisanal illegal fishing on coastal fisheries and the ecosystem more broadly. IUU fishing in the small-scale segment can be addressed by building on SWIOFish1 achievements and integrating lessons learned, including by training the staff of unions, associations, and cooperatives who can, in turn, train fishers. For the industrial segment, the Comoros should have its own IUU register, for example, building to the Indian Ocean Tuna Commission (IOTC) IUU vessel list, as well as procedures to quickly address IUU events when they are identified. Better participation

46 Effective management could be guided by, for example, improved availability of data on the status of stocks and catch and effort, rapid assessments, and gear selectivity studies.

in international and regional coordination efforts would also support efforts against IUU fishing and potentially offer opportunities to mobilize resources.

- **Protect and sustainably manage coastal zones and reduce the impacts of climate change.** Develop an Integrated Coastal Management Plan (ICMP) and Blue Economy Roadmap (BER) and support the Marine Spatial Plan in one integrated process. Identify management objectives, measures, actions, and opportunities. Involve relevant stakeholders from the beginning to co-create the BER and increase awareness, as well as to provide a higher degree of legitimacy. Support the Marine Spatial Plan initiated by the General Planning Commissioner, with technical and financial assistance from IOC-UNESCO beginning in November 2021. Assess interactions between maritime sectors, improve the compatibility of maritime socioeconomic activities with the carrying capacity of marine resources, and prevent conflicts between sectors and enhance their synergies.
- **Support the Blue Economy Committee** as the main beneficiary of the ICMP and BER. The committee was established after the completion of the BESF and provides an opportunity to operationalize the blue economy by building upon an existing institution. Arrange structural and long-term funding for the committee. The roles and responsibilities of the committee, such as the coordination of blue economy activities, need to become clear through statutes and a mandate, formalized in a new decree. The committee members need to be trained to fully grasp the interactions between the socioeconomic, environmental, and institutional dimensions of the blue economy paradigm. The committee can benefit from governmental organizations of other island states working with the concept of a blue economy, for example, the Indian Ocean Commission, the Blue Economy Working Group of the Indian Ocean Rim Association, the Western Indian Ocean Marine Science Association, and the Nairobi Convention. Countries to learn from include Seychelles and Cape Verde. Twinning projects could be initiated with these organizations and/or countries.[47]
- **Promote the protection and restoration of mangroves and nature-based flood defense.** Conduct a study on the current extent and status of the mangroves, their ability to attenuate waves, the potential to improve their role in flood protection through restoration efforts, their function as spawning areas, and their blue carbon offsetting potential. Accompany protection and restoration efforts with capacity building and awareness raising among local communities, especially about the damages of harvesting mangroves for firewood and construction activities.
- **Develop coral reef restoration projects** by providing technical and governance assistance to the Ministry of Agriculture, Fisheries, Environment, Tourism, and Handicrafts. The Comorian NFP for the GCF[48] also needs assistance in the development of coral reef restoration projects, possibly under the Global Fund for Coral Reefs Investment Window. Invest in strengthening adaptive capacity, reducing exposure to climate risks, increasing reef resilience from the reduction of local stressors, and protecting and restoring reefs. Ensure that projects are based on co-management principles and include capacity building on sustainable fishing practices to reduce pressures on the reef.

Recommendation 4: Invest in Integrated Solid Waste Management

This recommendation aligns with the PCE 2030 (structuring project on integrated waste management) and SCA2D (promote sanitation to raise the level of hygiene).

- **Support the implementation of the PCE 2030 structuring project "Integrated (Solid) Waste Management."** Set up an implementation roadmap for infrastructural development, taking into account the implementation capacities of national, regional, and local governments, as well as societal parties. Provide structural financing to the National Agency for Integrated Waste Management (ANAGID) and raise public awareness on preventing solid waste generation in the first place.
- **Invest in services and infrastructure capable of ensuring adequate waste collection, recycling, and disposal**. Expand and enhance waste collection services to households that are not yet covered, minimize collection losses, and increase voluntary, community-based collection points, including those for recyclable materials ("waste banks"). This process will significantly reduce harmful waste-handling practices such as open burning of plastic waste and result in positive spillover effects on public health and the environment. Improve recycling by setting up recycling, biodigesters, and composting

47 Twinning projects bring together public sector expertise from two or more countries with the aim of achieving operational results through peer-to-peer activities (derived from https://bit.ly/3vWZVCo).

48 National Focal Point for the Green Climate Fund.

platforms. Finalize the landfill sites already identified in the PCE 2030 and identify new final waste storage sites.

- **Reduce the generation of solid waste by incentivizing designs for reuse and using alternative materials**. To facilitate this process, carry out a life-cycle assessment of the most problematic waste products, particularly those with higher potential for reuse and recycling, followed by a feasibility study for policy and regulatory options to increase circularity (for example, market-based instruments to restrict, substitute, or incentivize reuse of plastic items).
- **Promote composting to reduce the volume of residual organic waste and increase benefits for farmers**. High-quality compost has the advantage that it can be sold to farmers as a biofertilizer, to reduce air and water pollution, lower operational costs, and increase income generation.
- **Raise awareness on waste-related risks and opportunities, in particular the prevention of solid waste generation and sorting at source.** Communication campaigns, awareness-raising events, and capacity building should be planned to promote behavior change by all stakeholders involved.
- **Improve private sector participation in waste management.** Promote dialogue with the private sector, implement a waste-collection fee, and identify specific PPPs in Comoros cities.
- **Improve data collection and analysis**. To develop effective and sustainable integrated solid waste management (ISWM) policies, it is crucial for the GoC to conduct in-depth, sound studies on cost recovery and sustainability aspects, as well as to quantify the environmental and public health footprint of waste in both rural and urban areas. Assessment of the potential impact of tourism-sector development on waste management in the country is also essential. Implementing such studies would be instrumental for the Comoros to close the gap through informed decision-making across all aspects of ISWM.
- **Support the development of comprehensive legislation and help define the institutional framework for solid waste management.** Adopting specific laws and reforms rooted in an overall vision for solid waste treatment is essential for the country. In addition, it would be extremely beneficial to clarify roles and responsibilities between municipalities and central government to address the gaps resulting from the incomplete decentralization process. In addition, ANAGID should be provided with the required funding and vision to implement its mandate.

Recommendation 5: Promote Nature-Based Tourism

This recommendation aligns with the PCE 2030 (tourism), BESF (enhancement of key sectors), and CPF's focus area 2 (inclusive growth and improving connectivity).

