# SEYCHELLES' BLUE CARBON ROADMAP

**DISCLAIMER**

This roadmap has been prepared by Deakin University's Blue Carbon Lab and The James Michel Foundation for the Seychelles Conservation & Climate Adaptation Trust (SeyCCAT), as part of the program 'Roadmap to Blue Carbon opportunities in Seychelles' funded through the Blue Grants Fund #3.

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*Appendices available as a supplementary file.

**ABOUT DEAKIN'S BLUE CARBON LAB**

Deakin University's Blue Carbon Lab offers innovative research solutions for helping to mitigate climate change and improve natural capital, while also contributing to jobs, economic growth, capacity building and community wellbeing.

**ABOUT THE JAMES MICHEL FOUNDATION**

The James Michel Foundation is guided by a commitment to promote Seychelles' Blue Economy, to sensitise people about climate change and its impacts, and to promote environmental protection and sustainable development.

Blue Carbon Lab
A DEAKIN IDEA

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SEYCHELLES' CONSERVATION AND CLIMATE ADAPTATION TRUST
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OVERVIEW

# SEYCHELLES' BLUE CARBON ROADMAP

**SEYCHELLES' BLUE CARBON ROADMAP SETS A LONG-TERM PATH TO ESTABLISH A NATIONWIDE, EVIDENCE-BASED PROGRAM GEARED TOWARDS THE PROTECTION AND RESTORATION OF BLUE CARBON ECOSYSTEMS FOR CLIMATE CHANGE MITIGATION AND ADAPTATION.**

Coastal wetlands (aka blue carbon ecosystems) provide a wide range of environmental, economic, and livelihood benefits, including carbon drawdown. Protection and restoration of coastal wetlands will enhance these benefits, reduce greenhouse gas emissions, and improve resilience to climate change.

Seychelles is increasingly committed to using blue carbon ecosystems as a natural climate solution. Within its updated Nationally Determined Contributions[1] (NDCs), Seychelles pledged to protect at least 50% of its seagrasses and mangroves by 2025 as an effective natural climate solution to reduce 26.4% of the national greenhouse gas (GHG) emissions by 2030 and reach net zero emissions by 2050. Seychelles also highlighted the importance of ocean climate actions by committing to the long-term monitoring of blue carbon ecosystems and the accounting of carbon removals (and/or emissions) within its National GHG Inventory.

To achieve these ambitious targets and effectively capitalise on all its blue carbon potential, Seychelles must strategically advance its research, engage its community, and permeate its legal frameworks with blue carbon. Additionally, financial incentives for blue carbon conservation and restoration should be established through international voluntary carbon markets and other environmental financing mechanisms.

**Blue carbon**

**refers to the carbon captured and stored by the oceans.**

**Coastal vegetated ecosystems – such as seagrass meadows, saltmarshes and mangroves – are known as blue carbon ecosystems. They cover less than 0.5% of the ocean floor, but hold over half of the world's blue carbon.**

**Globally, blue carbon ecosystems store >30,000 Tg C across ~185 million ha[2].**

## ACRONYMS

| | |
|---|---|
| **C** | **Carbon** |
| **$CO_2$** | **Carbon dioxide** |
| **$CO_2$(e)** | **Carbon dioxide equivalent** |
| **GHG** | **Greenhouse gas** |
| **ha** | **Hectare** |
| **IPCC** | **Intergovernmental Panel on Climate Change** |
| **IUCN** | **International Union for Conservation of Nature** |
| **MACCE** | **Seychelles' Ministry of Agriculture, Climate Change and Environment** |
| **NDC** | **Nationally determined contributions** |
| **SeyCCAT** | **Seychelles Conservation & Climate Adaptation Trust** |
| **SWIOFISH3** | **Third South West Indian Ocean Fisheries Governance and Shared Growth Project** |
| **TG** | **Teragram (1 million tonnes)** |
| **UN** | **United Nations** |
| **UNDP** | **United Nations Development Programme** |
| **WIO** | **Western Indian Ocean** |

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*Appendices available as a supplementary file.

# WHY IS BLUE CARBON IMPORTANT?




## BLUE CARBON ECOSYSTEMS ARE ONE OF THE WORLD'S MOST EFFECTIVE CARBON SINKS, HELPING TO OFFSET CARBON EMISSIONS AND MITIGATE CLIMATE CHANGE.

Blue carbon ecosystems play a key role in global carbon drawdown. They can capture carbon up to forty times faster than terrestrial forests and store it in the underlying soils over millennial timescales[3]. The high productivity and structural complexity of these vegetated ecosystems allow for large carbon stocks to be quickly accumulated in the plant biomass and sediments, where they are stored for extended periods due to the waterlogged, anaerobic nature of the system. A single hectare of mangrove forest and seagrass bed stores on average 386 and 108 tonnes C[3] and captures approximately 31 and 48 Teragrams C each year[4], respectively.

Unfortunately, when blue carbon ecosystems degrade, they become sources of greenhouse gases (GHG) releasing ancient carbon back into the system. Globally, up to one billion tonnes of carbon dioxide are being released annually from degraded blue carbon ecosystems, equivalent to 19% of emissions from tropical deforestation[5]. With one-third of all blue carbon ecosystems already lost, halting and reversing their degradation is indispensable to climate change mitigation.

International organisations such as the IPCC and IUCN have increasingly recognised the protection and restoration of blue carbon ecosystems as a natural climate solution that can effectively help achieve climate targets under the Paris Agreement.

## CO-BENEFITS

Beyond the benefits of carbon storage, protecting and restoring blue carbon ecosystems offers additional ecosystem services, or co-benefits, by:

**Enhancing wildlife biodiversity (including threatened and endangered species) from habitat and food provisioning.**

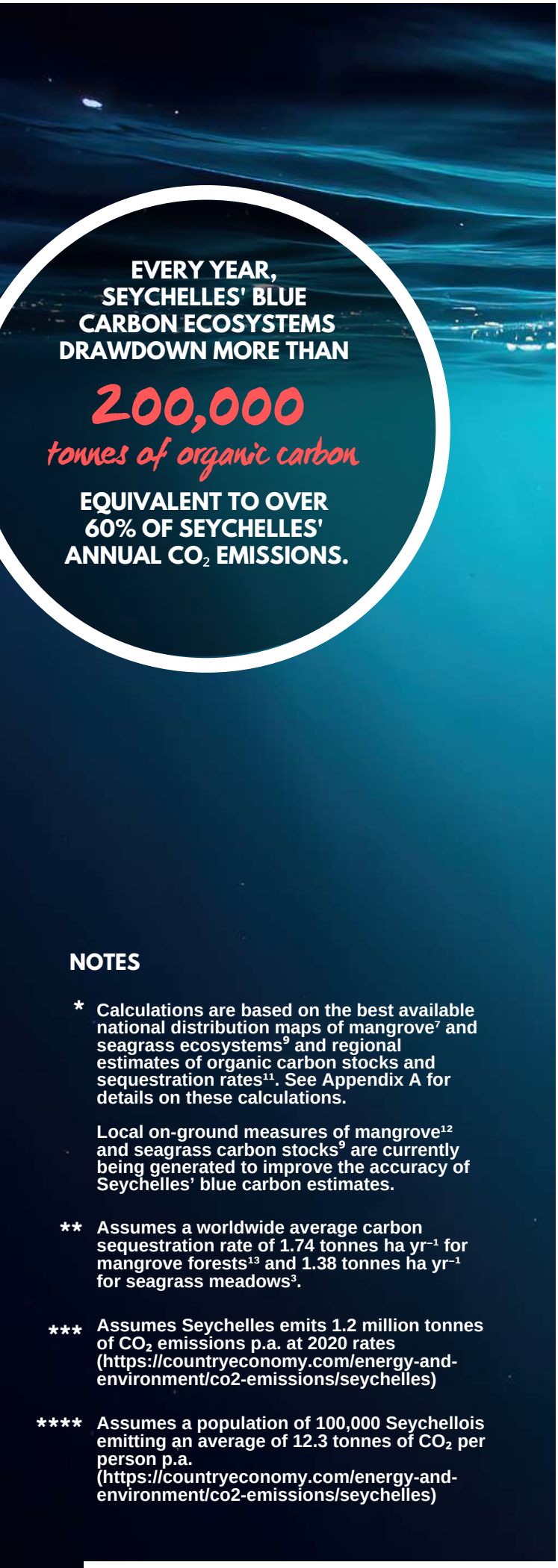
**Increasing coastal resilience to storm surges and sea-level rise by stabilising shoreline soils and serving as green walls.**

**Improving water quality by removing and retaining excess nutrients, sediments, and pollutants.**

**Supporting local economies and coastal livelihoods from fisheries and eco-tourism activities.**

**Providing for coastal recreation and enabling communities to connect with nature.**

The value of these co-benefits is considerable. Globally, the ecosystem services from mangroves alone are estimated to be worth at least US$1.6 billion each year[6].




# SEYCHELLES' BLUE CARBON

## SEYCHELLES' MANGROVE FORESTS AND SEAGRASS MEADOWS PROVIDE IMPORTANT OPPORTUNITIES FOR CARBON SEQUESTRATION AND CLIMATE CHANGE MITIGATION.

Mangrove forests occur across 1,700 ha of Seychelles' coastline[7], storing approximately 811,000 tonnes of organic carbon* (or 3 million tonnes of $CO_2e$) within their biomass and soil. More than 80% of these mangrove carbon stocks are located within the Aldabra Atoll, where they are protected under the Aldabra Atoll UNESCO World Heritage Site[8].

