



SEYCHELLES' BLUE CARBON CONTEXT: RESULTS FROM A STAKEHOLDER QUESTIONNAIRE

**PREPARED BY
BLUE CARBON LAB**



Seychelles' Blue Carbon context: results from a stakeholder questionnaire

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Compiled and prepared by:

Maria Palacios, Micheli Costa, Melissa Wartman and Peter Macreadie from Deakin University's Blue Carbon Lab (Australia), in collaboration with Ameer Ebrahim from the James Michel Foundation (Seychelles).

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EXECUTIVE SUMMARY

GRAPHICAL SUMMARY

Seychelles Blue Carbon context: Results from a stakeholder questionnaire

103 respondents
Most with scientific careers
and managerial roles



56 organisations



1. Attitudes towards coastal wetlands

Mangroves

Attitude: Slightly positive

✓ Better education and awareness

Seagrasses

Attitude: Indifferent or slightly negative

✗ Potential nuisance

2. Research biases



Mangroves more studied than seagrasses



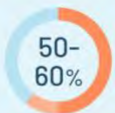
Research has focused on plant taxonomy or habitat mapping, with little attention to carbon storage

90% of scientists consider the main research limitation is the lack of funding, facilities and equipment

4. Scope for protection & restoration



45% of coastal wetlands are protected



50-60% of coastal wetlands are degraded

The top environmental threat to these ecosystems is coastal development

3. Vulnerability awareness

Top environmental concerns:



Extreme weather events



Sea level rise

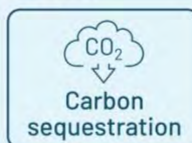


Climate change

Top ecosystem services:



Coastal protection



Carbon sequestration



Fisheries enhancement

5. Coastal revenues

Seagrasses and mangroves provide relatively similar profits

Revenue comes from fisheries enhancement rather than tourism

6. Organisations are keen to help



96% of organisations could support *in-kind* research or education on coastal wetlands



64% of organisations could support environmental projects mainly motivated by increasing biodiversity

EXECUTIVE SUMMARY

Seychelles is at the forefront of international efforts to incorporate coastal carbon within their National Determined Contributions (NDCs). This report depicts the results of a stakeholder questionnaire intended to solicit local knowledge on the current social, political, ecological and scientific context of blue carbon ecosystems in Seychelles (i.e., mangrove forests and seagrass meadows). To achieve this, the questionnaire was distributed among more than 200 stakeholders working in close connection to Seychelles' coastal ecosystems.

In total, 103 stakeholders from 56 organisations responded the questionnaire. Fifty-six percent of all respondents belonged to either governmental institutions or NGOs, with the rest of the stakeholders working in the tourism industry, academia, or other types of organisations (e.g., parastatal). Most of the respondents had scientific careers and undertook managerial roles within their organisation (i.e., programme coordinator).

Our analysis of the questionnaire identified key points about the local attitudes, knowledge, and frameworks around Seychelles' coastal ecosystems:

- **The public has indifferent attitudes towards coastal wetlands due to a lack of education.** Seychellois have slightly negative attitudes towards seagrass meadows, but slightly positive perception of mangrove forests thanks to more/better education campaigns around the latter. Most participants highlighted the need to increase community engagement, environmental education, and outreach, while encouraging the coordination of programs across sectors and disciplines.
- **Research is limited and biased towards a few topics.** Mangroves have been more studied than seagrasses, with research generally focussing on taxonomy or habitat mapping. Almost 90% of the scientists consider the main research challenge is the lack of funding, facilities, and equipment.
- **Seychellois are conscious of their vulnerability to the ocean.** Participant's indicated extreme weather events (ranked 1st), sea level rise, and climate change, are the top environmental issues in Seychelles. Not surprisingly, when asked to rank the top

ecosystem services coastal wetlands provide, they selected coastal protection as the main service, followed by carbon sequestration, and fisheries enhancement.

- **There is great scope for coastal wetland protection and restoration.** Stakeholders indicated less than 45% of the coastal wetlands are protected, and already 50-60% of them have been degraded. The top threat to these ecosystems is land use changes (i.e., coastal development), with environmental regulators often considered “slightly effective” or “not effective at all” at enforcing the protective law.
- **Revenues from coastal wetlands are low or largely unknown.** Almost ¼ of the stakeholders were unsure about the revenues provided by coastal wetlands. However, compared to coral reefs, seagrasses and mangroves seem to provide lower profits, with most revenue coming from fisheries enhancement rather than tourism.
- **Organisations are keen to help.** 96% of the respondents indicated their organisations could support *in-kind* research or education on blue carbon ecosystems. 64% of them would support conservation and rehabilitation projects mainly motivated by increasing biodiversity and offsetting carbon emissions.

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BACKGROUND

BACKGROUND

Blue carbon ecosystems, such as mangrove forests and seagrass meadows, are one of the world's most efficient carbon sinks. They can sequester and store carbon in their vegetation and soil, serving as a nature-based solution to offset carbon emissions and mitigate climate change^{1,2}. Recent estimates suggest that the large-scale protection and restoration of coastal wetlands worldwide could drawdown an additional 841 Tg CO₂e per year by 2030, amounting to ~3% of global fossil fuel emissions³. By accounting for the carbon sequestration of blue carbon ecosystems within national CO₂ mitigation strategies, Seychelles is currently at the forefront of international efforts to incorporate coastal carbon (*aka* blue carbon) within National Determined Contributions (NDCs)⁴. NDCs outline a country's climate action plan to cut emissions, mitigate climate change and achieve the global targets set out in the Paris Agreement.

The project '**Roadmap to blue carbon opportunities in Seychelles**', funded in 2019 by the Seychelles Conservation and Climate Adaptation Trust (SeyCCAT), seeks to explore Seychelles' blue carbon future, by developing a roadmap to potential blue carbon opportunities and building local capacity and literacy on coastal wetland ecosystems.

As part of the project, this stakeholder questionnaire aims to document the social, political, ecological, and scientific context of blue carbon ecosystems in Seychelles, as well as identify the challenges and opportunities that stakeholders foresee.

¹ Duarte, C.M., Losada, I.J., Hendriks, I.E., Mazarrasa, I., Marbà, N., 2013. The role of coastal plant communities for climate change mitigation and adaptation. *Nat. Clim. Chang.* 3, 961–968.

² IPCC. 2014. 2013 Supplement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories: Wetlands. Page (T. Hiraishi, T. Krug, K. Tanabe, N. Srivastava, J. Baasansuren, M. Fukuda, and T. G. Troxler, Eds.). IPCC, Switzerland.

³ Macreadie, P.I., Costa, M.D.P., Atwood, T.B. et al. 2021. Blue carbon as a natural climate solution. *Nat Rev Earth Environ.* <https://doi.org/10.1038/s43017-021-00224-1>

⁴ Republic of Seychelles. 2021. Update of the Nationally Determined Contribution of the Republic of Seychelles. UNFCCC. July 2021.



Photo: Juliet Sefton

METHODOLOGY

METHODOLOGY

The stakeholder questionnaire was delivered to over 200 stakeholders working in close connection to Seychelles' coastal ecosystems. Stakeholder recruitment was a self-selection process, with invitations to participate in the survey distributed via direct email (by scientists from Deakin University and the James Michel Foundation) or disseminated through the internal and external communication outlets of SeyCCAT. The questionnaire was developed and delivered according to Deakin University's Human Ethics guidelines (permit: SEBE-2020-45), with responses being non-identifiable and anonymous. Participation was voluntary, and consent implied through the completion of all the questions. Respondents were under no obligation to answer every question and were permitted to withdraw from the study at any time.

The questionnaire was prepared in English and delivered online via the survey platform Qualtrics⁵, between 03 Nov 2020 and 01 Sept 2021. Draft versions of the questionnaire were subjected to pre-tests and reviewed by scientists and members of SeyCCAT.

The final questionnaire included a total of 34 questions (Appendix A) and was structured into six sections:

- | | |
|---------------------------|--------------------------|
| 1. Participant demography | 4. Society and Education |
| 2. Ecological context | 5. Economic context |
| 3. Scientific context | 6. Policy and Management |

The survey was developed using conditional logic which automatically adjusted the questions displayed depending on the respondents' profile. Hence, the number of questions displayed could range between 21 and 34. Sixty percent of the questions were closed and included pre-coded response options (e.g., multiple choice, ranking). Open questions were mainly used to capture additional information or request explanations for some of the pre-coded choices.

Results displayed below include the responses of the entire pool of respondents. However, each question was screened to check if the responses varied according to the stakeholder's organisation type: Academia, NGO, Government, Tourism and Other (Appendix B). If so, the

⁵ www.qualtrics.com

pattern is described in the text. This classification was based on the stakeholders' response to the question "What is the nature of your organisation?", but was adjusted or changed if deemed necessary (e.g., participants from schools were considered "Other" instead of "Academia").

Responses from closed questions are displayed in bar graphs with the y-axis representing percentage of respondents. Responses from open questions are visually displayed in Wordclouds, with the text size indicating the frequency of the word (i.e., words in greater font size appeared more frequently). The number of stakeholders that responded each question is indicated at the top each graph (ranging from N= 13 to N =100). The dataset collected through this questionnaire is available online at the [Figshare repository](https://figshare.com/articles/dataset/Dataset_Stakeholder_questionnaire_on_Seychelles_Blue_Carb_on_context/17020067)⁶, excluding any personal identifiers of the respondents (i.e., profession, role, and email).