- **Develop upstream opportunity assessments and demand analyses to close the data gap and clarify a realistic market space for NBT in the Comoros.** Filling this data gap would be a prerequisite to the development of strategies and plans. This should include updating the 2013 Comoros Tourism Sector Review to provide evidence-based understanding of the Comoros NBT sector's effective potential as a growth driver for the country.
- **Place natural endowments and biodiversity at the core of the future of the Comoros NTB sector by conceiving of protected areas not only as a conservation tool but also as a livelihood support asset and potential engine of growth.** Expand the protected areas coverage in alignment with the government's National Park Strategy. Ensure the sustainable management of the protected areas, strengthening the capacities of relevant institutions, building skills in biodiversity conservation, and monitoring of NBT development, biodiversity, and ecosystems. Ensure financial sustainability for effective management and enforcement. Develop specific guidelines on the carrying capacity of each island to ensure that it is not exceeded, and data gaps should be filled on tourism performance and potential.
- **Ensure that NTB is upheld by participatory approaches in the decision-making process and by the establishment of benefit-sharing mechanisms with local communities.** Ensure Comorians can benefit directly from the tourism activity, not only through jobs and livelihood diversification opportunities but also through revenue-sharing arrangements and improved access to public goods such as schools, roads, and health clinics. It is especially important to involve youth and women, who experience the highest unemployment rates. Conduct awareness-raising and capacity-building activities on the benefits of protecting natural assets to ensure understanding and incentivize participation.
- **Conduct assessments and data gap analyses on tourism potential and performance to inform policies, improve tourist services, assist local communities, and refine the tourism business model.**

Update the 2013 Comoros Tourism Sector Review to regularly conduct assessments of the impacts of NBT on protected areas and conduct in-depth monitoring of the status of biodiversity in the country.

- **Develop safe and sustainable transportation infrastructure, ensuring that such plans are designed and implemented within a context of socioenvironmental sustainability.** Many infrastructural improvements are required to facilitate NBT development, including tourist transportation on and between islands as envisioned by the PCE 2030 flagship project "Unifying the Islands by Sea."
- **Develop a sustainability certificate for future construction of accommodations.** Such a measure has the potential to enhance the country's attractiveness within the international tourism market, while providing a significant opportunity to develop the sector sustainably.
- **Align the draft Sustainable Tourism Master Plan with the National Tourism Strategy report and Strategic Plan 2019–2025 to ensure the sustainable realization of the GoC's ambitions for the NBT sector.** The impact of NBT on freshwater resources, ecosystems, and biodiversity should be considered while the country is developing the sector.

7. Conclusions

The outcomes of this country environmental analysis (CEA) call for transformative changes toward sustainable management of natural resources to achieve long-term poverty alleviation and resilience. In this regard, an integrated approach to natural resource management will be key to maximize the benefits stemming from interactions between the different core elements of the country's natural capital.

To support the country's sustainable and climate-resilient development, this CEA has identified five macro recommendations, as explained in chapter 6: (1) strengthen environmental governance and support institutional capacity, (2) promote sustainable land, forest, and water management through an integrated landscape approach, (3) promote sustainable fisheries and integrated marine and coastal management, (4) invest in integrated solid waste management (ISWM), and (5) promote nature-based tourism (NBT). To achieve these goals, the Comoros would benefit significantly from adopting a co-management approach whenever possible, increasing local inclusiveness in decision-making processes, establishing benefit-sharing and women's empowerment mechanisms, and raising awareness among local populations about the main environmental challenges and opportunities. In addition, this CEA made the case for strengthening the decentralization agenda as envisioned under the 2018 constitution by clarifying the distribution of roles and tasks between local and central natural resource management institutions to avoid repetition, foster synergies, and ultimately improve efficiency in fulfilling their mandate.

The implementation of the recommendations articulated in this CEA can benefit highly from programs and pilot projects that have already been successfully implemented in the Comoros and, as such, could be used as justification for the country to invest in these efforts from pilot to scale through an integrated approach among sectors. Several existing opportunities could be leveraged in the short term to lay the foundation for the medium–long-term vision revolving around the five macro recommendations described above. For instance, the Comoros could build on the lessons learned from the World Bank's Integrated Development and Competitiveness Project (PIDC) project to further enhance domestic value chains in agriculture and livestock sectors or on the results of the South West Indian Ocean Fisheries Governance and Shared Growth Project (SWIOFish) to improve fisheries management. Successful projects such as Enhancing Adaptive Capacity for Increased Resilience to Climate Change in the Agricultural Sector (CRCCA) or the Family Farming Productivity and Resilience Support Project (PREFER) could also be replicated to spur a transition to sustainable land use. The Comoros could scale up the positive experience of Mwali National Park for biodiversity and ecosystem conservation and as a basis for the possible development of NBT. Replicating or scaling up such successful initiatives, as well as coordinating with donors and other countries in the region facing similar challenges, would allow the Comoros to take some concrete and actionable steps to pave the way for structural and lasting changes in natural asset management.

For this approach to be effective, it needs to be combined with a corresponding effort to strengthen data collection and data gap analyses. As clearly emerged from this CEA, the lack of adequate data and well-designed studies in the Comoros on major natural resource management issues often represents a significant constraint for the country to develop evidenced-based policies and strategies and intervention prioritization. For instance, it is critical that the Comoros improve forest inventories, data collection, and site monitoring to better understand the ecological functions of trees at the landscape scale in the country. It is also essential to conduct a vulnerability and risk assessment for all water sources to improve water resource management, especially hydro-climatic resilience, and inform island-level master plans and investment programs. Additional study of

the scale of illegal industrial fishing in the Comoros and the degree of coastal and marine degradation is also needed. Filling these existing gaps would enable the adoption of effective and targeted measures to halt and revert these trends. The Comoros could effectively move toward achieving such objectives by leveraging the recently approved World Bank PROBLUE grant and the ongoing World Bank Coastal Risk Assessment from the Post-Kenneth Project. For the NBT sector, bridging the data gaps, for instance, by updating the 2013 Comoros Tourism Sector Review, is particularly important, as in-depth analyses of the comparative advantages of the Comoros and the potential demand for tourism are key prerequisites for the development of tourism strategies and plans.

The above-mentioned initiatives, if coherently planned and agreed upon with the Government of the Comoros, represent an opportunity to strategically lay the groundwork in the short term and start planning the next steps to support the Comoros along its sustainable and climate-resilient development path.