Seychelles' extensive seagrass beds are also important carbon sinks. Despite new field-verified maps suggesting seagrasses cover approximately 143,000 ha[9], an area significantly smaller than previously mapped (2.1 million ha[7]), Seychelles' seagrass meadows can still hold more than 17 million tonnes of organic carbon (or more than 62 million tonnes $CO_2e$). Although seagrass stocks account for more than 95% of Seychelles' total blue carbon potential[10], many seagrass meadows are threatened by coastal development without a major level of protection.

Seychelles' blue carbon ecosystems drawdown important amounts of carbon, supporting national efforts to reach net-zero emissions. Together, mangroves and seagrass beds sequester every year more than 200,000 tonnes of organic carbon** (or ~730,000 tonnes $CO_2e$), which is equivalent to more than 60% of Seychelles' $CO_2$ emissions***.

Endowed with significant blue carbon ecosystems and stocks, Seychelles has a responsibility to safeguard these ecosystems for climate change mitigation and adaptation. If Seychelles' blue carbon ecosystems were lost, the carbon released into the atmosphere would be equivalent to the emissions of Seychelles' population over fifty years****.

Projects aiming to protect and enhance mangroves and seagrass habitats are essential to avoid carbon emissions, guarantee a continued carbon drawdown, and maintain additional ecosystem services critical to Seychellois (e.g., coastal protection and fisheries enhancement).

### NOTES

* Calculations are based on the best available national distribution maps of mangrove[7] and seagrass ecosystems[9] and regional estimates of organic carbon stocks and sequestration rates[11]. See Appendix A for details on these calculations.

Local on-ground measures of mangrove[12] and seagrass carbon stocks[9] are currently being generated to improve the accuracy of Seychelles' blue carbon estimates.

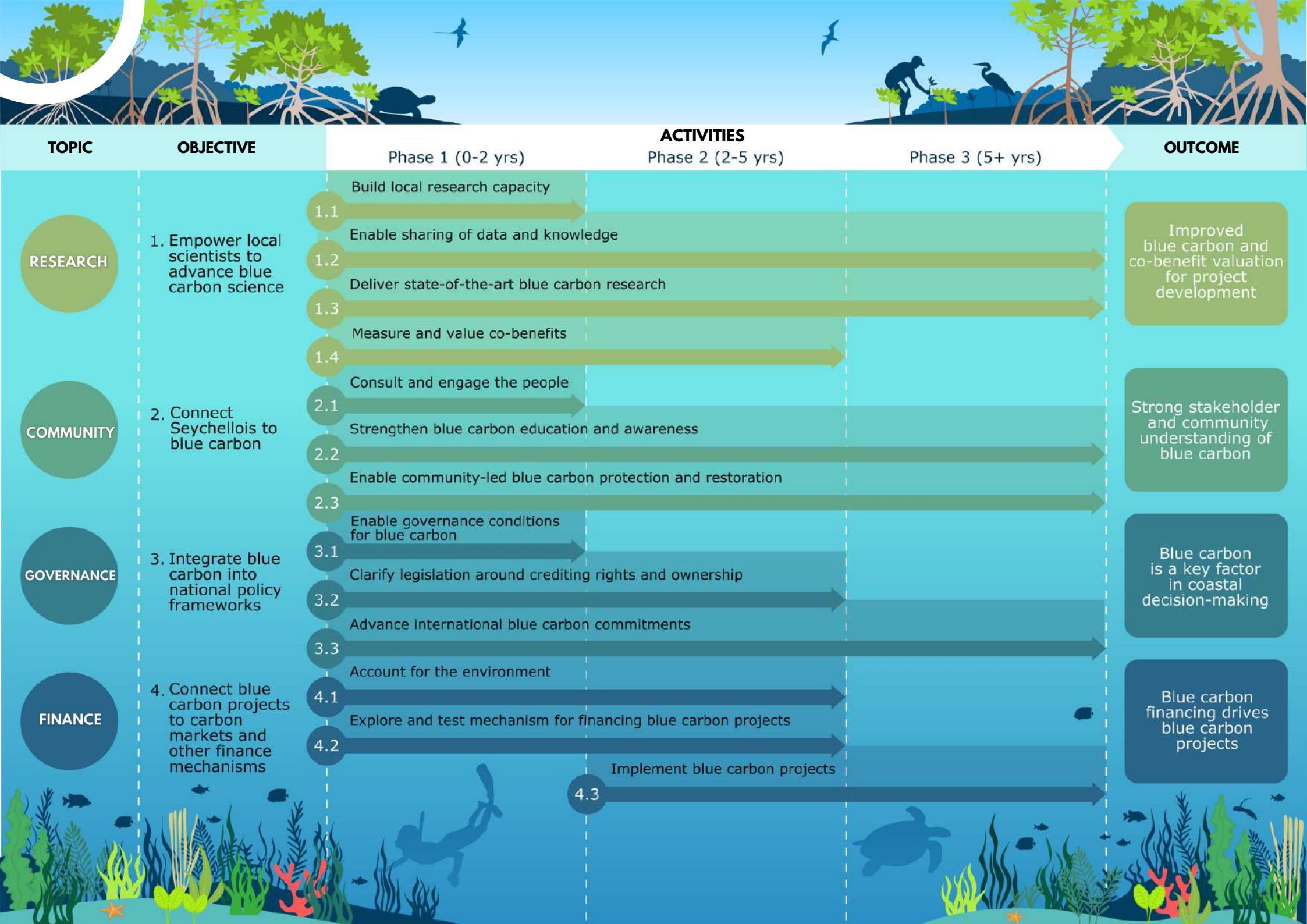
** Assumes a worldwide average carbon sequestration rate of 1.74 tonnes ha $yr^{-1}$ for mangrove forests[13] and 1.38 tonnes ha $yr^{-1}$ for seagrass meadows[3].

*** Assumes Seychelles emits 1.2 million tonnes of $CO_2$ emissions p.a. at 2020 rates (https://countryeconomy.com/energy-and-environment/co2-emissions/seychelles)

**** Assumes a population of 100,000 Seychellois emitting an average of 12.3 tonnes of $CO_2$ per person p.a. (https://countryeconomy.com/energy-and-environment/co2-emissions/seychelles)

# CAPITALISING ON BLUE CARBON

**SEYCHELLES CAN REALISE ITS BLUE CARBON OPPORTUNITIES BY STRENGTHENING ITS RESEARCH AGENDA, EMPOWERING LOCAL COMMUNITIES, AND PERMEATING GOVERNANCE AND FINANCIAL FRAMEWORKS WITH BLUE CARBON.**


TOPIC
OBJECTIVE
ACTIVITIES
Phase 1 (0-2 yrs)
Phase 2 (2-5 yrs)
Phase 3 (5+ yrs)
OUTCOME
RESEARCH
1. Empower local scientists to advance blue carbon science
1.1 Build local research capacity
1.2 Enable sharing of data and knowledge
1.3 Deliver state-of-the-art blue carbon research
1.4 Measure and value co-benefits
Improved blue carbon and co-benefit valuation for project development
COMMUNITY
2. Connect Seychellois to blue carbon
2.1 Consult and engage the people
2.2 Strengthen blue carbon education and awareness
2.3 Enable community-led blue carbon protection and restoration
Strong stakeholder and community understanding of blue carbon
GOVERNANCE
3. Integrate blue carbon into national policy frameworks
3.1 Enable governance conditions for blue carbon
3.2 Clarify legislation around crediting rights and ownership
3.3 Advance international blue carbon commitments
Blue carbon is a key factor in coastal decision-making
FINANCE
4. Connect blue carbon projects to carbon markets and other finance mechanisms
4.1 Account for the environment
4.2 Explore and test mechanism for financing blue carbon projects
4.3 Implement blue carbon projects
Blue carbon financing drives blue carbon projects

# RESEARCH

SOIL CORING DEVICE BEING USED TO COLLECT SOIL SAMPLES FROM PORT LAUNAY'S MANGROVE FOREST.

OBJECTIVE 1. RESEARCH

# EMPOWER LOCAL SCIENTISTS TO ADVANCE BLUE CARBON SCIENCE

STRENGTHENING LOCAL BLUE CARBON SCIENCE TO ENABLE ACCURATE MONITORING OF SEYCHELLES' BLUE CARBON STOCKS.

ACTION 1.1
**BUILD LOCAL RESEARCH CAPACITY**

ACTION 1.2
**ENABLE SHARING OF DATA AND KNOWLEDGE**

ACTION 1.3
**DELIVER STATE-OF-THE-ART BLUE CARBON RESEARCH**

ACTION 1.4
**MEASURE AND VALUE BLUE CARBON CO-BENEFITS**

OBJECTIVE 1. RESEARCH

# ADVANCE BLUE CARBON SCIENCE AND EMPOWER LOCAL SCIENTISTS

ACTION 1.1

## BUILD LOCAL RESEARCH CAPACITY

Quantifying blue carbon stocks and accounting for carbon removals and emissions requires the implementation of standard methodologies such as those described in the Coastal Blue Carbon Manual[14] and the IPPC Wetland Supplement[4].

Upskilling local personnel and providing all the required resources (e.g., facilities and equipment) is critical to obtaining high-quality data that can be incorporated into national GHG inventories (aligned with Action 3.3). Adequate implementation of blue carbon protocols also facilitates spatial and temporal comparisons within Seychelles and across countries.

### UPSKILL PERSONNEL

Blue carbon training should incorporate theoretical, field, laboratory, and analytical components where participants learn blue carbon concepts and receive step-by-step guidance on how to measure and report on mangrove and seagrass carbon stocks and fluxes. Upskilling should be coordinated by a blue carbon expert working group (EWG; details in Action 1.2) and offered to a wide range of stakeholders involved in blue carbon programs (e.g., scientists, community groups, government agencies).