⁶https://figshare.com/articles/dataset/Dataset_Stakeholder_questionnaire_on_Seychelles_Blue_Carb_on_context/17020067



RESULTS

RESULTS

STAKEHOLDER PROFILE

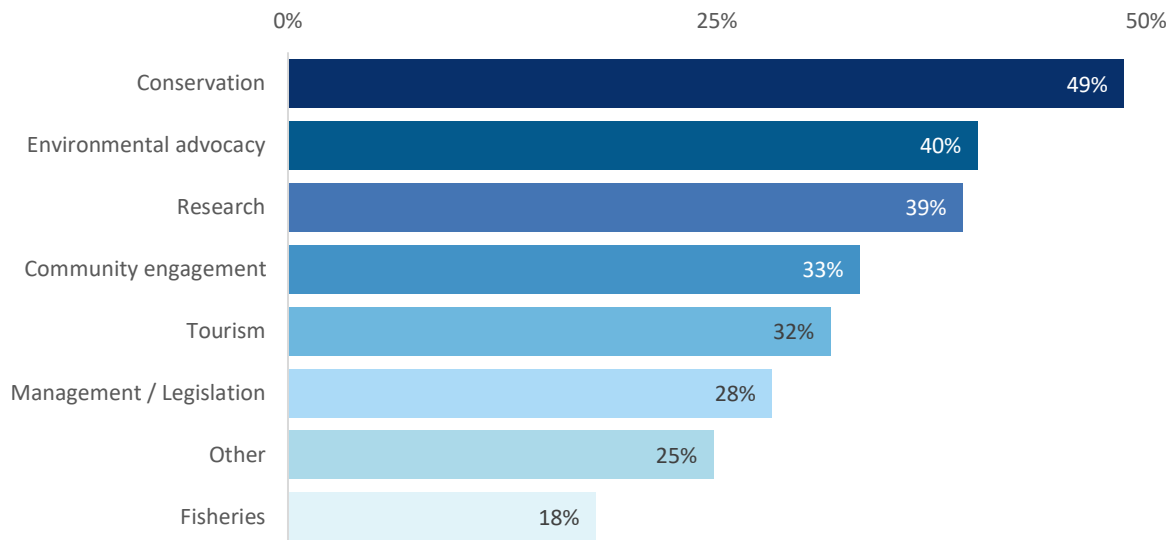
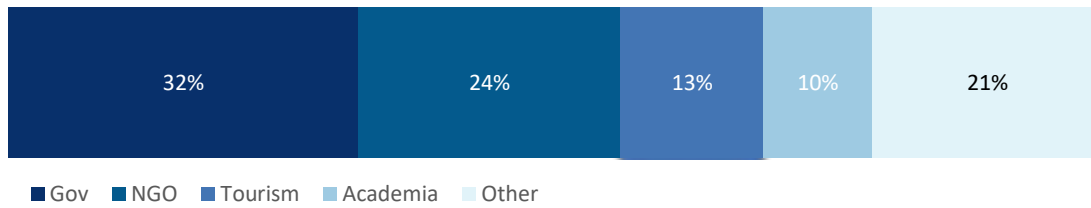
We received a total of 103 responses from stakeholders representing 56 different organisations (Appendix B). Thirty-two percent of the stakeholders belonged to governmental institutions such as the Ministry of Fisheries and Blue Economy and the Ministry of Agriculture, Climate Change and Environment; while 24% represented national or international NGOs such as the Island Conservation Society or Global Vision International (Q1; list of all organisations is available in Appendix B). The rest of the respondents corresponded to the Tourism industry (13%), Academia (10%), or “Other” types of organisations (21%) including public trusts (e.g., Seychelles Island Foundation), consultancies, schools, or media (Q1; Appendix B).

Most of the stakeholders indicated the purpose of their organisations spanned across several of the topics proposed (Q2). The conservation and protection of ecosystems was the most common goal selected (49%), followed by environmental advocacy/education (40%), and research (39%; Q2). Organisations working with local community engagement, tourism and legislation were represented by 25-35% of the respondents. “Other” organisational purposes included communication, project implementation, school education, finance, and consultancies.

We also asked participants about their career profile. The greatest percentage of stakeholders who answered the questionnaire had scientific careers in conservation biology, marine ecology, soil science, geography, zoology, and oceanography (Q3). A lower number of participants had careers spanning across education, hospitality, legislation/policy, communication/journalism, and economy. In relation to their position within their organisation, 65% of the stakeholders indicated having administrative roles either at a manager level (i.e., coordinator, officer, manager, leader) or a directorate level (i.e., president, CEO, chairperson, director, founder, owner; Q4). Participants working as scientists or lecturers represented 20% of the pool, while advisors, analysts, consultants and other made the remaining 15%.

ORGANISATIONAL PROFILE

Q1-Q2 What is the nature⁷ (top) and purpose (bottom) of your organisation? [N=103]



CAREER PROFILE

Q3-Q4. What is your profession (left)? What is your role or position within the organisation (right)? [N=102]



⁷ Some stakeholders from the same organisation differed when selecting the “nature” of their institution (e.g., some classified the Seychelles Fishing Authority as Government, while others as Industry). All the organisations were reclassified for consistency according to Appendix B.

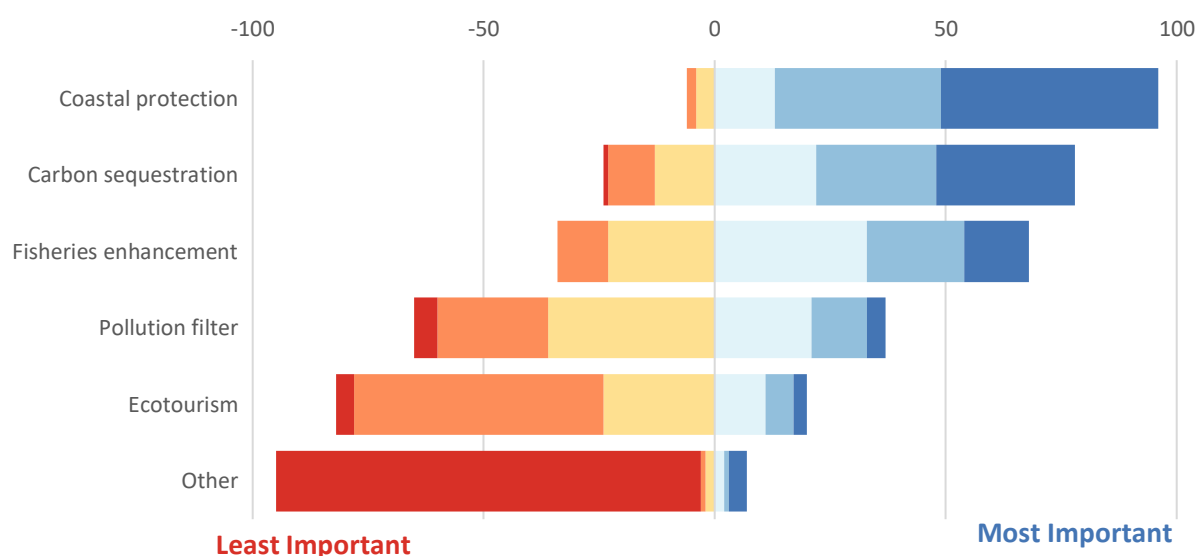
ECOLOGICAL CONTEXT

Stakeholders indicated the main ecosystem services provided by Seychelles' coastal wetlands are coastal protection (ranked 1st), carbon sequestration, and fisheries enhancement (Q5). Most stakeholders ranked ecotourism last, except for respondents from the Tourism Industry who ordered ecotourism services before pollution removal. When asked about the main threats to Seychelles' blue carbon ecosystems, the top three issues identified by most stakeholders were changes in land use (ranked 1st), followed by pollution (ranked 2nd), and irresponsible use (ranked 3rd; Q6). Only participants from Academia and "Other" organisations considered sea level rise a pressing issue ranking it in the 3rd and 2nd position, respectively.

Stakeholders indicated more than half the blue carbon ecosystems have been removed from areas adjacent to populated areas. Pooled stakeholder responses indicate 52% and 60% of the seagrass meadows and mangrove forests have been degraded, respectively (Q7). Academics proposed the highest levels of degradation for both seagrass (62% degradation) and mangrove ecosystems (65% degradation), while participants from NGOs tended to estimate lower levels of destruction (45% in seagrass; 55% in mangroves).