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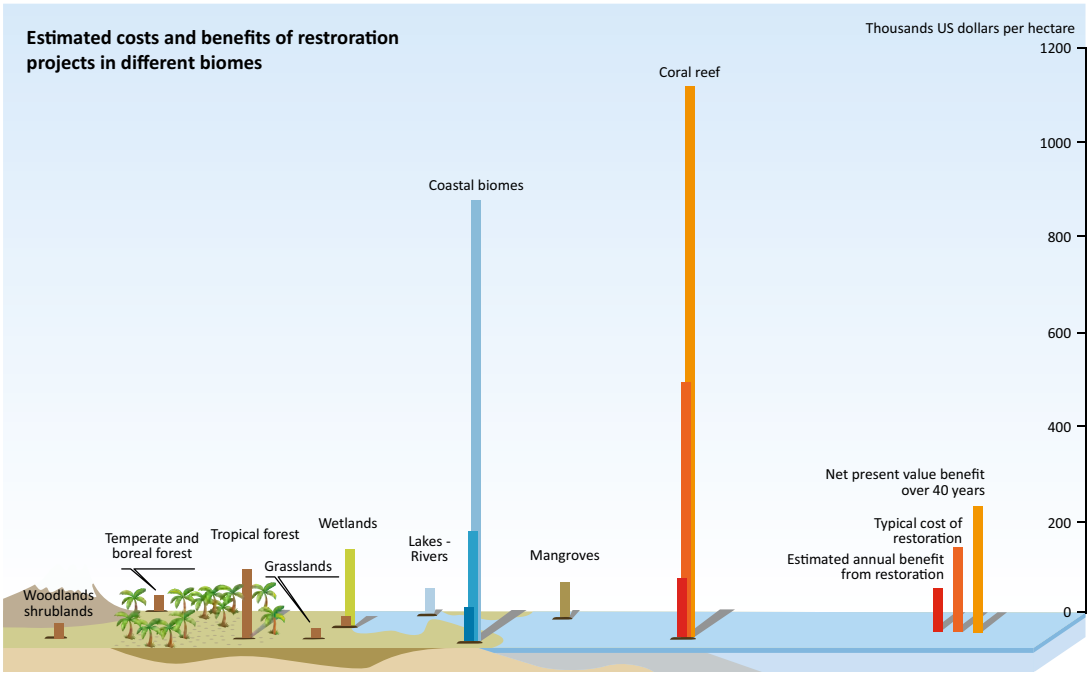
Annex 1: Estimated Costs and Benefits of Restoration Projects for Different Biomes

Figure 37. Estimated costs and benefits of restoration projects in different biomes.



Source: Pravettoni, UNEP, and GRID-Arendal 2012.

Annex 2: Calculations on the Costs of Environmental Degradation[49]

1. Land degradation

Parameter	Value	Unit	Source
ESV Terrestrial	1,487,886,624	US$/ha/year	Sutton et al., 2016
ESV Degraded	1,213,456,600	US$/ha/year	Sutton et al., 2016

$$Degradation\ costs = Actual\ NPP - Potential\ NPP$$

$$Degradation\ costs = 1{,}487{,}886{,}624 - 1{,}213{,}456{,}600 = \mathbf{274{,}430{,}024\ USD/year}$$

2. Deforestation

Parameter	Value	Unit	Source
Tropical forest ecosystem service value (total of service mean values)	5,264	Int. Dollar/hectare/year	De Groot et al., 2012
Forest area 2020	32,920	Hectares	World Bank 2020
Forest area 1990	46,060	Hectares	World Bank 2020
Agricultural GDP (including fisheries and forestry)	334,017,693	Constant 2015 USD	World Bank 2020a
Fishery contribution to agricultural GDP	7.5	Percent	World Bank 2020k
Forestry contribution to agricultural GDP	18,000,000	Constant 2006 US$	FAO 2008
Agricultural area	131,000	Hectares	World Bank 2018
CPI (2007–2022)	1.34	Dollar	Official Inflation Data (2022)
CPI (2006–2022)	1.38	Dollar	Official Inflation Data (2022)
CPI (2015–2022)	1.18	Dollar	Official Inflation Data (2022)

The costs of deforestation are based on the deforestation rate, the ecosystem service value of forests, and the ecosystem value of new land use. The deforestation rate was calculated using World Bank data:

$$Annual\ deforestation = \frac{(Forest\ area\ (2020) - Forest\ area\ (1990))}{\Delta\ time}$$

$$Annual\ deforestation = \frac{(32{,}920 - 46{,}060)}{(2020 - 1990)} = 438\ ha/year$$

Since the primary cause of deforestation is clearance for agricultural expansion, it is assumed that the entire deforested area is used for agriculture. The ecosystem service value (ESV) of the new land use was obtained by subtracting the CPI adjusted fisheries and forestry contribution from the agricultural GDP and dividing this by the total agricultural area.

49 Analysis by Deltares

$$ESV_{new\ land\ use} = \frac{((Agricultural\ GDP * CPI) - (Fishery\ contribution * CPI) - (Forestry\ contribution * CPI))}{Agricultural\ area}$$

$$ESV_{new\ land\ use} = \frac{((334{,}017{,}693 * 1.18) - \left(\frac{334{,}017{,}693 * 7.5}{100} * 1.18\right) - (18{,}000{,}000 * 1.38))}{131000} = 2594.8\ USD/ha$$

$$ESV_{forest} = ESV_{forest} * CPI$$

$$ESV_{forest} = 5{,}264 * 1.34$$

$$Costs = Annual\ deforestation * (ESV_{forest} - ESV_{new\ land\ use})$$

$$Deforestation\ costs = 438 * (7053.8 - 2594.8) = \mathbf{1{,}953{,}019\ USD/year}$$

3. Health

Parameter	Value	Unit	Source
Water, Sanitation and Hygiene attributable DALYs	8,747	DALY	World Health Organization (WHO) 2013
Ambient Air Pollution attributable DALYs	10,965	DALY	WHO 2018a
Indoor Air Pollution attributable DALYs	30,466	DALY	WHO 2018c
Human Development Index (HDI)	0.554	-	UNDP n.d.
Costs per DALY averted (low HDI score)	998	US$/DALY	Daroudi et al., 2021
Costs per DALY averted (Medium HDI score)	6,522	US$/DALY	Daroudi et al., 2021
CPI (2011–2022)	1.24	Dollar	Official Inflation Data (2022)

The costs per DALY averted are different based on HDI category. The HDI of the Comoros is 0.554, barely falling into the medium category (0.55 – 0.70). To get a more fitting presentation of the actual costs per DALY averted, it was decided to take the average between the low and the medium HDI categories:

$$Costs\ per\ DALY\ averted\ Comoros = \frac{(998 + 6{,}522)}{2} = 3760\ \text{USD/DALY}$$