Considering most of Seychelles' blue carbon is located in the outer islands, it is important to include representatives and organisations based on these locations (e.g., Seychelles Island Foundation- SIF, Island Conservation Society- ICS).

### INCREASE ACCESS TO EQUIPMENT, FUNDS, AND FACILITIES

Building local capacity requires tackling Seychelles' shortage of research funding, facilities, and equipment. As highlighted by local scientists[15], Seychelles should invest in its blue carbon future by funding targeted research programs (highlighted in Actions 1.3 and 1.4) and provisioning national organisations and scientists with cutting-edge equipment and tools. Blue carbon scientists should have access to peat corers, soil core extruders, muffle furnaces and/or elemental C:N analysers to allow the adequate collection and processing of blue carbon samples (i.e., currently, there are only two muffle furnaces in Seychelles, and no C:N analyser available). Seychelles' shortage of equipment and technical expertise has hampered several academic blue carbon research projects that have required international facilities and scientific support to proceed[16,17].

ACTION 1.2

# ENABLE SHARING OF DATA AND KNOWLEDGE

Seychelles' blue carbon research is sparse and hidden, with most of the datasets located within unpublished theses and reports[11,15]. Furthermore, there is limited coordination amongst national scientists leading to isolated and poorly aligned research projects across organisations. These circumstances limit the development of a cohesive research agenda (as per Action 1.3 and 1.4) that can rapidly and effectively advance Seychelles' national research priorities.

### ESTABLISH A NATIONAL REPOSITORY OF BLUE CARBON RESEARCH

Seychelles could develop a national repository of blue carbon research (e.g., theses, consultancy reports, publications) and datasets (e.g., carbon stocks, sequestration, and fluxes) that facilitate accounting and accessing all of Seychelles' blue carbon research. The database should be publicly available allowing scientists to build upon existing research, cite data, identify knowledge gaps, and monitor temporal trends. Even if datasets are under embargo or unpublished, basic project metadata can be helpful to understand research priorities and gaps. Once blue carbon restoration and protection projects commence (as per Action 4.3), it is also important to keep a detailed record that allows learning from their failure or success.

### ESTABLISH A BLUE CARBON EXPERT WORKING GROUP (EWG)

Seychelles should establish a national Blue Carbon Expert Working Group (EWG) that can steer the development and implementation of blue carbon science to meet national research priorities while assuring the quality and relevance of the data produced. Comprised of relevant representatives from academia, government, industry, and NGOs, the EWG should also serve to facilitate the transfer of scientific outcomes, promote collaborations, coordinate training workshops, and expedite the sharing of equipment, facilities, and resources (aligned with Action 1.1).

The EWG should be capable of providing objective advice to the government in any national and international blue carbon matters (as per Action 3.3), including the development and implementation of blue carbon projects (as per Action 4.3). Hence, the EWG should also support the integration of blue carbon into national policies frameworks (in alignment with international agreements) and can help project developers navigate the country's blue carbon governance to expedite the protection and restoration of blue carbon ecosystems (as per Action 4.1).

ACTION 1.3

# DELIVER STATE-OF-THE-ART BLUE CARBON RESEARCH

Seychelles' blue carbon research agenda should be guided by the Blue Carbon EWG (as per Action 1.2) and be based on standard international protocols such as the Coastal Blue Carbon Manual[14] and the IPPC Wetland Supplement[4]. The use of verified protocols will guarantee national estimates of blue carbon gains and losses are compatible with GHG inventories, climate change frameworks (e.g., IPCC; aligned with Action 3.3) and international carbon crediting mechanisms (e.g., Verified Carbon Standards; aligned with Action 4.1).

| Nationwide on-ground blue carbon research | SEAGRASS | MANGROVES |
|---|---|---|
| Habitat mapping and ground- truthing | a | |
| Plant C stock | a | b |
| Soil C stock | a | b |
| Soil C sequestration | a | |
| C modelling | a | b |

**a.** 'Seychelles Seagrass and Carbon Mapping Project'[9] [funded by the Pew Charitable Trusts, implemented by the University of Oxford, Island Conservation Society, University of Seychelles, German Aerospace Agency, and SeyCCAT]

**b.** 'Blue carbon assessment for mangrove ecosystems in Seychelles'[12] [funded by MACCE, the World Bank, GEF and SWIOFIS3, implemented by Deakin University]

Although Seychelles' blue carbon research is in its infancy [11,15], two nationwide programs will soon provide some of the first on-ground estimates of carbon stocks for Seychelles' mangrove and seagrass ecosystems [9,12]. Building on these baseline datasets and maps, Seychelles should continue to advance its blue carbon science.

### PRODUCE HIGH-RESOLUTION MAPS OF BLUE CARBON DISTRIBUTION

Seychelles needs to work closely with universities and national GIS and remote sensing teams to update the nationwide distribution maps of mangroves and seagrasses in Seychelles. Nationwide maps are limited to those included in the Seychelles Marine Spatial Planning Initiative[7], which collates maps at different spatial scales, and therefore, potentially under- or overestimates the extent of mangroves and seagrasses in Seychelles (Appendix A, Table 2 includes a summary of existing maps). High-resolution maps (e.g., 30 m grids) are only available for Aldabra[19] .

Despite the technical complexity of mapping seagrass beds, the vast extent of seagrasses in Seychelles (~ 2 million ha) underscores the need for producing detailed distribution maps that can inform blue carbon assessments and detect subtle temporal and spatial changes in extent or habitat condition. Mangrove maps should also be improved to include mangrove distribution at the species level **[Box 1]**. Paired with field-derived blue carbon data, species-specific maps could significantly improve the estimates of blue carbon stocks at local and national scales (see Appendix B for a case study).

Working in collaboration with elders from local communities (aligned with Action 1.2), Seychelles should also develop historical maps of the distribution of mangroves and seagrasses in the past. Historic maps are essential to guide restoration efforts and estimate Seychelles' blue carbon opportunities for additionality.

### QUANTIFY ON-GROUND CARBON STOCKS AND SEQUESTRATION RATES

Nationwide field campaigns need to be implemented in mangrove and seagrass ecosystems to collect local-scale on-ground data on plant carbon stocks, soil carbon stocks, and soil carbon sequestration rates. Data should be collected by trained personnel (as per Action 1.1), ideally with the support of local community members (aligned with Action 2.3). The field protocols and laboratory analyses should follow standard guidelines to ensure compatibility with international blue carbon frameworks and allow comparisons across studies and nations. All the research projects and datasets generated from Seychelles' blue carbon research (including academic theses, consultancy reports, or community-led projects) should be inventoried within a national repository (as per Action 1.2).

### INVEST IN LONG-TERM MONITORING OF BLUE CARBON ECOSYSTEMS

Seychelles must establish a long-term monitoring program that can track any spatial and temporal changes in the distribution of blue carbon ecosystems, their carbon-sink capacity (e.g., plant biomass, soil carbon stocks and sequestration rates), and any potential threats to the health of the system (e.g., excessive sedimentation, sea-level rise). This information is critical to quantify the carbon gains and losses resulting from the protection and restoration of blue carbon ecosystems, accurately account for blue carbon fluxes within Seychelles' National GHG Inventory, and ultimately inform Seychelles' NDCs.

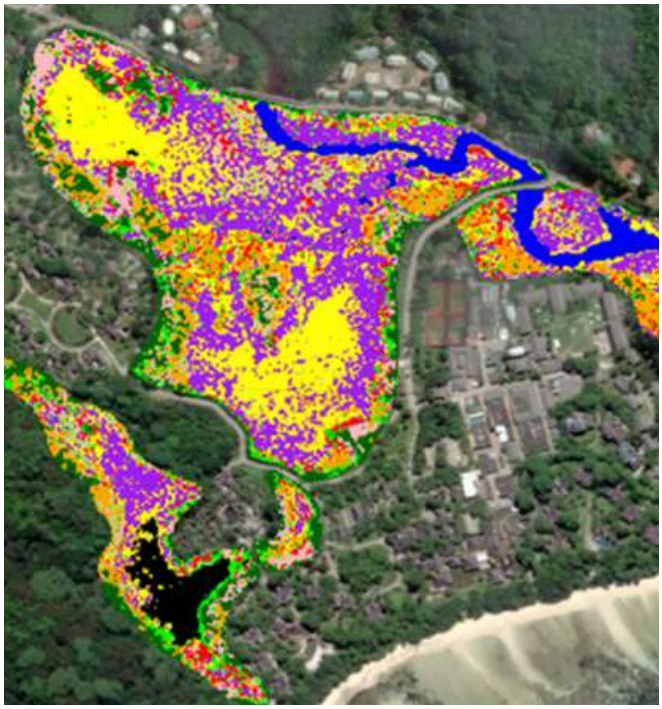
The monitoring should encompass a wide range of mangrove and seagrass sites across Seychelles' inner and outer islands. Additional to having a robust experimental design and being implemented with scientific rigour, the success of a long-term monitoring program in Seychelles requires the engagement of local communities that endorse the on-ground actions and are empowered through different activities (e.g., field data collection, outreach workshops; aligned with Action 2.3). To guarantee the longevity of the program it is important to implement low-cost technologies and analytical tools (e.g., remote sensing via satellites or Unmanned Aerial Vehicles) that can safely and cost-effectively monitor the distribution of blue carbon. Paired with on-ground data on carbon stocks and sequestration rates, these high-resolution maps can be easily employed to detect blue carbon additionally through time (see Appendix C for a case study).