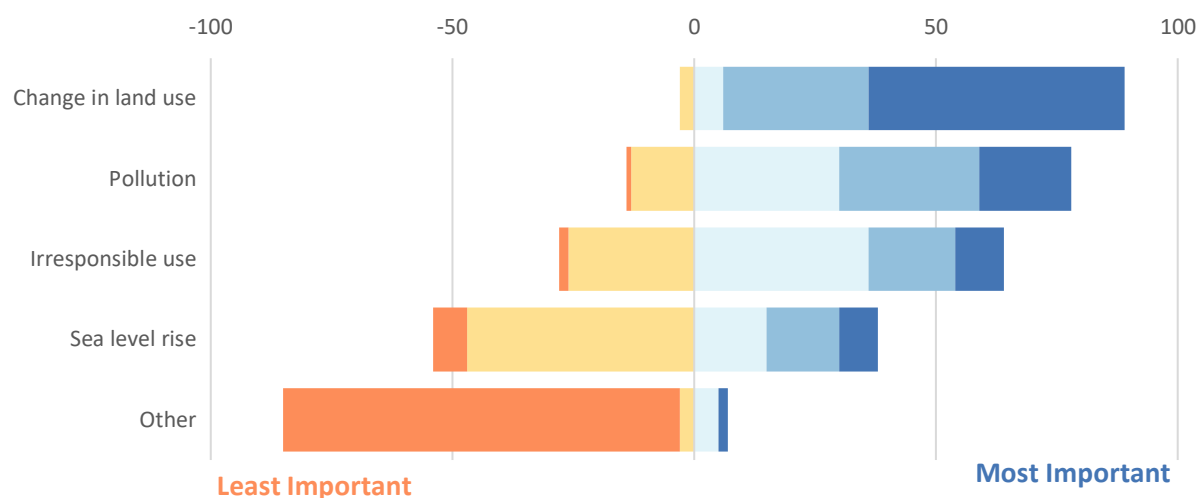
ECOSYSTEM SERVICES

Q5 Rank the main benefits provided by mangrove and seagrass ecosystems in Seychelles.
[N= 101]



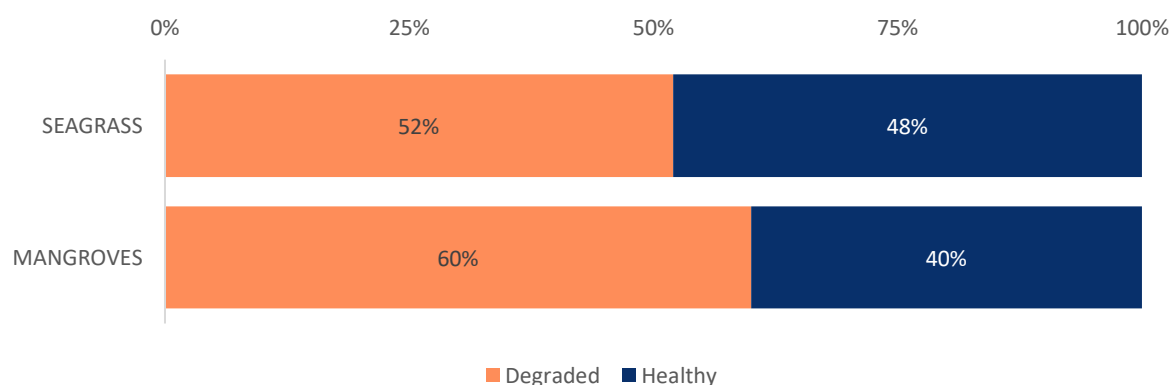
ECOSYSTEM THREATS

Q6. Rank the main threats to Seychelles' Blue Carbon ecosystems. [N=92]



ECOSYSTEM LOSS

Q7. Adjacent to the populated islands, what percentage (%) of the Blue Carbon ecosystems has been degraded? [N=94]



SCIENTIFIC CONTEXT

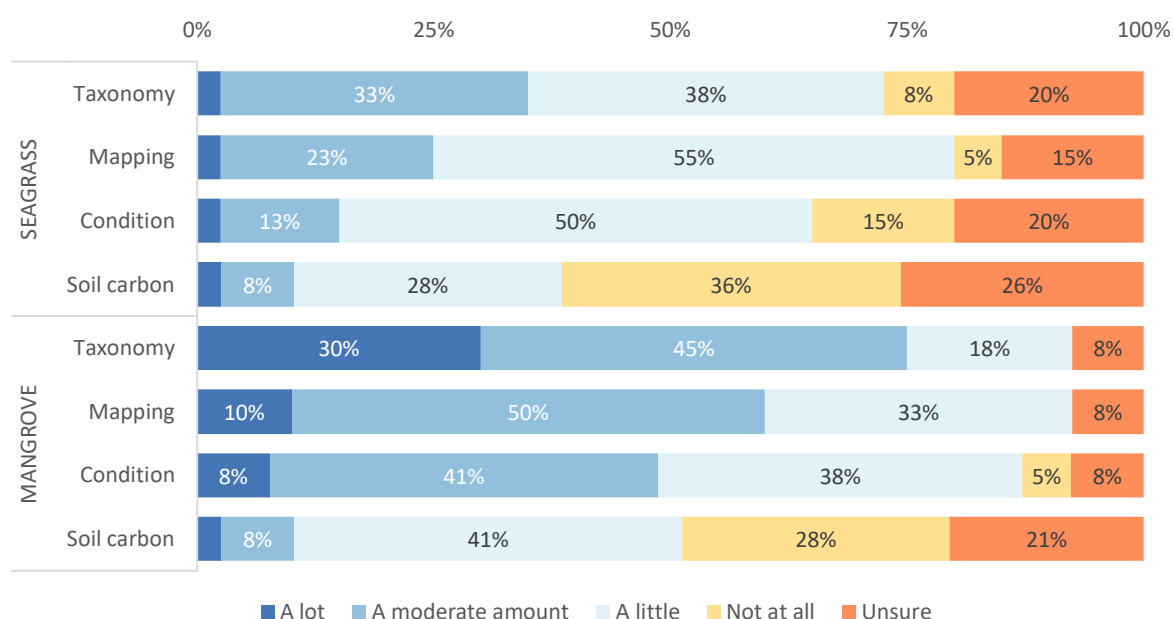
Scientists agreed that Seychelles has very limited blue carbon research (Q8). Results suggest most existing research is based in mangrove ecosystems, where many research topics have been studied at least a “Moderate amount”. Seagrass research seems to be lagging, with the largest number of respondents (46 - 64%) suggesting either “Little research” or “No research at all”. On both ecosystems, research has focused on taxonomy (ranked 1st), mapping, and to a lesser extent, habitat condition. The topic least explored has been soil carbon stocks, with 21 - 26% being ‘unsure’ about any available research on this topic. These results corroborate

findings from our recent review of Seychelles' blue carbon literature⁸, which revealed significant knowledge gaps in mangrove and seagrass carbon stock assessments.

In alignment with the type of research already available (Q8), we found that 61% of the organisations fund research in mangrove ecosystems, but only 40% have projects on seagrass meadows. Most of the mangrove datasets collected are related to mapping exercises and vegetation surveys (outer ring; Q9), while seagrasses studies also have a significant component of fish surveys or biodiversity assessments (inner ring, Q9). As expected, few organisations have conducted research on soil carbon stocks (9-11%). In fact, we expect the percentages to be lower given that there are several participants from a single organisation.

EXISTING RESEARCH

Q8. In your opinion, how much research has been undertaken across the following topics in Seychelles? [N=40]



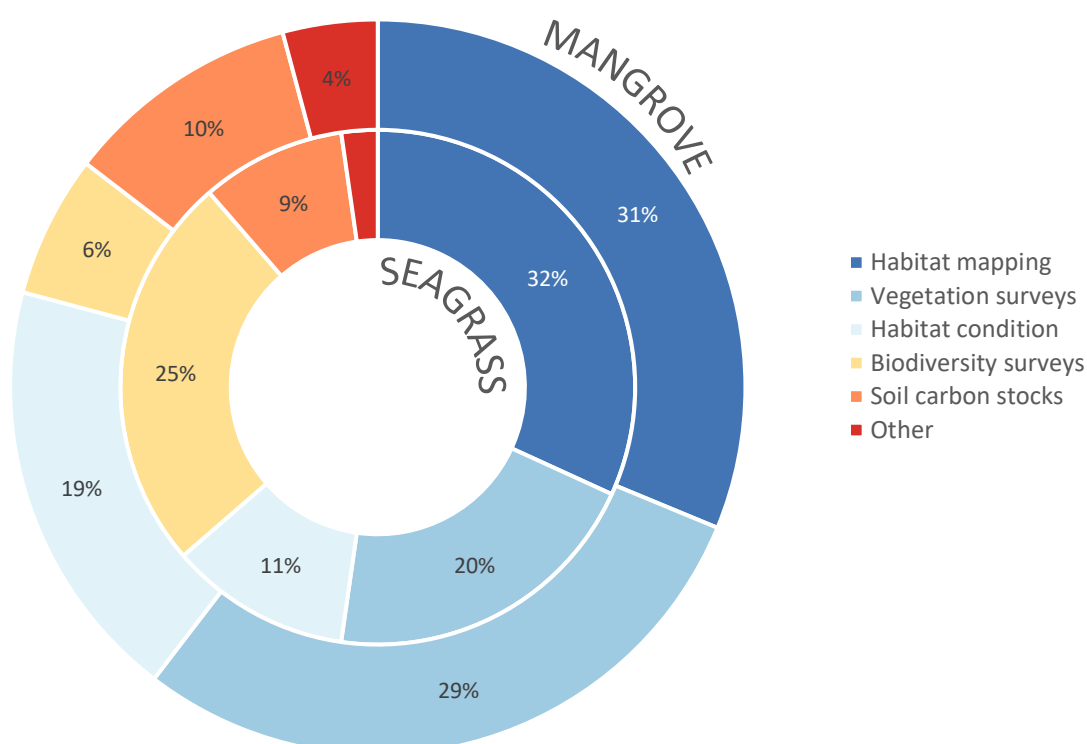
The advancement of coastal research has been hindered by many factors. More than 75% of the scientists considered that the main challenges to undertake blue carbon research are the lack of funding, facilities, and equipment (ranked 1st), along with a lack of expertise (Q10). A lower number of stakeholders (47%) indicate that a lack of community support is also a factor

⁸ Palacios, M., P. Waryszak, M. Costa, M. Wartman, A. Ebrahim, and P. Macreadie. 2021. Literature Review: Blue Carbon research in the Tropical Western Indian Ocean. Deakin University, Australia.

limiting coastal research. Some other issues raised include the lack of a national strategy for marine research, a lack of collaborations, a lack of government support, a lack of continuity (in terms of long-term funding and staff turnover), and the difficulty of working in strenuous coastal environments.