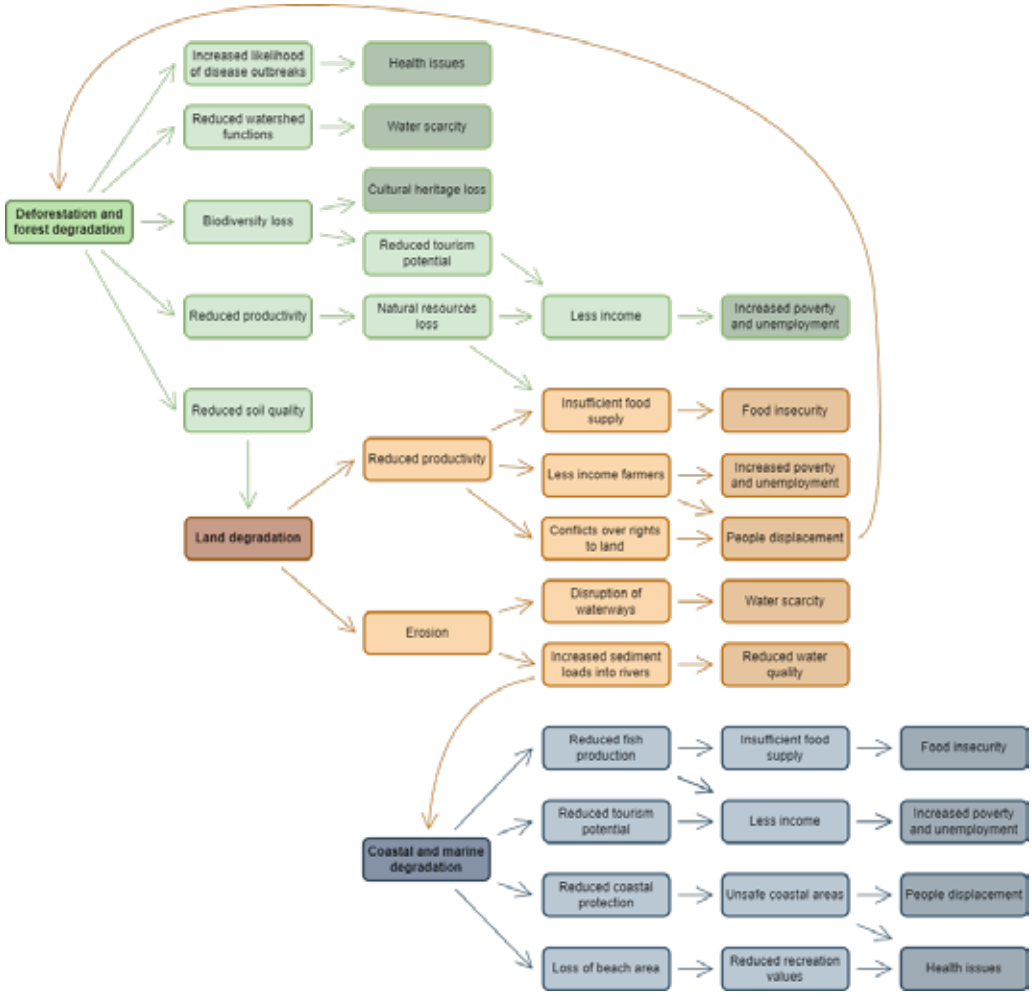
Subsequently, the costs per DALY averted were multiplied with the total number of DALYs per health category and were corrected using the CPI:

$$Costs\ Water, Sanitation\ and\ Hygiene = 3{,}760 * 8{,}747 * 1.24 = \mathbf{40{,}782{,}013\ USD/year}$$

$$Costs\ Outdoor\ Air\ Pollution = 3{,}760 * 10{,}965 * 1.24 = \mathbf{51{,}123{,}216\ USD/year}$$

$$Costs\ Indoor\ Air\ Pollution = 3{,}760 * 30{,}466 * 1.24 = \mathbf{142{,}044{,}678\ USD/year}$$

Annex 3: Impacts of Environmental Degradation on the Livelihoods of the Comorian Population



Source: Created by Deltares

Annex 4: Overview of Fisheries Laws and Regulations

1. Décret N°20-051/PR du 1er avril 2020, portant promulgation de la loi N°19-05/AU portant révision du Code des Pêches et de l'Aquaculture, Loi N° 07-011 du 29 août 2007
2. Décret N°21-071/PR du 13 juillet 2021, portant promulgation de la Loi N°21-005/AU du 29 juin 2021, portant nationalisation de la Société Anonyme « Comoros National Fishing Compagny.SA »
3. Décret N°14-034/PR du 14 mars 2014, portant obligation de publication des accords de pêche ou autres arrangements assimilés, de la liste des navires autorisés à pêcher ou à exercer des activités liées à la pêche et des revenus associés
4. Décret N°15-050/PR du 15 avril 2015, portant application du Code des Pêches et de l'Aquaculture de l'Union des Comores.
5. Décret N°15-051/PR du 15 avril 2015 portant Création de l'Office National de Contrôle Qualité et de Certification des Produits Halieutiques en Union des Comores (ONCQCPH)
6. Décret N°15-052/PR du 15 avril 2015 portant Constatation des infractions sanitaires et les mesures administratives prises sur la vente et la salubrité des produits halieutiques
7. Arrêté N°03-32/MDIPTTI/CAB du 26/09/2003 fixant les attributions des Départements et le mode de Fonctionnement de la Direction Nationale des Ressources Halieutiques
8. Arrêté N°17-014/VP-MAPEATU-CAB du 13 avril 2017, relatif aux méthodes d'échantillonnage à appliquer pour l'analyse de certains contaminants dans les produits de la pêche.
9. Arrêté N°17-015/VP-MAPEATU-CAB du 13 avril 2017, relatif aux limites maximales autorisées pour certains résidus et contaminants dans les produits de la pèche
10. Arrêté N°17-016/VP-MAPEATU-CAB du 13 avril 2017, relatif aux contrôles officiels applicables aux produits de la pêche
11. Arrêté N'17-017/VP-MAPEATU-CAB du 13 avril 2017, fixant les règles d'hygiène applicables aux produits de la pêche destinés à l'exportation
12. Arrêté NI7-018/1/P-MAPEATU-CAB du 13 avril 2017, relatif aux critères microbiologiques applicables aux produits de la pêche
13. Arrêté N°17-019/VP-MAPEATU-CAB du 13 avril 2017, relatif aux eaux utilisées dans 'Industrie de traitement des produits de la pêche et de l'aquaculture
14. Arrêté N°16-005/MAPEEIA-CAB du 06 janvier 2016 portant désignation de l'autorité compétente de contrôle et de certification d'origine de capture des ressources halieutiques en Union des Comores
15. Arrêté N°17-016/VP-MAPEATU-CAB du 13 avril 2017, relatif aux contrôles officiels applicables aux produits dé la pêche
16. Arrêté conjoint du 25 février 2021, relatif l'immatriculation et au marquage des embarcations de pêche locales de type artisanal d'une longueur égale ou inférieures à 12m
17. Arrêté N°17-67/VP-MTPTTIC-CAB du 1er février 2017, portant réglementation des embarcations de pêche d'une longueur inférieure à 12m
18. Arrêté N°20-032/MAPE-CAB du 21 mars 2020 portant modalités et conditions de délivrance des cartes professionnelles des revendeurs des produits de la pêche