BOX 1

## MAPPING THE DISTRIBUTION AND COMPOSITION OF MANGROVE SPECIES IN PORT LAUNAY'S MANGROVE FOREST

Seychelles' knowledge gaps in the distribution of blue carbon ecosystems have led to uncertainties in the calculation of national carbon stocks and the magnitude of the climate mitigation potential. However, an exciting case study in Mahe's Port Launay Coastal Wetlands has demonstrated local capacity in the development of state-of-the-art maps of mangrove distribution.

Remote sensing research conducted by Alvin Alcidor [20] produced one of the most detailed maps of mangrove forests in Seychelles. Combining satellite imagery of high spatial resolution (50 cm and 2 m) with over 1,500 ground-truthing sampling points, this research successfully modelled the species-specific distribution of seven mangrove species within the Port Launay Ramsar site. This mapping study generated accurate estimates of mangrove cover by species that can be used to estimate species-specific carbon stocks at Port Launay (see Appendix B).



**Map of Port Launay's mangrove forest.** Different colours indicate the distribution of seven different mangrove species (purple, red, orange, yellow, pink, light green, green). Rivers are represented in blue, while dead mangroves are in black. Map kindly shared by A. Alcindor [20].

ACTION 1.4

# MEASURE AND VALUE BLUE CARBON CO-BENEFITS

Additional to serving as carbon sinks, mangroves and seagrass meadows provide many other ecosystem services to people and nature (e.g., fisheries enhancement, coastal protection).

Measuring these co-benefits and their economic value is important to prioritise sites for monitoring or restoration (as per Action 1.3) and generate further financial incentives for project development through the stacking of environmental credits (see Action 4.1). Highlighting biodiversity, fisheries or tourism values can also attract investors who have an interest in supporting research or on-ground actions that align with their organisation's mission or strategies.

Little research is available on the economic value of the ecosystem services provided by Seychelles' mangroves and seagrass beds, with most of the data available relating to coral reefs or marine protected areas in general[10]. Future actions to quantify and value the co-benefits provided by Seychelles' blue carbon ecosystems should include:

- **Fisheries enhancement (artisanal and semi-industrial):** Existing data on fisheries catch within blue carbon habitats could be used to estimate potential fisheries enhancement. However, research needs to focus on comparing fish biomass (or abundance) between unvegetated and blue carbon habitats. Studies using acoustic telemetry and stable isotope techniques can help elucidate the importance of blue carbon ecosystems as nurseries, feeding and shelter grounds by providing information on fish diet, habitat use, and connectivity.
- **Soil retention and creation:** Study the impacts of mangrove forests on sediment accretion and identify whether the elevation can help prevent sea-level rise. Monitoring of land subsidence will help local and national governments to decide setback limits for infrastructure development along the coasts and to design adaptation measures for areas vulnerable to soil erosion.
- **Coastal resilience:** Develop coastal hazards assessments to map and monitor sea-level rise, seawater intrusion, flooding, tides, etc. This information can be used to estimate the role of blue carbon ecosystems in safeguarding people and infrastructure, therefore, helping Seychelles adapt to increased coastal hazards.
- **Water quality improvement:** Monitor pollutants, sedimentation, and nutrient run-off within and adjacent to blue carbon ecosystems. Mangroves and seagrasses can improve water quality by retaining excess nutrients (e.g., nitrogen and phosphorous), pollutants and sediments. Water monitoring will help measure this co-benefit, as well as guide the management actions required.
- **Recreation and tourism:** Explore the contribution of blue carbon ecosystems to local economies and livelihoods via recreation and eco-tourism. Blue carbon ecosystems are home to charismatic marine wildlife (e.g., sea turtles, dugongs) that can attract tourists through snorkelling and recreational fishing. Local hotels and tourist establishments adjacent to these habitats should be encouraged to promote sustainable eco-tourism activities.


COMMUNITY

OBJECTIVE 2. COMMUNITY

# CONNECT SEYCHELLOIS TO BLUE CARBON

EMPOWERING SEYCHELLOIS TO VALUE AND CARE FOR THEIR BLUE CARBON ECOSYSTEMS.

ACTION 2.1

**CONSULT AND ENGAGE THE PEOPLE**

ACTION 2.2

**STRENGTHEN BLUE CARBON EDUCATION AND AWARENESS**

ACTION 2.3

**ENABLE COMMUNITY-LED BLUE CARBON PROTECTION AND RESTORATION**

OBJECTIVE 2. COMMUNITY

# CONNECT SEYCHELLOIS TO BLUE CARBON

ACTION 2.1

## ENGAGE AND CONSULT THE PEOPLE

Local communities can be either enablers or constraints of blue carbon projects. Seychelles' social dimension should be carefully explored and incorporated into local blue carbon projects for the successful adoption, longevity, and ongoing support of conservation and restoration targets.

### EXPLORE LOCAL PERCEPTIONS OF BLUE CARBON

Seychelles needs to explore the social and cultural acceptability of blue carbon through consultations with local communities and different sectors (public and private) to understand the knowledge, practices, social values, and concerns regarding blue carbon ecosystems and on-ground projects. For example, some projects may generate apprehensiveness if local livelihoods are affected, benefits are unevenly distributed, or if they lead to tenure issues. Understanding the social perception and standing towards blue carbon is critical to identifying the best approach to engage the public (aligned with Actions 2.2 and 2.3) and make sure on-ground projects have a social license to operate and are designed to meet specific community needs (aligned with Action 4.3).

### FACILITATE PROJECT CO-DESIGN THROUGH A BLUE CARBON KNOWLEDGE NETWORK

Seychelles should establish a Blue Carbon Knowledge Network (BCKN) that facilitates knowledge transfer *from* and *to* local communities. Including representatives from different sectors of society (e.g., educators, elders, youth, fishers, tourism operators), the BCKN should work closely with project developers or the EWG to discuss and provide a community perspective in the design, decision-making or implementation of blue carbon research and on-ground projects. The BKN can also support community education and engagement in blue carbon by organising local training workshops or coordinating groups of citizen scientists (in support of Action 2.2 and 2.3).

ACTION 2.2

# STRENGTHEN BLUE CARBON EDUCATION AND AWARENESS

Increasing Seychellois' awareness and understanding of blue carbon ecosystems are indispensable to fostering a deeper appreciation of their value for Seychelles' livelihoods and prosperity. Successful educational programs can also strengthen people's connection to coastal ecosystems and increase mindfulness towards actions and decisions that affect them.

More focus needs to be directed toward seagrass meadows, as most existing educational programs target mangrove ecosystems **[Box 2]**. Stakeholder surveys suggest that seagrasses are the least known blue carbon ecosystem, often perceived as a nuisance by beachgoers[15] . In fact, until recently Seychellois did not have a local (creole) name for seagrass, with it often being classified as a seaweed ('gomon' in creole).

### EARLY EDUCATION

Seychellois could be introduced to blue carbon ecosystems and their ecosystem services from a very young age. Blue carbon can be embedded within the academic curriculum and explored through diverse disciplines (e.g., creative arts, science, history). Hands-on immersive experiences such as field trips, classroom research projects, and citizen science events (aligned with Action 2.3) are one of the most effective strategies to simultaneously educate children about science, coastal wetlands, and the value of nature **[Box 2]**.

To capitalise on this, Seychelles should increase its support for local-scale (e.g., school-specific) and national-scale on-ground environmental programs, as well as invest in the training of educators and classroom teaching resources **[Box 3]**.

### TAILORED MEDIA

Educational media campaigns on blue carbon should be based on objective scientific information and built around the social and environmental fingerprint of the community (identified via Action 2.1). Media campaigns can incorporate complementary messages aiming to (a) elevate Seychellois' perception of coastal ecosystems, (b) educate on blue carbon and co-benefits, and (c) provide a call to action (e.g., avoid stepping on seagrass). The information should be tailored to different audiences and disseminated through the most relevant platform for each audience (e.g., social media to target the youth, airport billboards to target tourists).

### LONG-TERM INVESTMENT

Educational programs are long-term strategies to enhance blue carbon awareness and perception, hence long-term funding and commitment are indispensable for their success. Additional to public sector investment, it is recommended to unlock private sector funding by harnessing cooperation with industries (e.g., hospitality) that benefit from educated perceptions towards blue carbon ecosystems (e.g., more interest in eco-tourism activities in seagrass beds or mangrove forests). Funding from philanthropy, foreign governments, NGOs, and multilateral organisations (e.g., UNDP Global Environment Facility, IUCN-UNDP Mangroves for the Future) should also be explored to finance education and environmental stewardship in Seychelles.

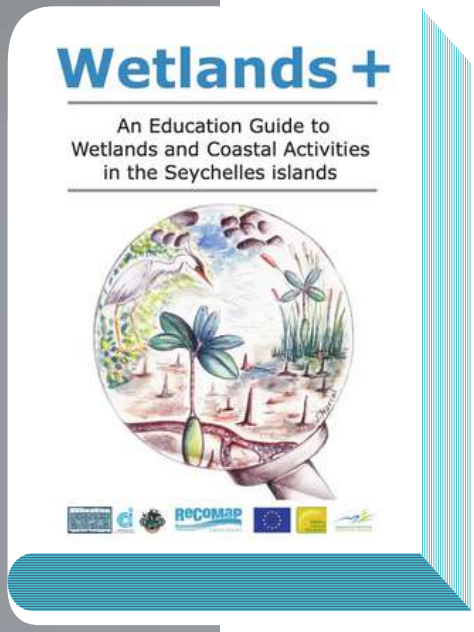
BOX 2

## SCHOOL STUDENTS LEAD MANGROVE RESTORATION IN THE MOUNT FLEURI WETLANDS

Students from the International School Seychelles (ISS) have led the restoration of the Mount Fleuri mangrove ecosystem adjacent to the school grounds. With funding from SeyCCAT and scientific advice from the University of Seychelles and the Wildlife Clubs of Seychelles, the students have implemented a mangrove nursery to source seedlings that are used to restore the intertidal habitat destroyed during a construction nearby.