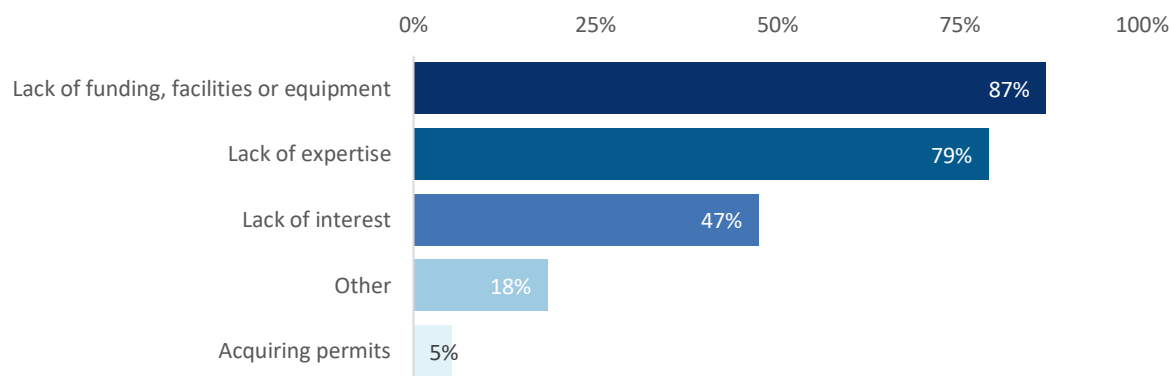
FUNDED RESEARCH

Q9. What sort of research data has your organisation collected? [N=44]



RESEARCH CHALLENGES

Q10. In your opinion, what are the main challenges to undertake Blue Carbon research in Seychelles? [N=38]

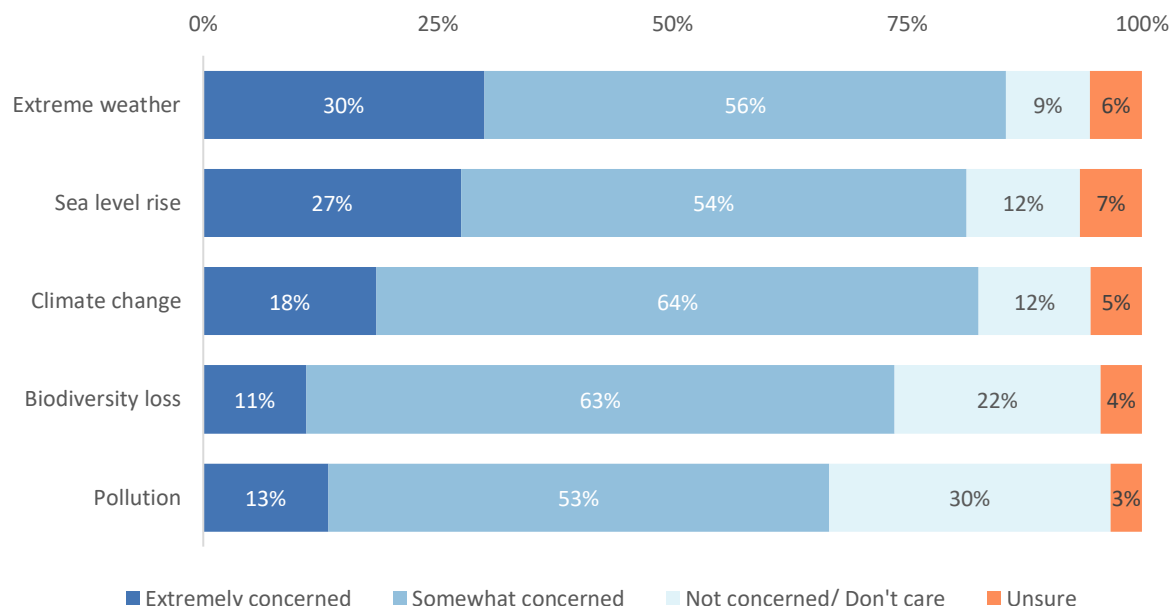


SOCIAL CONTEXT

Stakeholders were asked about the Seychellois' attitude towards key environmental issues. Most stakeholders indicated (60-90%) the public is *not* "Extremely concerned" about any of issues proposed (Q11). However, they suggested extreme weather events (ranked 1st), sea level rise, and climate change, are the top issues raising some sort of concern on Seychelles' population. These results were consistent across the different stakeholders, except for 30% of the participants from the Tourism Industry who considered Seychellois are "Not concerned at all" about extreme weather events.

PEOPLE'S CONCERNS

Q11. To your knowledge, what is the public level of concern about the following environmental issues? [N= 92]



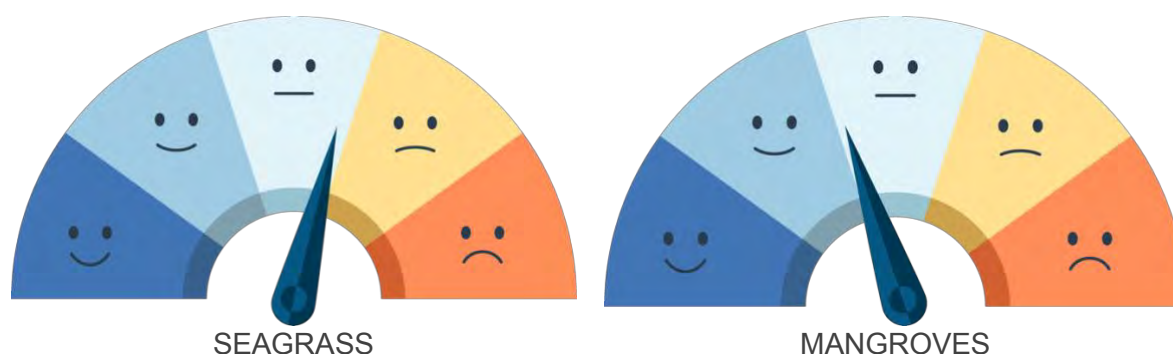
To understand the perception of Seychelles' society towards coastal ecosystems we asked stakeholders about people's perceptions towards seagrass and mangroves. Stakeholders indicated people have indifferent or slightly negative attitude towards seagrass meadows (Q12) due to (1) the lack of education about their importance, (2) the nuisance they cause when washed ashore, (3) the potential dangers they host (e.g., urchins, sharp clams, poisonous fish), and (4) the lack of aesthetic appeal (compared to corals). Attitudes towards mangrove ecosystems are slightly better (Q13), with many stakeholders suggesting this is due to better education and awareness for this ecosystem. Participants highlighted that many people still dislike mangroves as they block the sea view, tend to accumulate rubbish, and

host mosquitoes. While most stakeholders agreed on Seychellois' attitudes towards seagrass and mangrove ecosystems, participants from the Tourism Industry were the ones to indicate the lowest public perceptions towards these two habitats.

Given the need to raise awareness on blue carbon ecosystems, more than 70% of all participants highlight the need to increase community engagement, environmental education, and outreach (Q14). Stakeholders also suggested other strategies to improve environmental awareness such as: better coordination of programs across sectors and disciplines (i.e., government, NGOs, community, science, creative arts, education), better law enforcement, better quality media (i.e., more science and less political propaganda), creation of environmental stewardship programs within districts, and better recognition of individuals/organisations undertaking environmental education roles.