19. Arrêté N°20-033/MAPE-CAB du 21 mars 2020 portant modalités et conditions de délivrance des cartes professionnelles de pêche
20. Arrêté N°20-034/MAPE-CAB du 21 mars 2020 portant nomination des inspecteurs de Pêche du Centre National de Contrôle et de Surveillance des Pêches (CNCSP)
21. Arrêté N°20-036/MAPE-CAB du 21 mars 2020 portant nomination des inspecteurs de l'Office National de Contrôle Qualité et de Certification des produits halieutiques (ONCQCPH)
22. Arrêté conjoint du 11 mars 2016, portant création d'un Comité de Concertation, et de coordination entre l'Administration chargée des pêches et l'Autorité chargée des Affaires maritimes

Source: DGRH 2021b

Annex 5: Soil Restoration Measures

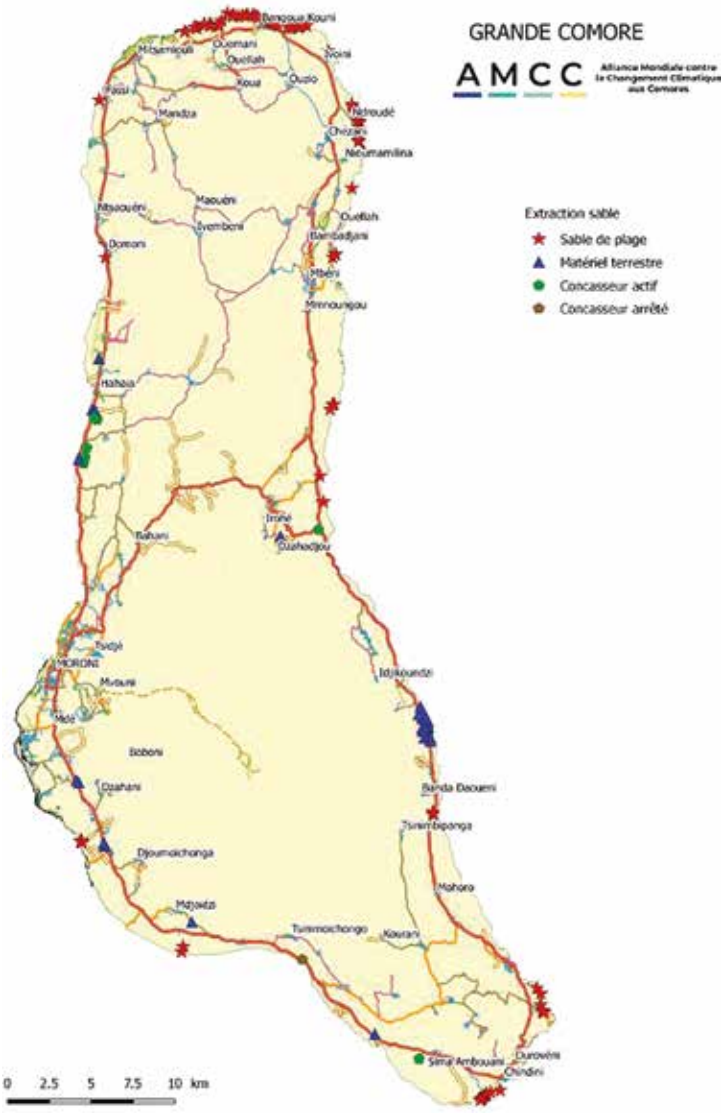
Table 16. Soil restoration measures

Objective	Restoration Measures
Improve yield	• Dispersal of high-quality seeds of crops that produce higher and faster yields (pass along to other farmers) • Training in more productive agricultural practices • Promotion of the use of organic compost • Improved access to market information and creation of a network of entrepreneurs selling agricultural inputs
Increase soil fertility	• Livestock management integrated with agriculture • Reduction in the overuse of chemical fertilizers and pesticides
Anti-erosion	• Hedges and anti-erosion bunds of fast-growing tree species • Training in agroforestry adoption • Training in planting trees across contour lines and developing ridges to protect root crops

Adapted from: Doulton et al., 2016.

Annex 6: Maps of Sand Extraction in Ngazidja and Ndzuwani

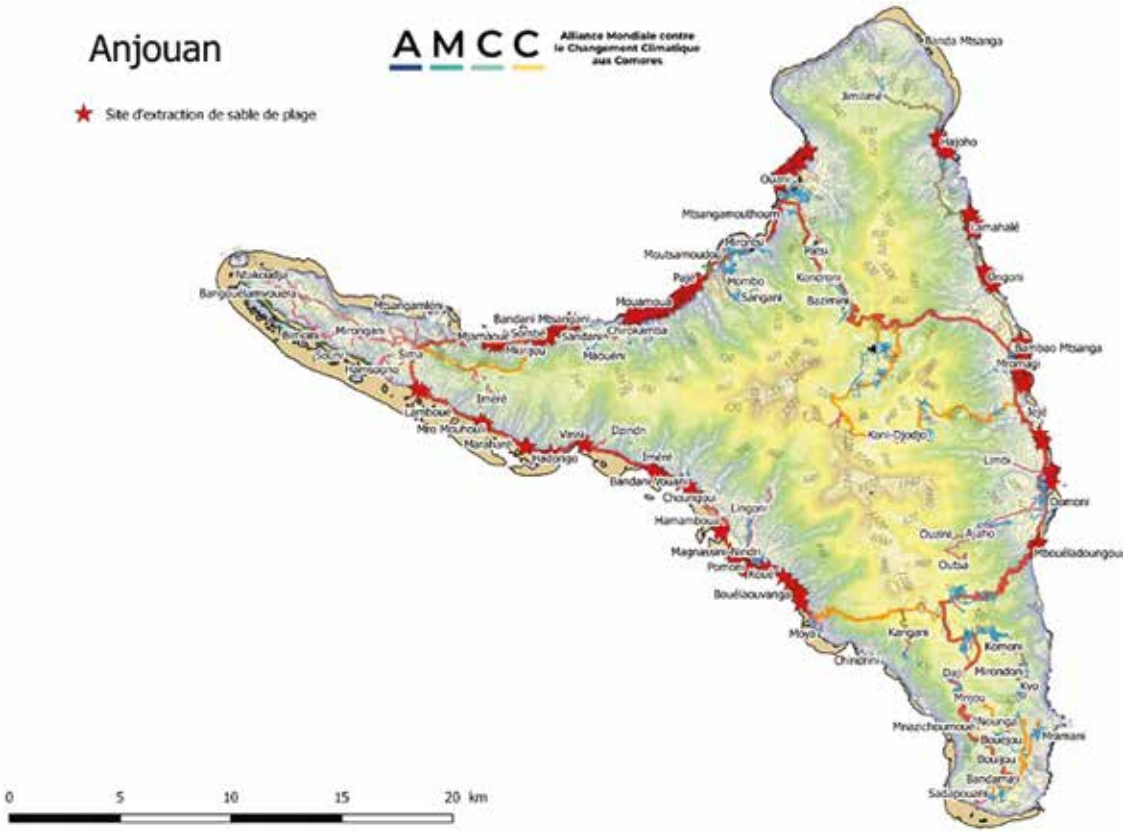
Figure 38. Map of sand extraction in Ngazidja.