Children have been involved in the growth and planting of seedlings, the identification of mangrove species, and the survey of the associated wildlife (e.g., crabs, birds, mudskippers). While enhancing the health of the mangrove ecosystem, this hands-on program is a great educational tool allowing students to connect with nature and learn first-hand the value and importance of blue carbon ecosystems.

Student from the International School Seychelles holding mangrove saplings that will be planted around the school grounds.




BOX 3

## SEYCHELLES' EDUCATIONAL GUIDE TO WETLANDS AND COASTAL ACTIVITIES

Wetlands +, An education guide to wetlands and coastal activities in the Seychelles Islands[21] is a teaching tool and activity guide designed to educate and engage students on Seychelles' wetlands.

Suitable for all age groups, the guide includes factsheets, games and hands-on activities (indoors and in the wetland) to help kids discover the importance of Seychelles' wetlands for climate change mitigation, the creatures that live within, and their responsibilities to the natural world.

The guide links to national curriculum programs in science and geography and was developed by Lyndy Bastienne with support from Seychelles' Coastal Engineering and Wetlands Unit and the Wildlife Clubs of Seychelles.

ACTION 2.3

# ENABLE COMMUNITY-LED BLUE CARBON PROTECTION AND RESTORATION

Community-led actions around blue carbon ecosystems can significantly contribute to Seychelles' marine conservation objectives, while creating social cohesion, raising public awareness, and building a resilient society and economy.

## ACCELERATE COMMUNITY STEWARDSHIP AND CO-MANAGEMENT

Local communities should be encouraged to be guardians of their blue carbon resources and empowered to take direct on-ground actions to protect them, enhance them, or restore them. To achieve this, Seychelles should champion and accelerate funding to stewardship programs and local actors (community leaders and local organisations) that can care for their mangrove and seagrass habitats by delivering on-ground conservation and restoration actions.

Community inclusion in the management of blue carbon ecosystems should also be a priority for Seychelles. Although co-management strategies such as Locally Managed Marine Areas (LMMA) are relatively new in the WIO, they can be an effective platform to achieve both environmental and social needs (e.g., food security and livelihoods; identified via Action 2.1). With the launch of the first LMMA in Seychelles [**Box 4**], there is momentum to keep exploring, testing, and supporting locally-led natural resource management in blue carbon ecosystems.

## EMPOWER AND MOBILIZE YOUTH

Seychelles has a very active youth community. Youth empowerment through social innovation and entrepreneurship has incredible potential to solve problems at a grassroots level if youth are given the correct space and platforms to connect and act. With almost 50% of Seychellois aged under 35 years, initiatives such as the Environmental Youth Leadership Programme (EYLP), the Seychelles National Youth Council (SNYC), Global Shapers (Victoria, Seychelles Hub), UN Youth Seychelles (UNYS), the Seychelles National Youth Assembly (SNYA), and the Seychelles Youth Aims Hub have the potential to drive environmental actions and be a force of positive change at a local, national, and international scale.

BOX 4

## FIRST CO-MANAGED MARINE PROTECTED AREA IN SEYCHELLES

In 2020, Seychelles launched its first co-managed marine protected area as part of a regional project implemented by Nature Seychelles and coordinated by the IUCN. The Locally Empowered Area Protection (LEAP) project seeks to engage local communities in the management of the Port Launay and Baie Ternay Marine National Parks, while they sustainably use and benefit from the natural ecosystems.

Through a participatory process, local stakeholders (including hotels, fishers, vendors, government officials, youth, and district leadership) can actively contribute to decision-making and participate in on-ground activities.

At the site level, the project will build infrastructure, undertake conservation and restoration actions, provide training and equipment, and support sustainable tourism and fisheries. At a strategic level, the project seeks to improve local governance to support equity in the design, decision-making, and benefit-sharing, as well as strengthen national policy and regulatory frameworks through an evidence-based policy review.

# GOVERNANCE

OBJECTIVE 3. GOVERNANCE

# INTEGRATE BLUE CARBON INTO NATIONAL POLICY FRAMEWORKS

OPTIMISING GOVERNANCE TO ENSURE THE PROTECTION OF BLUE CARBON ECOSYSTEMS, THE SUSTAINABILITY OF PEOPLES' LIVELIHOODS, AND THE BUILDING OF A CLIMATE-RESILIENT SEYCHELLES

ACTION 3.1

## ENABLE GOVERNANCE CONDITIONS FOR BLUE CARBON

ACTION 3.2

## CLARIFY LEGISLATION AROUND CREDITING RIGHTS AND OWNERSHIP

ACTION 3.3

## ADVANCE INTERNATIONAL BLUE CARBON COMMITMENTS

OBJECTIVE 3. GOVERNANCE

# INTEGRATE BLUE CARBON INTO NATIONAL POLICY FRAMEWORKS

ACTION 3.1

## ENABLE GOVERNANCE CONDITIONS FOR BLUE CARBON

Governance related to the management and restoration of blue carbon ecosystems (e.g., who 'owns' blue carbon credits) is not well established in most countries, including Seychelles.

Mangroves and seagrasses occupy the intertidal and subtidal zones of the coastline which are often legally contested spaces, due to a lack of clarity over land tenure and competing land uses. Further, Seychelles lacks specific legislation and action plans on mangrove or seagrass ecosystems. Under the blanket definition of 'Wetlands', they are increasingly being incorporated into national legal frameworks and management plans, however, most often their governance is limited to their protection.

Private investors, particularly the largest asset managers, respond strongly to government-backed guidance. Therefore, clear, stringent guidance or regulation could help accelerate natural capital investments. Several actions need to be undertaken to progress clear and robust blue carbon governance in Seychelles, especially to address competing and/or conflicting land-use practices and capture the dynamic response of blue carbon ecosystems to changing coastlines (e.g., sea-level rise, coastal erosion).

### EVALUATE NATIONAL POLICIES

Undertake the IUCN's National Blue Carbon Policy Assessment[22]. The five-step assessment framework allows countries to complete a structured analysis of current policies, coastal priorities, challenges, and demands, to help identify and develop new legislation, policy, or mechanisms for the better conservation and restoration of blue carbon ecosystems. The Framework helps identify priority policies that are likely to have the biggest positive impact and success based on a country's ecological, market, policy, social, and institutional conditions.

| Five-step IUCN's National Blue Carbon Policy Assessment[22] | |
|---|---|
| 1 | Collate information on blue carbon ecosystems (C stocks, distribution, threats..) |
| 2 | Identify features of the four enabling conditions (policy, legal, institutional, market) |
| 3 | Identify the status of four enabling conditions |
| 4 | Determine policy priority option(s) |
| 5 | Develop policy priority pathway(s) |

## ADDRESS POLICY GAPS AND ALIGN WITH INTERNATIONAL INITIATIVES

Key policy gaps identified in the IUCN's National Blue Carbon Policy Assessment should be addressed. Further, Seychelles should focus on developing coherent and coordinated frameworks (at local, regional, and national scale) that prevent unintended outcomes that can compromise the viability of investments in blue carbon projects (e.g., subsidies to aquaculture could lead to mangrove clearing).

Any new policies and frameworks need to align with multilateral environmental agreements (e.g., Paris Agreement, Ramsar Convention) and international climate governance (e.g., UNs Sustainable Development Goals, Decade on Ecosystem Restorations, Aichi Biodiversity targets).

Frameworks, regulations, and policies developed should ensure that blue carbon projects financed through Voluntary Carbon Markets generate carbon credits that are additional (i.e., result from implementing the management action), not double-counted (i.e., what is counted in Seychelles' NDCs is not sold on the market), transparent, and traceable (i.e., authentic, and verifiable data available via public registry or Blockchain technology).

## DEVELOP A BLUE CARBON WHITE PAPER

Seychelles could develop a plain language governance document that outlines the main policies related to blue carbon ecosystems, as well as the frameworks, standards, strategies, and guidelines that support the implementation and operationalisation of these policies. To facilitate investment and project development, the document should specifically highlight and clarify the regulations that are relevant to the design and implementation of blue carbon projects in Seychelles.

It is important that this whitepaper provides a transparent and coordinated approach for protecting and restoring blue carbon ecosystems, outlining the keys roles of government, researchers, industry, and community (e.g., a process and decision-making framework). All stakeholders involved should have a clear understanding of their role and responsibilities to ensure bureaucratic bottlenecks are avoided when blue carbon projects are implemented.

## REDUCE LONG-TERM POLICY UNCERTAINTY

Blue carbon projects generally run for 25 years, with the commitment to maintain the carbon stored during the crediting period for a longer period (from 25 to 100 years). During this period, risks for blue carbon projects may arise from changes in the government (resulting in changed priorities and policies), reduction in public funds to support projects, or relaxation of regulations that could directly or indirectly affect projects and investment. Seychelles should develop strategies to maintain long-term collaboration and policy frameworks (i.e., reduce policy uncertainty) to help de-risk investment into blue carbon projects.

ACTION 3.2

# CLARIFY LEGISLATION AROUND CREDITING RIGHTS AND OWNERSHIP

Blue carbon ecosystems occupy intertidal and subtidal zones, which are often contested spaces in terms of land tenure. Mangrove forests can exist across both public and private land, while seagrass meadows can occur beyond a country's Exclusive Economic Zone or within jointly managed areas between several countries **[Box 5]**. Complex land tenure makes it difficult to determine who 'owns' the rights to credits, including carbon, biodiversity, or other generated within a project.