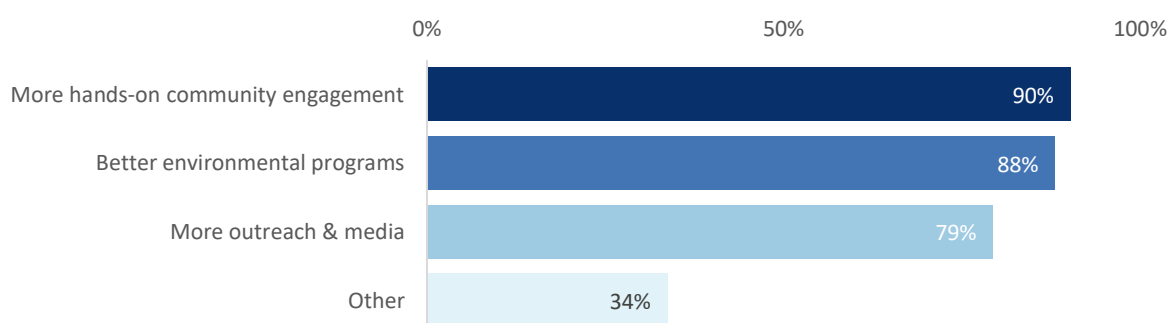
PEOPLE'S ATTITUDES

Q12-Q13. To your knowledge, what is people's attitude towards seagrass beds and mangrove forests? [N = 80]



IMPROVING AWARENESS

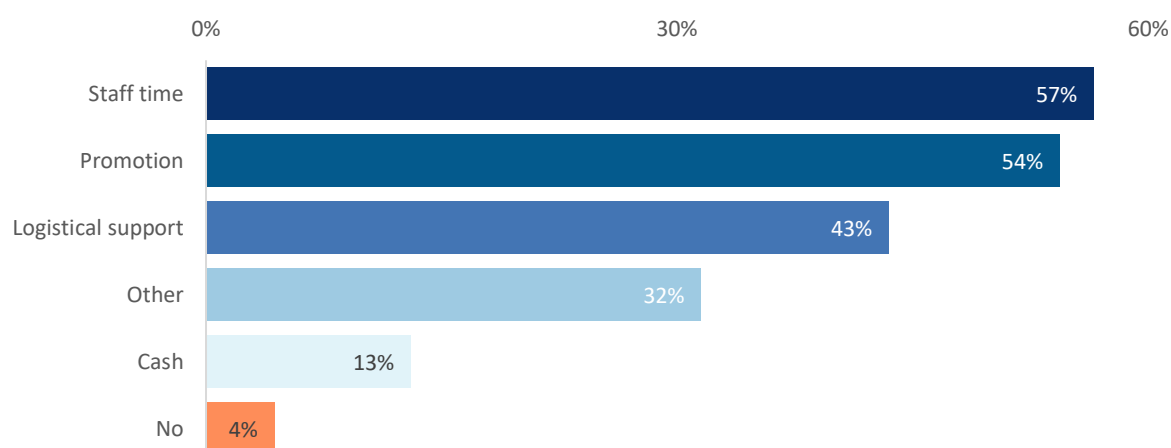
Q14. In your opinion, how can environmental awareness and education be improved in Seychelles? [N=92]



In alignment with the organisational purpose of most institutions (Q1-Q2), 96% of the respondents indicated their organisations could support research or education on blue carbon ecosystems (Q15). Overall, most of the support would be *in-kind* in the form of staff-time, promotion, and logistical support (use of equipment or facilities; Q16). However, organisations prefer to contribute in different ways. Support from Academics would be mainly in the form of advice and research, while NGOs and the Tourism Industry are more likely to help through promotion or community recruitment. More than 50% of all government stakeholders indicated their organisations could provide logistical support and contribute staff time. Stakeholders suggested other ways of supporting environmental programs such as sharing knowledge and data, collecting long term datasets or monitoring, facilitating access to governance or funds, and preparing/delivering educational material or talks. Only 13% of the organisations could potentially provide a cash contribution.

ORGANISATIONAL SUPPORT

Q15-Q16. Could your organisation potentially support research or educational programs on blue carbon ecosystems? How? [N=92]



ECONOMIC CONTEXT

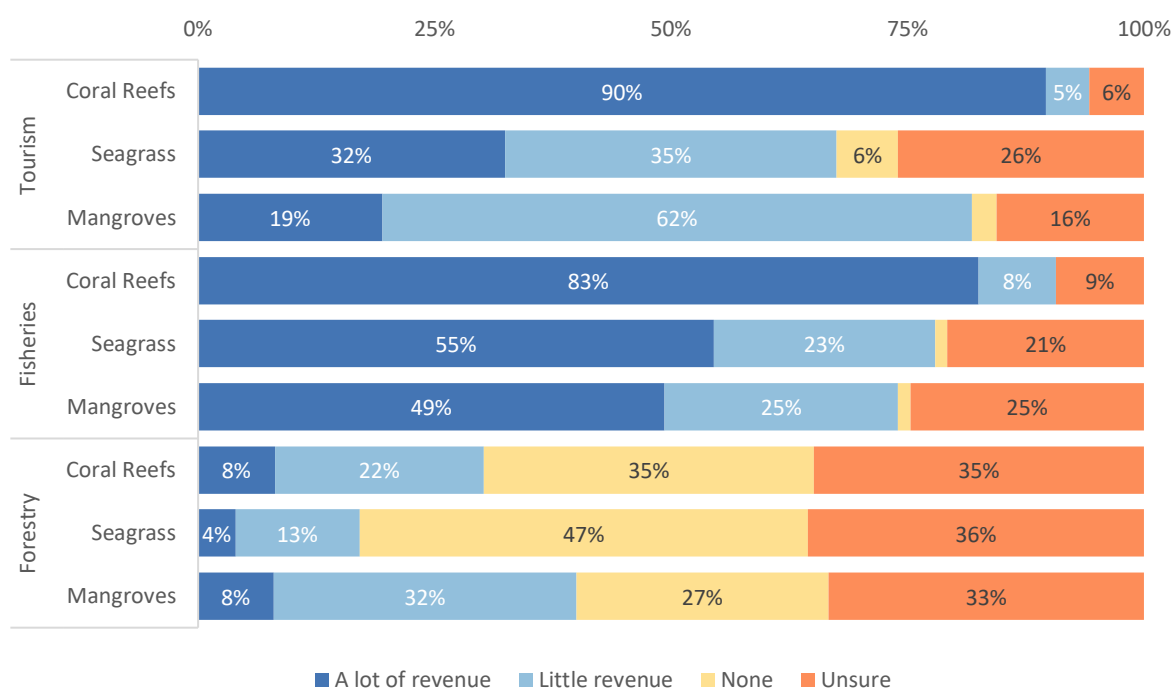
When asked about the economic benefits from coastal ecosystems, more than 80% of the stakeholders indicated that Seychelles' coral reefs bring "A lot of revenue" from ecotourism activities and fisheries enhancement (Q17). Seagrass meadows and mangrove forests provide lower, but relatively similar profits, with 70-80% of the participants suggesting these ecosystems generate *some sort* of ecotourism or fisheries revenue (i.e., "A lot of revenue" + "Little revenue"). There is consensus that most of the revenue from these two blue carbon ecosystems comes from fisheries enhancement rather than tourism.

Results suggest Seychelles' coastal ecosystems do not produce much forestry revenues (30-50% selected "None") or most stakeholders are unaware or unsure of those profits (33-35% selected "Unsure"; Q17). The little forestry revenues produced seem to arise from the extraction of mangrove or coral materials.

Most stakeholders (and their organisations) seem to understand the importance of healthy coastal ecosystems, as 64% of them indicated their organisation would support conservation and rehabilitation projects in coastal wetlands. NGOs seem to be more likely to support these kinds of projects (74% of respondents), while those from government the least (only 56% of the respondents). Organisational support would be mainly motivated by increasing coastal biodiversity (Q18), however this greatly varies across organisations. As expected, the Tourism industry would mainly support projects that enhance the recreational benefits of the ecosystem, while Academia favours programs that have a scientific value (included in the "Other" category). Twenty-five percent of the respondents indicated "other" motivations include advancing research, promoting education and outreach, and building resilience.

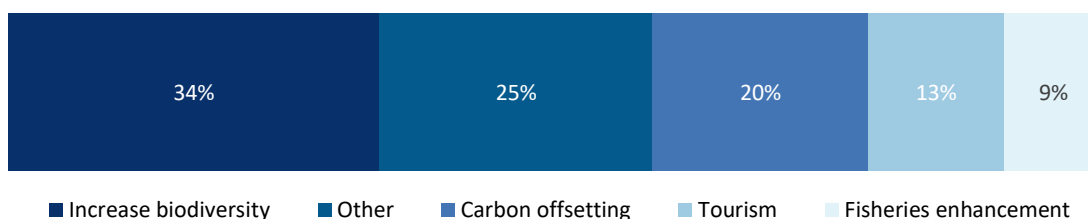
ECONOMIC BENEFITS

Q17. To your knowledge, how much revenue do the following coastal ecosystems bring to Seychelles? [N=86]



DRIVERS OF SUPPORT

Q18. What would be the main motivation for supporting restoration or conservation projects that enhance the value of Blue Carbon habitats? [N=88]

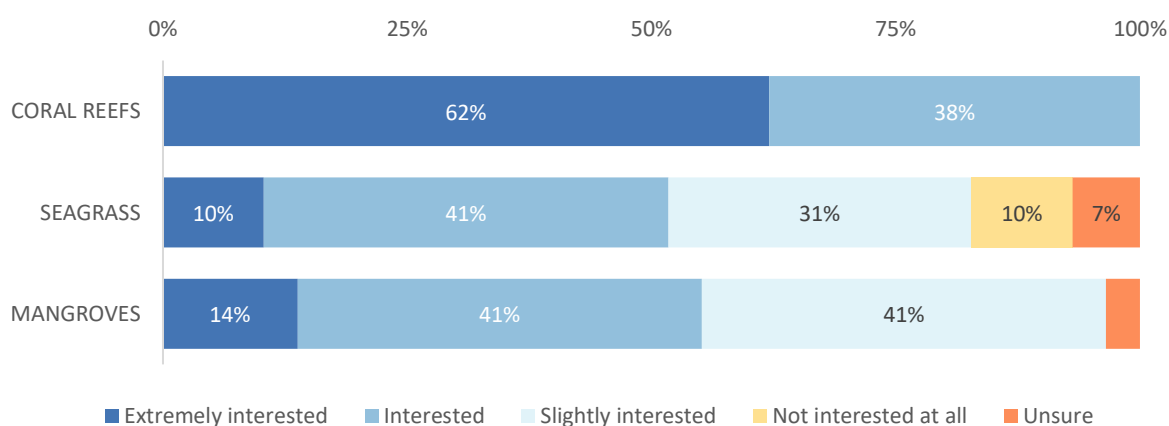


TOURISM

Tourism stakeholders were asked about the demand and offer of ecotourism activities in Seychelles. They indicated that 62% of the tourists are “Extremely interested” in doing activities in the coral reefs, while only 14% and 10% of the visitors show that same level of excitement for mangrove forests or seagrass beds, respectively (Q19). Among the two blue carbon ecosystems, mangrove forests seem to attract more attention than seagrass beds. In fact, 10% of the respondents suggested tourists are “Not interested at all” in doing seagrass ecotourism.