Source: AMCC 2019a.

Note: Red stars indicate sites where sand is extracted from beaches. The blue triangles indicate land-based extraction sites. The green pentagons indicate sites with active crushers. The brown pentagons indicate sites with stationary crushers.

Figure 39. Map of sand extraction in Ndzuwani.



Source: AMCC 2019a.
Note: Red stars indicate sites where sand is extracted from beaches.

Annex 7: Key Environmental Policy, Legislation, and International Agreements of the Comoros

Level	Title	Date and Legal Tool	Objectives
National	Reforestation and forest management	1988: Law N°88-006/PR	(1) Safeguard the local environment, (2) protect agricultural plantations, (3) combat erosion, (4) provide fuel or construction wood or improve living conditions
	National Environmental Policy	1993: Decree No. 93-214/PR	Ensure sustainable and rational management of natural resources and support the rational use of resources in the development of alternative solutions. Currently in the process of updating.
	Environmental Action Plan (PNE)	1994	Identify a set of actions to fulfill the PNE
	Environmental Impact Assessment (EIA)	1994: Decree No. 94/100/PR	Establish key elements of the EIA process
	Framework Law of the Environment	1994: Decree No. 94-018/AF	Regulate all activities related to the sustainable management and conservation of land, coastal, and marine biodiversity. Currently in the process of updating.
	Water Code	1994: Law No. 94-037. 2020: revised Law No. 20-036/AU	Implement integrated water resource management to contribute to the socioeconomic development of the Comoros
	Agricultural Policy	1994, updated in 2011 and 2014	Achieve food security, create employment, and promote sustainable use of natural resources
	Protected species	2001: Order No. 01/033 / MPE / CAB	List protected species. Currently in the process of updating.
	Fishing and Aquaculture Code	2007: Law No 07-011/AU 2015 revision, 2020 revision	Ensure sustainable management. Updated in 2020 to include illegal unregulated and unreported (IUU) fishing.
	National Forests Policy	2010	Conduct conservation and sustainable development of the forest cover
	Waste	2011: Law No. 17-011/AU	Production, importation of plastic bags and packaging ban
	Priority Action Plan for Forestry Development (PAPDF)	2011–2015	Develop a reference framework to guide funding for the National Forest Policy
	Forestry Management Act	2012: Law No. 12/001 AU	Govern forests under the domain of public persons and the domain of private individuals, for sustainable management
	National Action Plan to Combat Desertification	2014	Secure land tenure for farmers and promote sustainable land management
	National Parks Strategy	2017	Manage more than 25 percent of the national territory with a community approach for ecological and sustainable economic development
	National protected areas system	2018 Law No. 18-005/AU 2019 Decree No. 19-129/PR	National system of protected areas
	Protected areas	2019: Presidential Decree No. 19-129/PR	Define the conservation and management of a protected area and classify its protection
	Access to genetic resources	2020: Law No. 20-001/AU Decree No. 20-081/PR	Regulate access to genetic resources and associated traditional knowledge, ensuring sharing of fair and equitable benefits from their use

Level	Title	Date and Legal Tool	Objectives
International	United Nations Convention on the Law of the Sea (UNCLOS) (1982)		Define the rights and responsibilities of nations concerning their use of the world's oceans
	Convention on Biological Diversity (1992)		Conserve biological diversity, promote the sustainable use of its components, and encourage equitable sharing of the benefits
	2030 Agenda for Sustainable Development (2015)		Provide a shared blueprint for peace and prosperity for people and the planet, now and into the future
	The United Nations Framework Convention on Climate Change (1992)		Stabilize greenhouse gas concentrations "at a level that would prevent dangerous anthropogenic interference with the climate system."
	Stockholm Convention on Persistent Organic Pollutants (2007)		Reduce or eliminate the releases resulting from intentional or unintentional persistent organic pollutants and releases from chemical wastes
	African Union Agenda 2063 (2015)		Aim for inclusive and sustainable development through unity, self-determination, freedom, progress, and collective prosperity
	Paris Agreement (2015)		Strengthen the global response to the threat of climate change

Adapted from: Nairobi Convention 2022; PNE 2021.

Annex 8: Stakeholder Consultations

This annex describes the stakeholder consultation process. It consisted of four phases:

1. Interviews with key stakeholders
2. Site visit to the Comoros
3. Two-day workshop in Moroni
4. Final workshop in Moroni

Each phase is described below with regard to objectives, stakeholders consulted, and outcome.

Phase 1: Stakeholder interviews

The objectives of the semi-structured interviews were to:

1. Assess the perception of stakeholders on the main environmental challenges (related to key sectors) in the Comoros and the gaps between the current and desired levels of sustainability
2. Collect information on perceived opportunities (recent and future initiatives and measures) for the development of key economic sectors that will address environmental challenges and align them with desired socioeconomic development

Some respondents were interviewed individually and others in a focus group setting. Table 17 lists the respondents.

Phase 2: Site visit to the Comoros

The site visit to the Comoros took place March 8–13, 2022. The objectives were as follows:

1. Strengthen collaboration with the local partners and stakeholders to enhance the quality of the country environmental analysis (CEA).

Table 17. List of stakeholders interviewed individually and in focus groups

Name	Organization
Mr. Elamine Youssouf M'bechezi	Direction Générale de l'Environnement et des Forêts
Mrs. Hayria Mohamed	Point focal adjoint, Direction Générale de l'Environnement et des Forêts
Mrs. Fatouma Abdallah	Programme ANCAR2
Dr. Anwar Maeva	Université des Comores/ Faculté des Sciences et Techniques
Mr. Faissoil Mhadji	DGEF
Mr. Ali Mohamed Nobataine	Coordinateur National PREFER
Mr. Mahamoudou Abidina	Juriste DGRH
Dr. Ahmed Mohamed Nadjim	Biologiste marin Faculté de sciences et techniques
Mr. Mohamed Halifa	Conseiller / AIDE
Mr. Fouady Goulam	CGP
Mr. Abdillah Msaidie	Président de la chambre de l'agriculture, pêche et l'élevage
Mr. Imam Abdillah	Direction General de la Coopération Internationale
Dr. Andilyat Ahmed	Université des Comores/ Faculté des Sciences et Techniques
Mr. Soalihy Hamadi	CGP
Mrs. Kamaria Hassane	INRAPE
Mr. Elarif Abdoulkarim	Agent S. Foret
Mr. Samir Ali	Gestion des ressources naturelles/DGEF
Mr. Chamouine Soidri	DG/DGRH
Mrs. Marie Ange	Chargée de programmes Délégation de l'Union Européenne
Mr. Mohamed Ali Mlazahahé	Chargé de programmes Délégation de l'Union Européenne
Mr. Pouliquen Tangi	AFD
Mr. Mohamed Ibrahim Diop	Maire de la Commune de Gouwengé
Dr. Kamal Thabiti Soudjay	Direction Générale des Ressources Halieutiques
Mr. Mouchtadi Mmadi	Parc National de Mohéli