Seychelles' Civil Code (1976)[23] and Environmental Protection Act (1995)[24] jointly suggest that seabeds, rivers, foreshores, and intertidal zones (up to the highwater mark) are part of the public domain, and hence owned by Seychelles' government. However, there will be many instances where this might not be the case **[Box 5]**. The successful implementation of blue carbon projects requires clear legislation that directly addresses ownership of land occupied by blue carbon ecosystems and the credits that will be generated from them now and into the future.

'Credit rights', including carbon, and other ecosystem services credits, need to be understood, defined, and allocated based on Seychelles' Laws. It needs to be decided if the credit rights only rest with the investors and project developers, or if other key stakeholders have rights to the credits. For example, community rights to credit ownerships should be considered, as blue carbon projects can directly impact the livelihoods of adjacent communities.

Sea-level rise will further complicate the governance of blue carbon projects, due to imminent changes to the highwater mark, the distribution of blue carbon ecosystems, and the carbon sequestration rates. Seychelles should prioritise modelling the impacts of sea-level rise on blue carbon ecosystems (as per Action 1.3) and determine how coastal management planning (e.g., creating accommodation space to allow the landward migration of mangroves) can help protect these ecosystems into the future. As blue carbon project boundaries will change long-term due to sea-level rise, this issue will need to be addressed and planned for during the early stages of projects.

BOX 5

## CREDITING RIGHTS IN THE JOINTLY MANAGED SAYA DE MALHA BANK

Located in the WIO's Mascarene Plateau, the Saya de Malha Bank is one of the world's most important blue carbon assets, as it supports the world's largest seagrass meadow (10% of global seagrass).

In 2012, Seychelles and Mauritius jointly extended their outer continental shelf to include the Mascarene Plateau, with approval from the United Nations Convention on the Law of the Sea (UNCLOS). As a result, both countries share governance of approximately 400,000 km² of seabed, while the water column remains on the high seas.


While there is great potential for large-scale blue carbon conservation projects across the Saya de Malha Bank, the interests, roles, and responsibilities between Seychelles and Mauritius need to be clarified, in particular relating to blue carbon project development and biodiversity conservation.

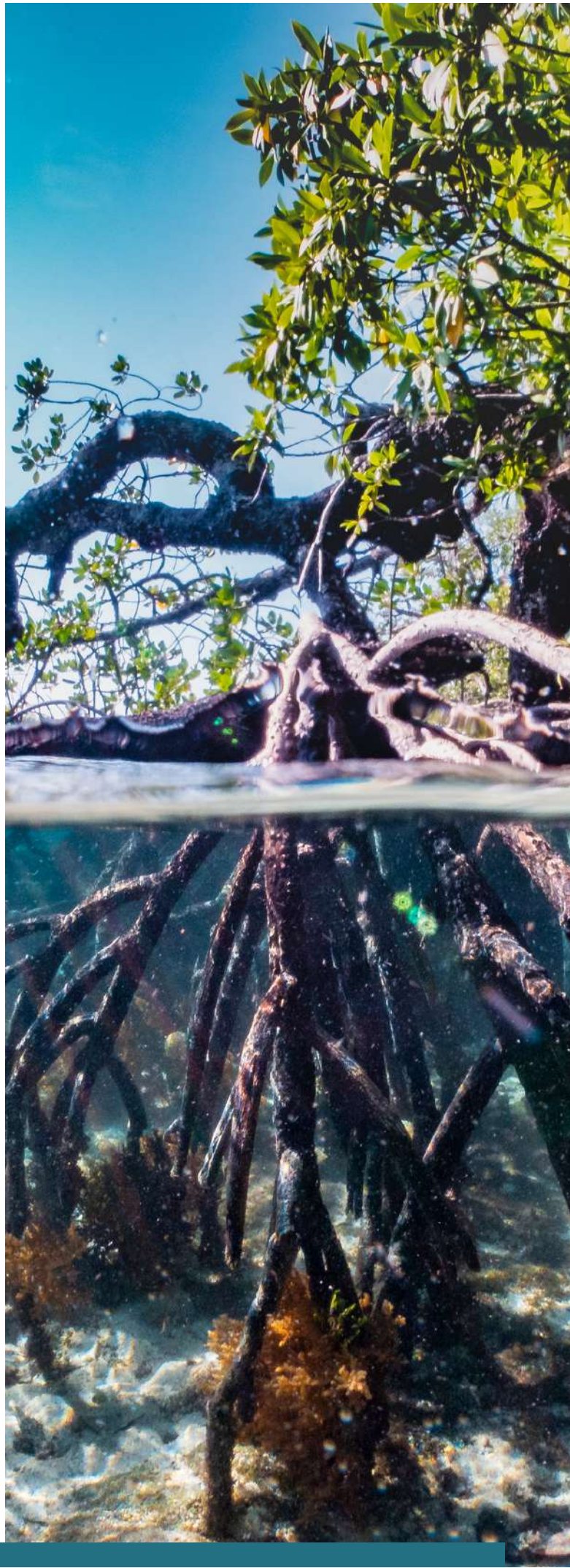
Both countries need to develop legal frameworks for the conservation and sustainable use of marine biodiversity in areas beyond national jurisdiction (BBNJ). The UN is currently developing an international legally binding instrument to address this issue, also known as the 'BBNJ Agreement'[25]. This framework would be critical if biodiversity credits were to be a part of a blue carbon project.

ACTION 3.3

# ADVANCE INTERNATIONAL BLUE CARBON COMMITMENTS

To meet the long-term goals of the Paris Agreement, a legally binding international treaty on climate change, each country is required to prepare, communicate, and maintain successive NDCs. The NDCs are national climate plans highlighting climate actions, and targets by governments to respond to climate change. In July 2021, Seychelles revised its NDCs which included very ambitious targets and actions for the period of 2021-2030.

Seychelles committed to reducing its GHG emissions by ~24% compared to a business-as-usual scenario. As part of the NDCs adaptation contribution, Seychelles pledged to protect at least 50% of its seagrass and mangrove ecosystems by 2025, and 100% of the seagrasses by 2030. Furthermore, by 2025 Seychelles is to establish a long-term monitoring program for seagrass and mangrove ecosystems and include the GHG sink of Seychelles' blue carbon ecosystems within the National GHG Inventory.



### QUANTIFY THE MITIGATION VALUE OF MANGROVES AND SEAGRASSES USING THE IPCC GUIDELINES

The IPCC Wetlands Supplement[4] is the main guideline to support carbon and emission inventories. As a signatory of the United Nations Framework Convention on Climate Change (UNFCCC), Seychelles is required to submit GHG emission inventories on a regular basis according to these guidelines. In this case, these guidelines provide essential recommendations on how to estimate carbon fluxes in coastal wetlands.

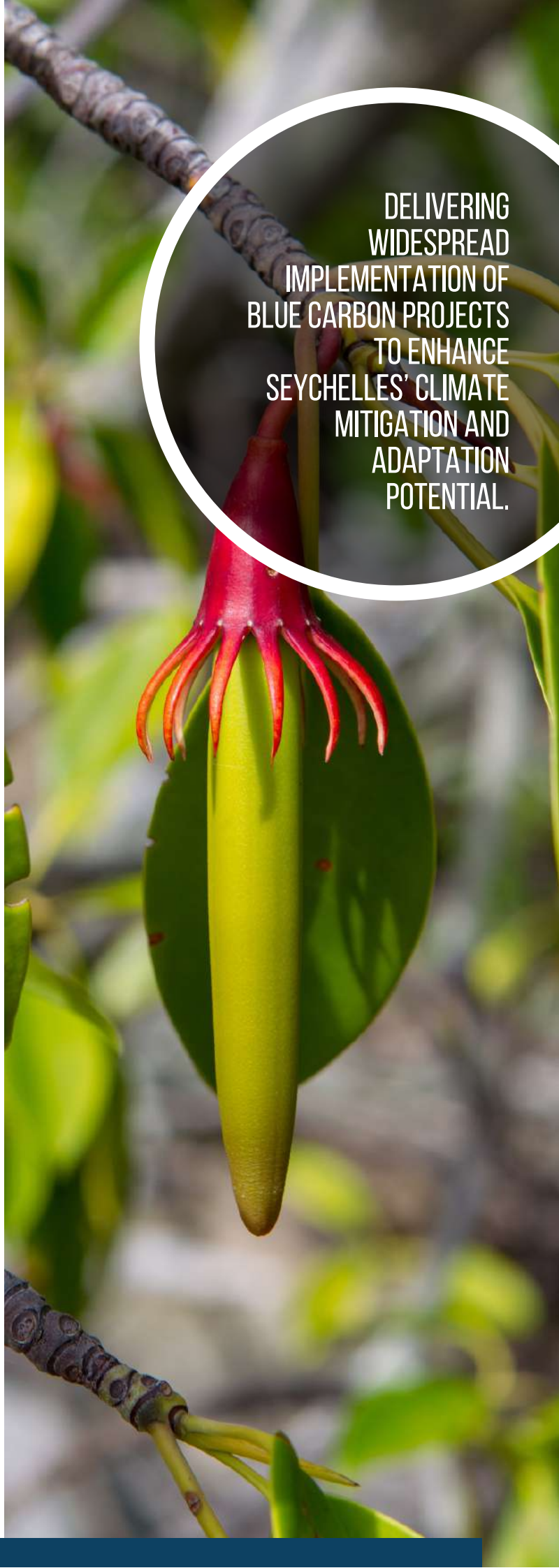
Furthermore, it is important to highlight that such guidelines are also key for the development of blue carbon projects. In this case, carbon credits generated by these projects and acquired by the government, can then be included in the national inventory and provide a direct contribution to Seychelles' commitments in their updated NDCs (as discussed in Action 3.1).