ECOTOURISM DEMAND

Q19. To your knowledge, how interested are tourists in ecotourism activities (e.g., educational talks, guided walks/snorkelling) in the following ecosystems? [N=29]

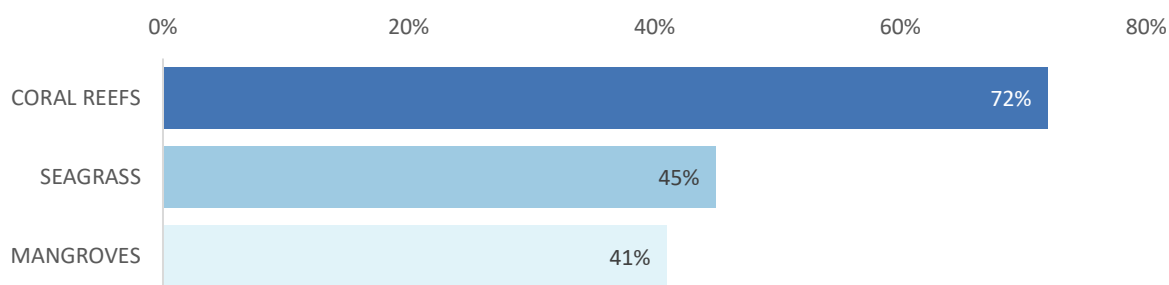


Aligned with tourist’s interest, more than 70% of the stakeholders indicated their organisations offer ecotourism activities in coral reefs, but only 40-50% of them have programs in mangroves or seagrass meadows (Q20). More than half of the tourism stakeholders indicated the main challenges associated to running ecotourism and environmental activities include hiring

experienced staff (ranked 1st), preparing the educational program, and guaranteeing participant safety (Q21). Only 20-35% of the respondents indicated participant interest and securing permits can be an issue.

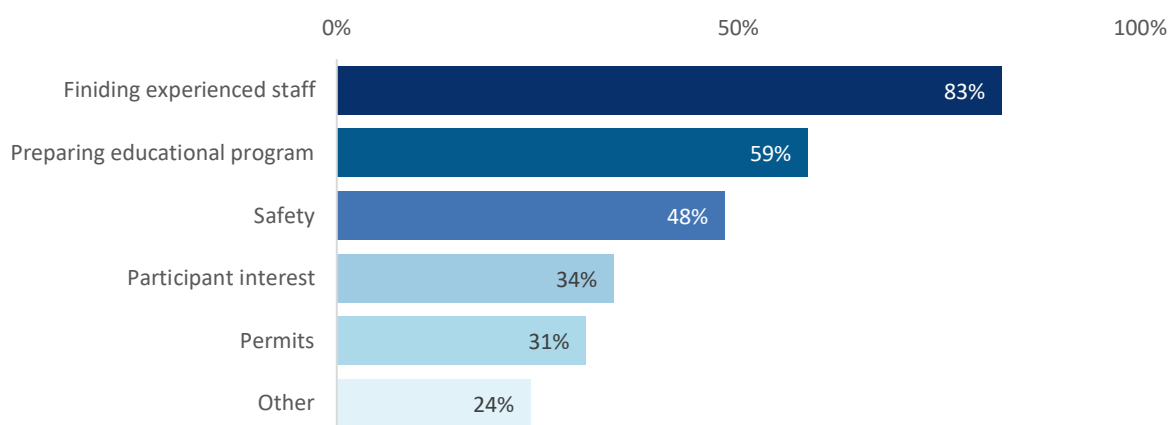
ECOTOURISM OFFER

Q20. Does your organisation offer educational or ecotourism activities in the following coastal ecosystems? [N=29]



ECOTOURISM CHALLENGES

Q21. What are the main challenges when offering ecotourism activities in coastal ecosystems? [N=29]



FISHERIES

Stakeholders from fish-related organisations were asked about the Seychelles fisheries industry. They indicated the main fish species harvested are tunas (i.e., skipjack tuna, yellowfin tuna; ranked 1st), red snappers, and carangids (trevallies; Q22), with the principal harvest methods being nets (i.e., purse seine; ranked 1st) and hook and line (Q23). Almost half of the respondents indicated that their organisations support programs that enhance spawning or nursery habitats.

FISHERIES

Q22-Q23. What are the main fisheries species harvested? (left) What is the main harvest method? (right) [N=13]

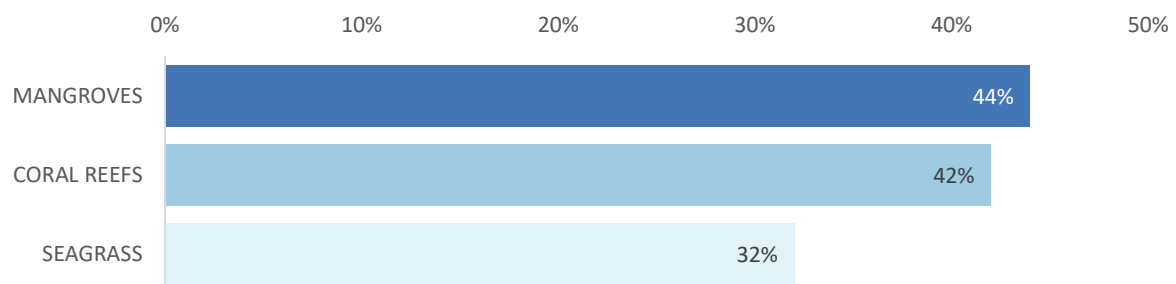


POLICY AND MANAGEMENT

Stakeholders were asked several questions about the policy context surrounding coastal ecosystems and carbon offsetting in Seychelles. *On average*, participants indicated that 40-45% of Seychelles' mangroves and coral reefs are protected, while only about 32% of the nation's seagrass meadows have such status (Q24). However, there was large variability among the respondents, particularly around the level of protection of mangrove ecosystems (responses ranging from 1% to 100%). The most likely reason for such variability was explained by one of the stakeholders who indicated "...I have put 90% simply because the largest coverage of mangroves is in Aldabra, a protected atoll. If Aldabra is excluded, then the % drops to below 25%".

ECOSYSTEM PROTECTION

Q24. To your knowledge, what percentage (%) of the following coastal ecosystems is protected within Seychelles? [N=71]



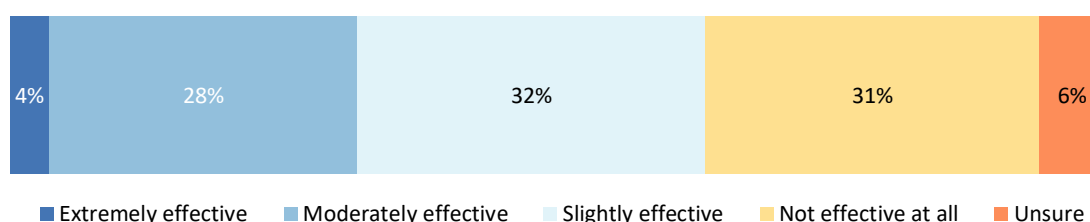
When asked about the enforcement of environmental regulations, the survey revealed participants have a slightly negative opinion about Seychelles' environmental regulators, with most stakeholders (63%) indicating the regulators are "Slightly effective" or "Not effective at all" (Q25). Participants from NGOs and the Tourism Industry had the lowest perception of

environmental regulators (40-41% indicated “Not effective at all”), while participants from Academia and Other organisations ranked them the highest (9-12% indicated “Extremely Effective”). When asked about the main barriers to investing in blue carbon projects, stakeholders first ranked lack of frameworks, followed by a lack of finance mechanism, and methodologies for quantifying carbon gains or co-benefits (Q26). Other issues raised include lack of knowledge on blue carbon and limited qualified personnel available to undertake the projects.

Aligned with the consensus of the lack of frameworks in Seychelles, only 9 stakeholders from 66 indicated knowing about mechanisms to support the offsetting carbon emissions or restoration/protection of coastal ecosystems. Responses included: the Wetland Policy and Environmental Protection Act, National Parks and Nature Conservancy Act, Seychelles NDCs, National Development Strategy, SSDS, Coastal Management Plan, Marine Spatial Plan, and REDD+.