Table 17. (*Continued*)

Name	Organization
Mr. Bouchourane Aoussidine	Coopérative des Pêcheurs des Comores/ Anjouan
Mr. Mmadi Djae	Direction de l'Aménagement Territoire
Mr. Mohamed Abdou	Direction de l'Aménagement Territoire
Mr. Mohamed Saindou	Charge de la planification Direction Tourisme
Mr. Fakridine Djambae	Juriste RNAP
Mr. Houssoyini Housseni	Coordinateur Projet R-POC
Mr. Ahamada Mmadi	DGEAT
Mr. Ahmed Youssouf	Maison des Organisations de la Société Civile (MOSC)
Mr .Zaharani Moindjié	AMIE
Mrs. Nema Ahmada	Plateforme Femmes et développement durable
Mr. Bacar Mze 'Ali	Bureau Geologique des Comores
Mohamed Chaheire	Bureau Geologique des Comores
Mr. Said Boina	DGRH
Dr. Soule Hamidi	Doyen de la Faculté des Sciences et Techniques/Université des Comores
Mrs. Ramadhoini Ali	Enseignante chercheur, Faculté des Sciences et Techniques/Université des Comores
Youssouf Mze	Agence Nationale de gestion des dechets
Said Mmadi	Expert Etudes d'Impact Environnemental DGEF
Mr. Joshua Rambahiniarison	Field researcher, projet de Renforcement de la Protection des Oceans
Mr. Hugh Doulton	NGO Dahari Anjouan

2. Collect local data and information to enrich the CEA.
3. Identify drivers, pressures, status, and impacts of environmental challenges as well as the existing policy plans for the environmental sectors; discuss (identified) data and information gaps as well as proposed strategic programs for the way forward.
4. Plan next steps (including technical aspects of the Phase 3 workshop in Moroni).

The organizations visited during the site visit are listed in Table 18.

The conclusions from the site visit are as follows:

- Examples exist of effective projects, but there is a lack of continuity in efforts following project completion.

Table 18. List of organizations engaged during the site visit to the Comoros

Organization	Category
Bureau de l'Union Européenne en Union des Comores	International Organization
Agence Française de Développement – Union des Comores	International Organization
UNDP	International Organization
Direction Générale de l'Environnement et des Forêts	Government
Direction Générale des Ressources Halieutiques/de la Pêche	Government
Commissariat Général au Plan	Government
Bureau Géologique	Government
Maire municipalité Ngongwe	Government
Herbier National des Comores/Université des Comores	Nongovernmental Organization (NGO)/ private sector
Maison des Organisations de la Société Civile (MOSC)	NGO/private sector
Dahari	NGO/private sector
Le Réseau National Femmes and Développement (RNFD)	NOG/private sector
Union des Chambres d'Agriculture d'Elevage et de la Pêche	NGO/private sector
Microfinance	NGO/private sector
Cordio (international NGO)	NGO/private sector
Comores Plongée	NGO/private sector

- Lack of appropriate legislation, organization, and funding were frequently mentioned as obstacles.
- Lack of training/capacity is an important obstacle to sustainable management of resources and development of sectors. Capacity building/training is therefore necessary at different levels, including ministry, municipality, and community (farmers/fishermen).
- Lack of awareness is an obstacle; therefore, awareness raising is necessary.
- There has been a lack of involvement of communities in implementation of projects;
- It would be instrumental to involve communities, NGOs, informal community organizations at the submunicipality level, and national bottom-up organizations like the Chamber of Agriculture.

- One way to involve women more is to focus on activities in which women engage and on the capacity building of women.

Phase 3: Validation workshop

The validation workshop was held April 7–8, 2022 in Moroni. Four objectives for participants were developed for the workshop:

- Understand the importance, scope, and development process of the CEA
- Understand the project objectives and preliminary results. They have ownership of these preliminary results.
- The opportunity to ask questions and provide comments and input on the preliminary results
- The opportunity to indicate their perceived priorities for future action

The workshop agenda is presented below.

Validation Workshop Agenda (Day 1)

Day 1	
Time	**Activities**
08.00	Welcoming of participants, registration
08.30	Opening of the workshop
08.45	Introduction of participants
09.10	Introduction - Presentation of the context and agenda - Adoption of the agenda
09.20	Introduction to the workshop and stakeholder engagement - Project objectives and process - Previous steps (interviews, Deltares site visit to Moroni)
09.35	Presentation of preliminary results
	Observations/questions/answers
10.15	Break
10.45	Breakout group discussions (5 groups) 1. Land 2. Fresh water and access to water 3. Forests 4. Marine and coastal: fishing 5. Marine and coastal: ecotourism and national parks
12.10	Return and presentation in plenary
12.30	Conclusions, introduction of day 2, closing of day 1
12.45	Closing of the workshop

Validation Workshop Agenda (Day 2)

Day 2	
Time	**Activities**
08.00	Walk in
08.30	Opening of the workshop and recap of day 1
08.40	Presentation of solutions and actions
08.50	Plenary discussions and selection of 3–4 solutions to be developed
09.20	Group discussions: steps for realization of solutions/actions
10.20	Break
10.35	Return to plenary and presentation
11.00	Synthesis, validation of selected actions and next steps
11.15	Acknowledgments/closing remarks
11.30	Closing of the workshop

Table 19. Validation workshop participant list

Name	Organization
Abdillah Msaidie	President of the Chamber of Agriculture, Fishing and Livestock
Abu Mahoma	Regional Directorate of Environment and Forests in Moheli
Ahamada Mmadi	DGEAT
Ahmed Karim Farida	Ministry of Energy
Alhabib Said Toihir	University of the Comoros/Faculty of Science and Technology
Ali Abdou Razar	DNSAE
Ali Mohamed Nobataine	PREFER National Coordinator
Ali Mohamed Youssouf	Deputy Director General, Directorate General of Fishery Resources
Ameroine Mohamed	DGAT
Athoumani Moussa	ANACM/ METEO
Bouchourane Aoussidine	Comoros Fishermen Cooperative/Anjouan
Dr. Ahmed Mohamed Nadjim	University of the Comoros/Faculty of Science and Technology
Dr. Ahmed Ouled	NGO Ulanga
Dr. Andilyat Ahmed	University of the Comoros/Faculty of Science and Technology
Dr. Anwar Maeva	University of the Comoros/Faculty of Science and Technology
Dr. Fouad Mohamed Oussouf	National Directorate of Agricultural Strategies
Dr. Kamal Thabiti Soudjay	General Directorate of Fisheries Resources
Faissoil Mhadji	DGEF
Fakridine Djambae	RNAP Lawyer
Fakridine Mohamed	Representative AIDE a MOHELI