FINANCE

OBJECTIVE 4. FINANCE

# CONNECT BLUE CARBON PROJECTS TO CARBON MARKETS AND OTHER FINANCE MECHANISMS

DELIVERING WIDESPREAD IMPLEMENTATION OF BLUE CARBON PROJECTS TO ENHANCE SEYCHELLES' CLIMATE MITIGATION AND ADAPTATION POTENTIAL.



ACTION 4.1
**ACCOUNT FOR THE ENVIRONMENT**

ACTION 4.2
**EXPLORE AND TEST EFFECTIVE MECHANISMS FOR FINANCING BLUE CARBON PROJECTS**

ACTION 4.3
**IMPLEMENT BLUE CARBON PROJECTS**

OBJECTIVE 4. FINANCE

# CONNECT BLUE CARBON PROJECTS TO CARBON MARKETS AND OTHER FINANCE MECHANISMS

ACTION 4.1

## ACCOUNT FOR THE ENVIRONMENT

Healthy mangrove and seagrass ecosystems provide many intangible and non-marketable services and goods to Seychellois (e.g., clean fresh air, relaxation). Seychelles should perform environmental accounting of its blue carbon ecosystems to understand, recognise, and value the contribution of these environmental assets to the local communities and the national economy.

Several environmental-economic accounting frameworks (e.g., UN's System of Environmental-Economic Accounting[26] -SEEA; The World Bank's Wealth Accounting and Valuation of Ecosystem Services[27] - WAVES) are designed to link ecosystem assets and services to measures of economic and human activity. They report on the inventory of environmental assets and the services they provide to society through time, including information about which assets have been depleted or lost, which are declining in condition, and how the health of these assets affects local society.

Integrating environmental and economic data into blue carbon project assessment and appraisal can facilitate effective decision-making. These frameworks also provide insights into how and where strategic investments can be made to manage blue carbon ecosystems.

ACTION 4.2

# EXPLORE AND TEST EFFECTIVE MECHANISMS FOR FINANCING BLUE CARBON PROJECTS

Many climate- and biodiversity-related financial mechanisms can be used to fund the conservation and restoration of blue carbon ecosystems in Seychelles **[Table 1]**. These include market mechanisms (e.g., Voluntary Carbon Market), non-market mechanisms (e.g., Dept-for-Nature Swap, philanthropy giving), and a wide range of funds from governments (national and foreign), international conventions (e.g., Global Environment Facility), and multilateral development banks (e.g., Blue Bonds).

There is no 'one size fits all' in terms of financing blue carbon projects, therefore a financial mechanism needs to be explored according to the environmental and socio-economic context of each project. Three key steps to identify potential mechanisms include:

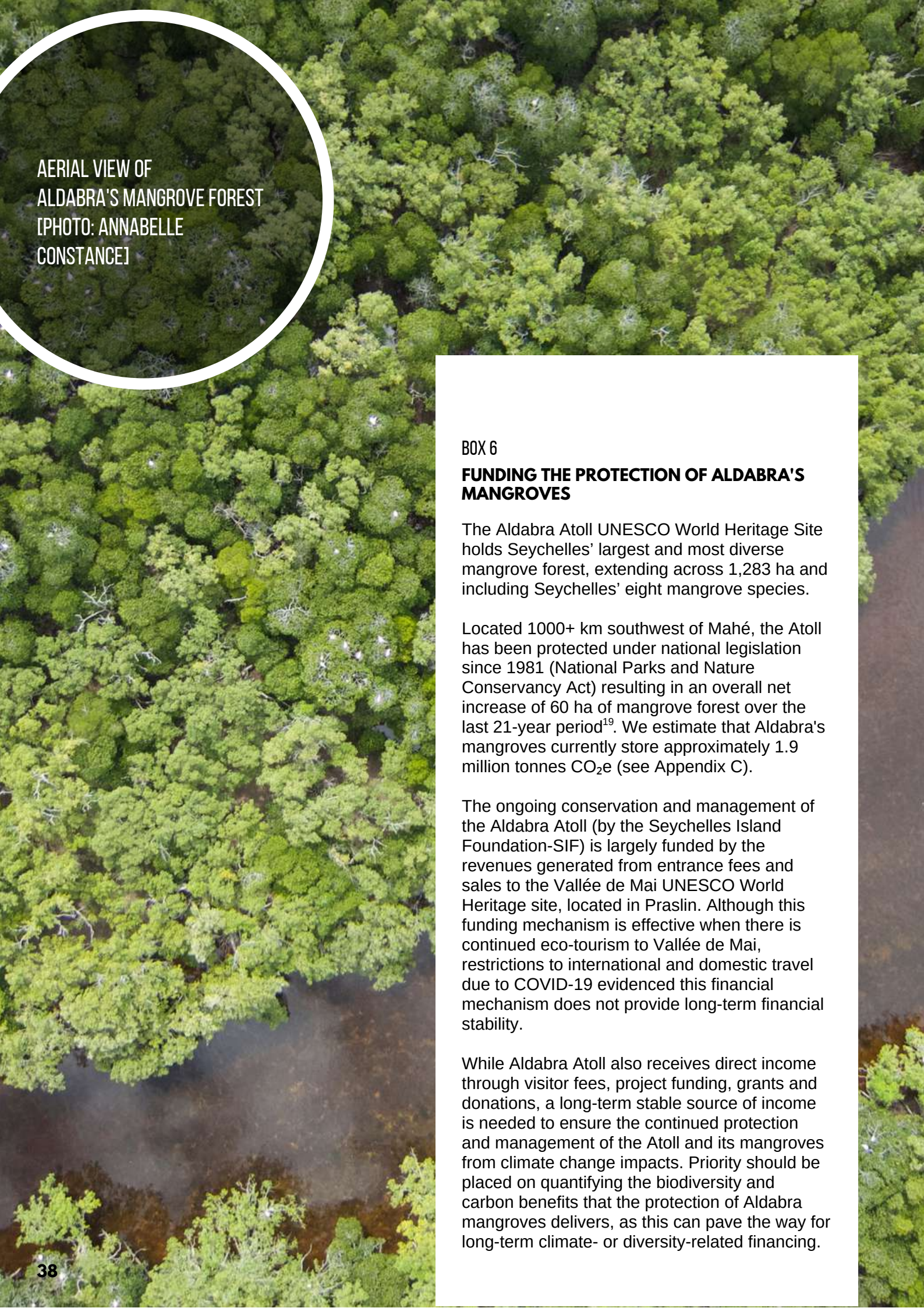
| | |
|---|---|
| 1 | **Determining the project type.** Identify the ecosystem type, project size (area), the management action or intervention type, land use, and amount of funding required. |
| 2 | **Matching the project with a potential funding source.** Examine the most suitable financial mechanism considering eligibility criteria, barriers, risks, and outcome expectations (e.g., profit versus social cohesion). |
| 3 | **Identifying any incremental/additional funds.** Blue carbon ecosystems provide many co-benefits (see Action 1.4), so it is important to explore financing through alternative funds (e.g., biodiversity funds) and the possibility of stacking environmental credits (e.g., carbon + biodiversity + social). |

Large-scale blue carbon projects are usually undertaken by numerous stakeholders and funded through blended finance, while small-scale projects can often be financed by philanthropy or governments. Projects that require long-term financial stability **[Box 6]**, should seek a finance mechanism that guarantees a long-term flow of investments or the possibility of leveraging additional funds. It is always recommended to run workshops or round-table discussions with potential investors, relevant stakeholders, and local actors to help elucidate local expectations, motivations, and barriers.

Several guides provide insights and compare blue carbon financial mechanisms, including case studies of how projects can be implemented (e.g., Coastal "blue" carbon: A revised guide to supporting coastal wetland programs and projects using climate finance and other financial mechanisms[28]).

**Table 1. Overview of climate- and biodiversity financial mechanisms that may potentially be used to fund large-scale blue carbon restoration and conservation in Seychelles.**

| Type | Mechanism | Description and Case study |
|---|---|---|
| **Market Mechanism** | **Voluntary Carbon Markets** | Allow trade of carbon credits. Each credit is equivalent to a tonne of carbon dioxide equivalent (t $CO_2$ e) reduced, avoided, or sequestrated in carbon sinks, in comparison to a baseline scenario. Carbon credits must demonstrate 'additionality' (i.e., emission reductions would not have occurred under business-as-usual) and be measurable, verifiable, permanent, real, and unique. They must be issued by a certification standard (e.g., Verified Carbon Standards, Gold Standard, Plan Vivo Standard, Clean Development Mechanism).<br>Case study: Mikoko Pamoja- Kenya |
| | **Payment for Ecosystem Service (PES) Schemes** | Provide payment incentives for the additional or sustained ecosystems services provided by restored or protected ecosystems (e.g., water quality credits, biodiversity enhancement, etc.)<br>Case study: Reef Credits |
| **Non-Market Mechanisms and Multilateral Funds** | **Carbon insetting** | Evaluating, reducing, and offsetting the climate and environmental footprint of a company by developing impactful socio-environmental projects within its value chain.<br>Case Study: Plant for the planet |
| | **Blue Bonds** | Debt instrument issued by governments, development banks, or others to raise capital from impact investors to finance marine and ocean-based projects that have positive environmental, economic, and climate benefits.<br>Case Study: Seychelles' Blue Bonds |
| | **Debt-for-Nature Swaps** | Financial mechanisms that allow portions of a developing country's foreign debt to be forgiven in exchange for commitments to invest in biodiversity conservation and environmental policy measures.<br>Case Study: Seychelles 'Debit-for-Nature Finance Swap' |
| | **Parametric Insurance (index-based insurance)** | Non-traditional insurance product that offers pre-specified payouts based upon a trigger event (e.g., a pay-out is triggered if wind speeds reach greater than 100 knots across a coral reef). It is a relatively new financial tool to increase the climate resilience of natural ecosystems.<br>Case Studies: Coral reef insurance |
| | **Blended Finance** | The strategic use of public and philanthropic funding designed to entice private investors to emerging and frontier markets, resulting in positive results for both investors and communities<br>Case Study: Sustainable Ocean Fund |
| **National Funds** | **Tax subsidies** | Tax concessions or subsidies are given to private landholders when they enter into a voluntary agreement (e.g., conservation covenant or easement) that aims to protect and enhance the natural, cultural and/or scientific values of certain land.<br>Case Study: Trust for Nature Conservation Covenant |



AERIAL VIEW OF ALDABRA'S MANGROVE FOREST [PHOTO: ANNABELLE CONSTANCE]

BOX 6

## FUNDING THE PROTECTION OF ALDABRA'S MANGROVES

The Aldabra Atoll UNESCO World Heritage Site holds Seychelles' largest and most diverse mangrove forest, extending across 1,283 ha and including Seychelles' eight mangrove species.