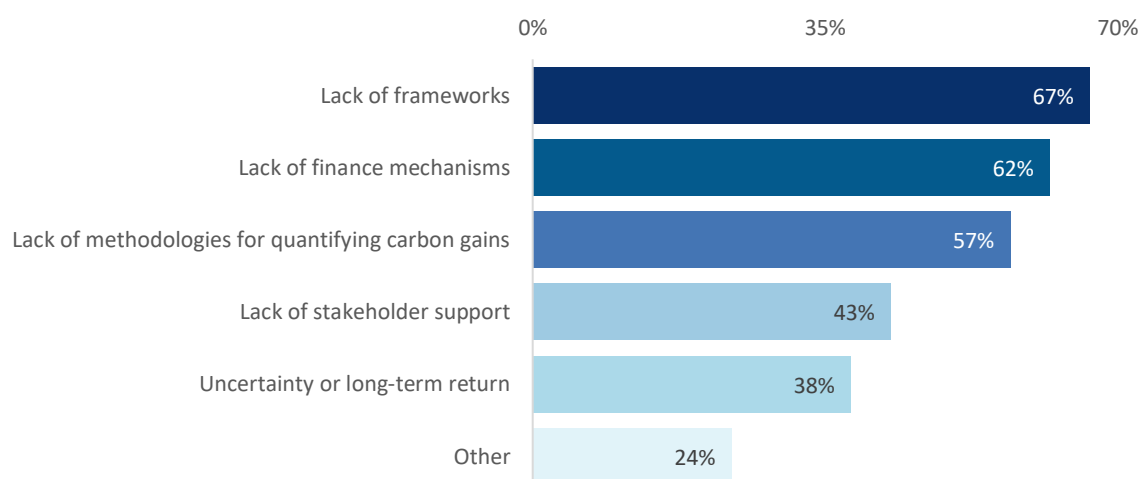
LAW ENFORCEMENT

Q25. In your opinion, how effective is the enforcement of Seychelles' environmental regulations? [N= 85]



BARRIERS FOR INVESTMENT

Q26. In your opinion, what are the main barriers to investing in Blue Carbon projects for restoration or conservation? [N=61]



ADDITIONAL COMMENTS

The survey offered stakeholders the opportunity to share additional comments related to blue carbon ecosystems. We received a total of 31 responses, with most of the comments highlighting the need for more education and research environments (Q27). Other stakeholders used this opportunity to raise concerns about the decline of Seychelles environments or provide reference to specific resources or information. The full list of responses available in Appendix C.

Q27 Is there any other information you would like to share with us about Blue Carbon ecosystems in Seychelles? [N= 31]

Topic	Example
Research	<i>"When assessing Blue Carbon ecosystems in Seychelles unvegetated intertidal areas, such as mudflats, should also be included. These ecosystems have been shown to have a carbon storage role similar to seagrass beds and are well represented in Seychelles, within shallow bays and tidal lagoons."</i>
Education	<i>"Visitors should be informed of the importance of nature protection before they come for holiday and locals should be continuously educated about the impacts of pollution and climate change and how important it is to safeguard the ecosystems of Seychelles. Environmental Law enforcement should be strictly adhered to, and the environment protection policy should be equally applied to all."</i>
Concern	<i>"Many hotels here are foreign owned and care little about long term benefits blue carbon ecosystems provide Seychelles. A lot of hotels have removed seagrass for tourists to have swimming space, back filled into mangroves for more land. Seychellois have also done this in mangrove ecosystems to have more land to develop on - due to land scarcity. Seychelles once had many dugongs near the populated islands which are now all gone. Only found near Aldabra now. Seychelles once had saltwater crocodiles in the mangrove ecosystems which are now extinct. Green sea turtles are extremely rare around the populated islands and high in numbers around outer islands. Coral reef species have declined drastically. Very little is known about blue carbon ecosystems around outer islands due to their isolation and high cost to get there. Cosmoledo atoll has rich mangrove and seagrass habitats that has no research."</i>
Reference to projects/information	<i>Wildlife Clubs of Seychelles is a leading, grassroots, self-sustaining environmental organization, dedicated to creating an environmentally conscious population in Seychelles. We provide opportunities for students and their leaders to learn about their</i>

environment, participate in environmental action, and be a force for positive change.

Mangrove restoration (EBA) is part of our tradition. WCS implemented mangrove restoration programs through grants to help raise awareness of the importance of wetlands and encourage more clubs and their communities to take better care of the wetlands in their districts. Mangrove clean-ups and planting events were organized for students to learn more about these ecosystems. please visit us

<http://www.wildlifeclubsofseychelles.org/projects.htm>



APPENDICES

APPENDIX A

Stakeholder questionnaire.



Welcome

Seagrass meadows and mangrove forests are often called 'Blue Carbon ecosystems'.

They have the capacity to capture and store atmospheric carbon into their biomass/soil helping us fight climate change! In addition, they provide key services for Seychelles such as fisheries enhancement and recreational and ecotourism values.



Please answer the following questions to help us understand the current ecological, social, scientific and political context of Blue Carbon ecosystems in Seychelles!

Metadata

ABOUT YOU

What is your organisation's name?

What is the nature of your organisation?

Please check the one that best applies.

- ☐ Government
- ☐ Academia
- ☐ NGO
- ☐ Industry
- ☐ Other

What is the purpose of your organisation?

Please check ALL that apply. The next questions will depend on the choices you select here.

- ☐ Research
- ☐ Conservation/ Protection
- ☐ Community engagement
- ☐ Environmental advocacy / education
- ☐ Tourism
- ☐ Fisheries
- ☐ Management / Legislation / Policy
- ☐ Other

What is your role or position within the organisation?

What is your profession?

Ecological context

ECOLOGICAL CONTEXT

Rank the main benefits provided by mangrove and seagrass ecosystems in Seychelles.

Drag & order from the most important benefit (#1) to the least important.

Carbon sequestration

Coastal protection

Fisheries enhancement

Recreation/Ecotourism

Pollution filter

Other

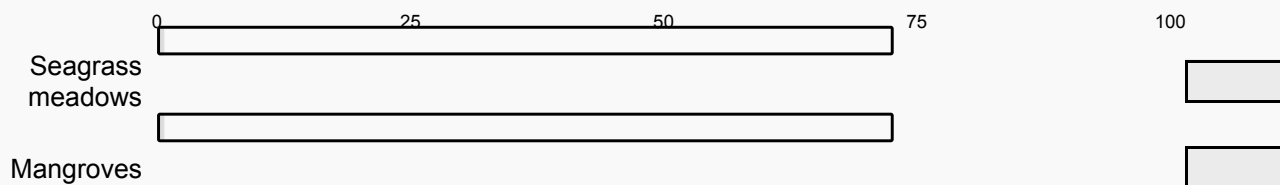
Rank the main threats to Seychelles' Blue Carbon ecosystems.

Drag & order from the main threat (#1) to the least important threat.

Change in land use (eg. coastal development)
Pollution, runoff, sedimentation
Irresponsible use (by fisheries, tourism or local communities)
Sea level rise
Other <input type="text"/>

Adjacent to the populated islands, what percentage (%) of the Blue Carbon ecosystems has been degraded?

Drag the bars and adjust them to the level of degradation evidenced in mangroves and seagrass beds.



Scientific context

SCIENTIFIC CONTEXT

In your opinion, how much research has been undertaken across the following topics in Seychelles?

	A lot	A moderate amount	A little	Not at all	Unsure
Seagrass mapping	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Seagrass soil carbon stocks	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Seagrass ID /taxonomy	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Seagrass health/condition	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Mangrove mapping	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Mangrove soil carbon stocks	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Mangrove ID/ taxonomy	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Mangrove health/condition	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

In your opinion, what are the main challenges to undertake Blue Carbon research in Seychelles?

Please check all that apply.

- ☐ Lack of funding, facilities or equipment
- ☐ Lack of expertise
- ☐ Lack of interest or community support
- ☐ Acquiring permits
- ☐ Other

Is your organisation involved with any research in Blue Carbon ecosystems?

- ☐ Yes
- ☐ No
- ☐ Unsure

What sort of research data has your organisation collected? *Please click all that apply.*

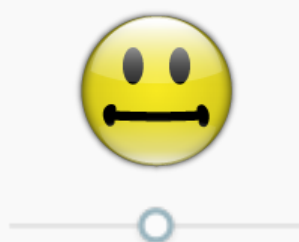
	On what ecosystem?	
	Seagrass	Mangrove
Vegetation & biomass surveys	<input type="checkbox"/>	<input type="checkbox"/>
Fish or Biodiversity surveys	<input type="checkbox"/>	<input type="checkbox"/>
Soil carbon stocks	<input type="checkbox"/>	<input type="checkbox"/>
Habitat mapping	<input type="checkbox"/>	<input type="checkbox"/>
Habitat condition/health	<input type="checkbox"/>	<input type="checkbox"/>
Other <input type="text"/>	<input type="checkbox"/>	<input type="checkbox"/>

Society & Education

SOCIETY & EDUCATION

To your knowledge, what is people's attitude towards seagrass beds?

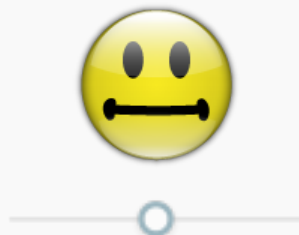
Move the slider to change the face expression.



Why?