Table 19. (*Continued*)

Name	Organization
Fouady Goulam	General Commissioner for Planning
Hachim Abderemane	Lagazette Newspaper
Hachim Abdermane	ONG ULANGA NGAZIDJA
Hafsoiti Abdou	DGEF
Houssoyini Housseni	Project Coordinator/R-POC
KAMARIA HASSANE	INRAPE
Loukoumane Moussa	DGEME
Mariama Chabani	ANGD
Mhoumadi Soihibou	NGO AIPEC
Mmadi Ahamada	RNAP
Mmadi Djae	Direction of the Territory Planning
Mohamed Abdou	Direction of the Territory Planning
Mohamed Halifa	HELP
Mohamed Maecha	SONEDE
Mohamed Saindou	Tourism Department
Moinaecha Ahamada	Platform of Women for Sustainable Development
Mouchtadi Mmadi	National Park of Moheli
Mr. Soalihy Hamadi	General Planning Commission
Mr. Ali Ibrahim Maziada	Directorate General of Energy
Mr. Yahaya Ibrahim	National Center of Documentation and Scientific Research
Ms. chadhouliati abdou chakour	National Director of Water and Sanitation
Ms. Hayria Mohamed	Deputy Focal Point, General Directorate of Environment and Forestry
Said Ahamada Tony	Banda Bitsi Association
Said Ali Antoissi	World Bank
Said Ali Antoissi	Operations Manager
Saifidine Mohibaco	ANACM
Youssouf Hamadi	Director of the Comoros Geological Survey
Zalhat Bacar	Regional Directorate of Environment and Forests in Anjouan

The workshop was attended by 48 individuals from 40 organizations (excluding Deltares, AIDE, and UniSey). A participant list is presented in Table 19.

The discussions with stakeholders at the workshop yielded the following points:

- The environment is of crucial importance for the Comoros. Everyone must be aware of it.
- There are no major differences between this CEA and the results from a 1994 diagnosis. If the Comoros is still at the same point, it is because nothing has been done. Real solutions must be found.

The workshop was attended by 48 individuals from 40 organizations (excluding Deltares, AIDE, and UniSey). A participant list is presented in Table 19.

- There are a lack of data and new measurements. Modern measurement tools are needed to analyze and measure pollution, for example.
- Progress has been made in environmental management, but more efforts are required to make a difference.
- Build upon the efforts and progress made in past projects, as stakeholders are proud of it.
- A key challenge is integrating environmental aspects into the missions of all institutions and not only the Ministry of the Environment, to whom responsibility is always attributed. All ministries must be concerned about the environment.
- Many documents have been written, but over the years and with the passage of time, too much copy and paste has taken place and few new insights have been developed. The approach of involving stakeholders is much appreciated. It is important to go to the field and conduct interviews.
- Sanitation and air pollution are key problems alongside waste pollution. This must be taken into account, and concrete actions need to be included in the CEA.
- Consider including "new" minerals such as gold, copper, oil, and gas in the CEA development.

Phase 4: Final workshop

The final workshop was held June 28, 2022, in Moroni. The objective was to discuss the final conclusions of the CEA. The workshop agenda is presented below.

The workshop was attended by 34 individuals (Table 20).

Final Workshop Agenda

Time	Activity
08.00	Welcoming of participants, registration
09.00	Opening remarks, introduction of participants and agenda
09.30	Introduction of the workshop and presentation of the main results of the ASP
10.15	Break
10.45	Discussion on waste management
11.30	Discussion on freshwater
12.15	Conclusions
12.30	Closing of the workshop
13.00	Lunch

The discussions on waste management and water resource management resulted in the following insights:

Waste management:

- Support the development of comprehensive legislation and help define the institutional framework for solid waste management.
- Develop a comprehensive integrated solid waste management strategy as part of a broader circular economy vision, considering interventions in waste prevention, collection, disposal, and recycling.
- Expand and improve waste collection services to households not yet covered, minimize collection losses, and increase voluntary and community collection points, including those for recyclable materials ("waste banks").
- Reduce solid waste generation by encouraging the design of reusable products and the use of alternative materials.
- Promote composting to reduce the volume of residual organic waste and increase benefits to farmers.
- Raise awareness of solid waste prevention.

Water resource management:

- Facilitate the development of water master plans at the island level.
- Clarify roles and mandates as part of the decentralization process.
- Support strategic prioritization of the water sector at the national level, focusing on hydro-climatic risk management in particular.
- Strengthen the water resource monitoring system.

Table 20. Final workshop participant list

Name	Organization
Ali Ibrahim Maziada	Directeur Général de l'Énergie et des mines
Kamaria Hassane	INRAPE
Nassur Ahamada Mroimana	Expert environnementaliste PRPKR
Nasssourdine Ahamada	Chercheur au CNDRS
Aboubacar-Tayffa Hassanali	Consultant AIDE
Ramadhoini Ali	Faculté des sciences et techniques/Herbier des Comores
Ismael Houda Oumilhouda	PFDDSA
Dr. Kamal Thabiti	DGRH
Youssouf Ben Ali	Coordinateur du parc national Coelacanthe
Mohamed Saindou	Direction du tourisme
Nadjouwa Mohamed	DGEF
Said Ahamada	Bandambitsi
Issiwaila Mohamed	DGA/DNSAE
Mkantsilé Abd-El-malik	DGA/DGEF
Chadhouliati Abdou	Directrice Nationale eau et assainissement
Al-Habib Said Toihir	UDC/FST
Salim Mohamed	BandaBitsi
Mouctadi Madi	Chargé de mission environnement marin, PARC NATIONAL MOHELI
Poriaven Tayi	AFD
Anrifidddine Ousseni	Agence des Parks Nationaux des Comores
Nassuf Humblot	Conservateur PNMN
Mohamed Maecha	DSNEPE
Hamidou Mfawoumé	Journaliste Comores Dounia news
Ikrame Ben Said	Journaliste ORTC
Houssoyni Housseini	Coordibnateur National du projet R.P.O.C/ WILDOCEAN
Faissoili Assoumani	Commune de Ngouengwe
Youssouf Hassani	Facilitateur communautaire/ Projet Kenet
Ismael Mohamed Hassane	BGC
Ahmed Mohamed Nadjim	FST/UDC
Mariama Chabani	ANGD
Fatoumia Abdallah	DGEF
Zamil Maanfou	Conservateur du Parc National Mont tringui/ ANJOUAN
Samir Ali	Chargé de la gestion de R.N-DGEF
Baraka Saindou	Agent de conservation communautaire Parc National Cœlacanthe

- Conduct a vulnerability and risk assessment study for all water sources.
- Further strengthen climate-resilient integrated water resource management.
- Expand water, sanitation, and health programs and improve drinking water quality standards and monitoring.

UNION OF THE COMOROS

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