Located 1000+ km southwest of Mahé, the Atoll has been protected under national legislation since 1981 (National Parks and Nature Conservancy Act) resulting in an overall net increase of 60 ha of mangrove forest over the last 21-year period[19]. We estimate that Aldabra's mangroves currently store approximately 1.9 million tonnes $CO_2e$ (see Appendix C).

The ongoing conservation and management of the Aldabra Atoll (by the Seychelles Island Foundation-SIF) is largely funded by the revenues generated from entrance fees and sales to the Vallée de Mai UNESCO World Heritage site, located in Praslin. Although this funding mechanism is effective when there is continued eco-tourism to Vallée de Mai, restrictions to international and domestic travel due to COVID-19 evidenced this financial mechanism does not provide long-term financial stability.

While Aldabra Atoll also receives direct income through visitor fees, project funding, grants and donations, a long-term stable source of income is needed to ensure the continued protection and management of the Atoll and its mangroves from climate change impacts. Priority should be placed on quantifying the biodiversity and carbon benefits that the protection of Aldabra mangroves delivers, as this can pave the way for long-term climate- or diversity-related financing.

ACTION 4.3

# IMPLEMENT BLUE CARBON PROJECTS

Restoring and conserving blue carbon ecosystems at small and large scales can help Seychelles adapt and mitigate climate change. Considering that >80% of Seychelles' mangroves are already protected within the Aldabra Atoll World Heritage site, large-scale blue carbon opportunities will be through seagrasses which are not fully protected and still facing numerous threats.

## EXPLORE BLUE CARBON PROJECT OPPORTUNITIES

Seychelles can explore its blue carbon opportunities by answering the two most critical questions underpinning project development and blue carbon investment- how big is the scale of blue carbon opportunities (e.g., how many tonnes of $CO_2$ could be offset per annum) and where to act?

By implementing the two key steps described below, Seychelles can identify how big is the opportunity under different protection and restoration actions and produce spatially-explicit information on where those opportunities exist.

1

**Identify blue carbon hotspots.**

A modelled heatmap of blue carbon stocks across Seychelles should be developed by combining field blue carbon data points (outputs from Actions 1.3) with local spatial data on the main ecological, geomorphological, and anthropogenic drivers of blue carbon in Seychelles (e.g., temperature, soil type, population). Additional layers (e.g., land tenure, community support) can help identify sites where restoration or protection is most needed, cost-effective, and where the likelihood of success is high.

2

**Predict blue carbon additionality under different management scenarios.**

Seychelles should identify the main threats to blue carbon ecosystems and explore the potential management actions to address them (e.g., establishing conservation easements, improving water quality for seagrass meadows, and creating space for mangroves to migrate with sea-level rise). Then, predictive models should be used to estimate future net carbon sequestration and its monetary value under the different management actions. Spatially-explicit tools such as the Coastal Blue Carbon InVEST model [29] can be used to facilitate this analysis.

## CREATE A PORTFOLIO OF PRIORITY SITES FOR PROJECT DEVELOPMENT

There is immense global demand for blue carbon projects, however, there is a lack of supply of investible blue carbon projects. To help fast track investment and implementation of blue carbon conservation and restoration, Seychelles could create a portfolio of blue carbon projects that vary in scale, interventions, and narratives. This inventory of priority sites for on-ground actions should provide details that facilitate project appraisal and decision making. Some key points include:

- **Scale of the blue carbon opportunity and potential co-benefits.** Reports the annual carbon captured and carbon dioxide offset through project development. Also identifies potential co-benefits.
- **Methods and costs for achieving blue carbon additionally.** Details of the management action required (e.g., protection by fencing, restoration by levee removal) and estimated costs for its implementation.
- **Likelihood of success/failure.** Information on land tenure, carbon ownership, community support, and local policies that might facilitate or block project development.
- **Feasibility assessments and cost-benefit analysis (CBA)**. Report expected revenues from the sale of carbon credits. Evaluates investment gains, losses and risks.
- **Potential financial options.** Highlight relevant financial mechanisms (as per Action 4.1), certification standards, and eligibility criteria.

## DEVELOP A NETWORK OF DEMONSTRATION PROJECTS

Demonstration projects help illustrate the business case for investments, while putting science into on-ground action (aligned with Action 1.3), engaging local communities (in support of Action 2.3), and testing governance frameworks (aligned with Action 3.1).

Blue carbon demonstration projects in Seychelles should represent a variety of ecosystem types (mangroves and seagrass), management activities (restoration or conservation), and socio-economic settings. A wide portfolio of projects will provide an opportunity to test different financial mechanisms under Seychelles' environmental, social, political, and economic context (Action 4.1), as well as identify research gaps and unexpected impacts on livelihood. The information and knowledge gained through demonstration projects will help de-risk, improve, and drive future investment into blue carbon projects in Seychelles.

Blue carbon demonstration projects are increasing worldwide, along with the learnings and knowledge from their implementation. Some relevant best practice guides and methods include IUCN's Manual for the creation of blue carbon projects in Europe and the Mediterranean[30], RAE's Coastal Blue Carbon in Practice: A manual for using the VCS methodology for tidal wetland and seagrass restoration[31], and IUCN's A guide to the Restoration Opportunities Assessment Methodology[32].

## ADVOCATE SHARING OF BLUE CARBON PROJECT OUTCOMES

Blue carbon projects in Seychelles should be systematically monitored, with the data and outcomes reported within the national repository of blue carbon research (described in Action 1.2). Learnings should also be actively shared with scientists, the government, and the public through different platforms (e.g., best practices guides and workshops held by the Blue Carbon EWG, see Action 1.2). Knowledge and data sharing will help increase the success of future restoration projects in Seychelles (e.g., avoid repeating the same mistakes) and improve restoration science by helping increase the predictive capacity of restoration actions and providing national information for evidence-based decision-making and scaling-up approaches. Additionally, knowledge sharing will build local capacity, further developing blue carbon expertise in Seychelles (aligned with Action 1.1).

Documents such as the SER's International Principles & Standards for the Practice of Ecological Restoration[33] , the Guidelines on Mangrove Ecosystem Restoration for the Western Indian Ocean Region[34], and the Guidelines on Seagrass Ecosystem Restoration for the Western Indian Ocean Region[35] provide detailed steps on how to design, implement, monitor, and evaluate on-ground projects that lead to restoration success.

## DEVELOP LOCAL NURSERIES AND SEED BANKS FOR RESTORATION

Local nurseries and seed banks could be established throughout Seychelles to increase the success of blue carbon restoration projects in areas with low natural recruitment of mangroves or seagrasses. Transplanting of seeds, seedlings, propagules, shoots, or saplings can significantly speed the re-vegetation of restored mudflats. Nurseries and seed banks help protect seeds and young propagules from pests, allow seedlings to be raised in a vegetation zone with similar conditions to the areas to be planted, and allow plants to reach a larger size before transplanting.

Several small-scale community nurseries have already been established in Seychelles. To accelerate and expand its establishment, Seychelles should invest in infrastructure, build more local capacity, and increase opportunities for community engagement and education (aligned with Actions 2.2 and 2.3). Engaging Seychellois in the care of native coastal vegetation can lead to a greater appreciation for blue carbon ecosystems and can become an ongoing source of income with the implementation of blue carbon restoration projects.

# CLOSING REMARKS

## SEYCHELLES HAS A WEALTH OF SEAGRASS MEADOWS AND MANGROVE ECOSYSTEMS THAT OFFER SIGNIFICANT OPPORTUNITIES FOR CARBON SEQUESTRATION AND CLIMATE CHANGE MITIGATION.

Seychelles has the opportunity to place itself at the forefront of international efforts to incorporate coastal carbon within $CO_2$ mitigation strategies, by strengthening its research agenda, empowering local communities, and permeating governance and financial frameworks with blue carbon.

By advancing an inclusive blue carbon program Seychelles will have the opportunity to achieve its NDCs and SDG commitments, while improving marine biodiversity, enhancing natural capital, and contributing to local livelihoods.

**Empower local scientists to map and monitor national blue carbon stocks at high resolution spatial and temporal scales.**

**Educate and engage local communities through the co-design and co-management of blue carbon projects.**

**Align and clarify national legislation to facilitate blue carbon governance and achievement of international commitments.**

**Encourage the conservation and restoration of blue carbon ecosystems using climate - and biodiversity finance mechanisms.**

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