To your knowledge, what is people's attitude towards mangrove habitats?

Move the slider to change the face expression.



Why?

To your knowledge, what is the public level of concern about the following environmental issues?

	Extremely concerned	Somewhat concerned	Not concerned/ Don't care	Unsure
Climate change	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Sea level rise	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Biodiversity loss	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Extreme weather events	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Pollution/sedimentation	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

In your opinion, how can environmental awareness and education be improved in Seychelles?

Select ALL that apply.

- ☐ Better environmental programs offered to students (school or university)
- ☐ More science outreach & media campaigns (TV, newspaper, radio)
- ☐ More hands-on community engagement
- ☐ Other

Could your organisation potentially support **research** or **educational** programs on Blue Carbon ecosystems?

Select ALL that apply.

- ☐ No
- ☐ Yes, through cash contribution
- ☐ Yes, through in-kind logistical support (use of our equipment/facilities)
- ☐ Yes, through in-kind contribution of staff time
- ☐ Yes, through promotion or community recruitment
- ☐ Yes, through ...

Economy (everyone else)

ECONOMIC CONTEXT

To your knowledge, how much revenue do the following coastal ecosystems bring to the following Seychellois industries/activities:

	Coral Reefs				Mangroves				Seagrass beds			
	A lot of revenue	Little revenue	Unsure	None	A lot of revenue	Little revenue	Unsure	None	A lot of revenue	Little revenue	Unsure	None
Fisheries (via fisheries enhancement)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Tourism (via ecotourism)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Forestry (via extraction/burning/use of materials)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

How likely is your organisation to support (in cash or in kind) restoration or conservation projects that enhance the value of Blue Carbon habitats (eg. boost fisheries, provide ecotourism opportunities, capture carbon dioxide)?

- ☐ Likely
☐ Unlikely
☐ Unsure

What would be the main motivation for supporting these restoration/conservation projects?

- ☐ Fisheries enhancement
☐ Tourism/recreational benefits
☐ Carbon offsetting
☐ Increase biodiversity
☐ Other

Economy (Tourism industry - ONLY)

Please answer the three (3) following questions considering your knowledge of Seychelles' tourism industry.

(1) To your knowledge, how interested are tourists in ecotourism activities (eg. educational talks, guided walks/snorkeling) in the following ecosystems?

	Extremely interested	Interested	Slightly interested	Not interested at all	Unsure
Coral reefs	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Seagrass beds	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Mangroves	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

(2) Does your organisation offer educational or ecotourism activities in the following coastal ecosystems?

	Yes	No	Unsure
Coral Reefs	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Seagrass beds	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Mangroves	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

(3) To your knowledge, what are the main challenges when offering ecotourism activities in coastal ecosystems?

Select all that apply.

- ☐ Safety
- ☐ Preparing educational content/program
- ☐ Experienced staff
- ☐ Participant recruitment/interest
- ☐ Permits
- ☐ Other

Economy (Fisheries industry - ONLY)

Please answer the three (3) following questions considering your knowledge of Seychelles' fisheries.

(1) What are the main fisheries species harvested?

(2) What is the main harvest method?

(3) Does your organisation support/undertake any programs to enhance the spawning or nursery habitat of fisheries?

Yes ☐

No ☐

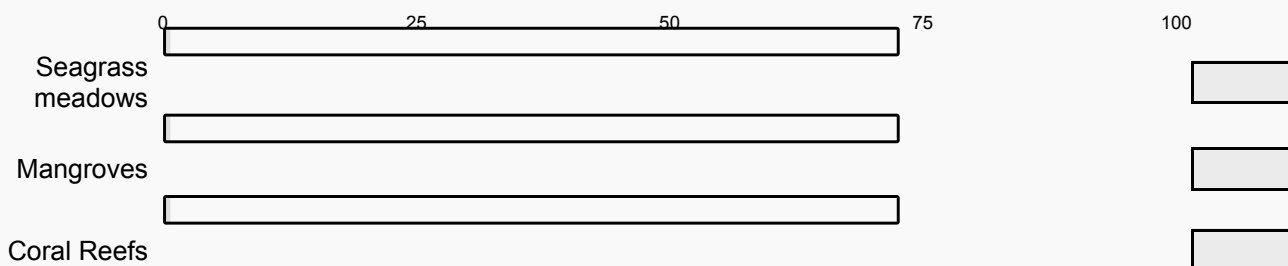
Unsure ☐

Policy & Framework

POLICY & MANAGEMENT

To your knowledge, what percentage (%) of the following coastal ecosystems is protected within Seychelles?

Drag the bars and adjust them to the level of protection for each ecosystem. Please skip this question if you are unsure.



In your opinion, how effective is the enforcement of Seychelles' environmental regulations?

- ☐ Extremely effective
- ☐ Moderately effective
- ☐ Slightly effective
- ☐ Not effective at all
- ☐ Unsure

In your opinion, what are the main barriers to investing in Blue Carbon projects for restoration or conservation?

Check all that apply.

- ☐ Lack of methodologies for quantifying BC gains/cobenefits
- ☐ Lack of finance mechanisms
- ☐ Lack of frameworks
- ☐ Lack of stakeholder support (community, industry, gov)
- ☐ Uncertainty or long-term return
- ☐ Other

To your knowledge, are there any frameworks or mechanisms to support the offsetting carbon emissions or restoration/protection of coastal ecosystems? If so, which?

Other

Finally....

Is there any other information you would like to share with us about Blue Carbon ecosystems in Seychelles?

Please enter your email address below if you would you like to be notified of the results of this research.

Otherwise leave blank. Your email address will be kept separate from your survey responses.

APPENDIX B

Stakeholder organisations that participated in the questionnaire.

Type	Organisation	No.
Academia	Durham University	1
	Tufts University	1
	University of Seychelles	3
	University of Zurich	2
	Did not specify	3
Government	Centre for GIS	1
	Department of Culture	1
	Environment Department	1
	GOS-UNDP-GEF Programme Coordination Unit, Seychelles	3
	Ministry of Agriculture, Climate Change and Environment	5
	Ministry of Education	1
	Ministry of Fisheries and Blue Economy (Dpt. of Blue Economy)	4
	Ministry of Foreign Affairs	1
	Ministry of Health	1
	Petroseychelles	1
	Seychelles Fishing Authority (SFA) <i>*Parastatal</i>	9
	Seychelles National Parks Authority (SNPA)	1
	Seychelles Natural History Museum	1
	Other or Did not specify	3
NGO	Anse Forbans Community Conservation Programme	1
	Climate War Room / Cayman Institute	1
	Global Vision International (GVI)	4
	Island Conservation Society (ICS)	3
	Jeo Jyoti Foundation, Seychelles	1
	Marine Conservation Society Seychelles	3
	Nekton	1
	Plant Conservation Action group	1
	Sustainable Ocean Seychelles	1
	Terrestrial Restoration Action Society of Seychelles	1
	The Nature Conservancy	2
	Turtle Action Group of Seychelles	1
	Wildlife Clubs of Seychelles	2
	WiseOceans	2

	Other or Did not specify	1
Tourism	Berjaya beau vallon bay hotel	1
	Constance Ephelia Seychelles	1
	Dar & Douce Pty Lyd	1
	Hotel La Digue Island	1
	Le Nautique Hotels	3
	Mason's Travel	1
	North Island	2
	Vizier Consulting	1
	Other or Did not specify	2
Other	Almasalla E Content For Tourism Travel News	1
	CoachCompanion South Africa	1
	Fisheries and Marine Consultancy Services (FMCS)	1
	GroupOrsay	1
	International School Seychelles	2
	Island castaways	1
	LMP consultancy	1
	NLA International Ltd	1
	Save Environmental	1
	Scenic landscaping	1
	Seychelles Islands Foundation (SIF) <i>*Public trust</i>	6
	Shining Star International School Abu Dhabi	1
	VetiverTech Pty Lrd	1
	Other or Did not specify	3

APPENDIX C

Q27 - Is there any other information you would like to share with us about Blue Carbon ecosystems in Seychelles?

Concern

Sea level rising is causing very heavy coastal erosion...we shall have to build walls around the coastline...we depend on the beauty of our islands. In another 100 years we may not be able to exist if global warming does not stop

Raffles Hotel dumping fuel kerosene in the environment, the authority concerned doing nothing

Many hotels here are foreign owned and care little about long term benefits blue carbon ecosystems provide Seychelles. A lot of hotels have removed seagrass for tourists to have swimming space, back filled into mangroves for more land.

Seychellois have also done this in mangrove ecosystems to have more land to develop on - due to land scarcity.

Seychelles once had many dugongs near the populated islands which are now all gone. Only found near Aldabra now.

Seychelles once had saltwater crocodiles in the mangrove ecosystems which are now extinct.

Green sea turtles are extremely rare around the populated islands and high in numbers around outer islands.

Coral reef species have declined drastically.

Very little is known about blue carbon ecosystems around outer islands due to their isolation and high cost to get there. Cosmoledo atoll has rich mangrove and seagrass habitats that has no research.

All boat drop anchor anywhere. Killing coral. Ripping up bed. No proper anchorages

Blue Carbon ecosystems should be more protected

Education

the subject is not well known

people should be more inform on the blue carbon via social media, radio, tv and in the school curriculum

Visitors should be informed of the importance of nature protection before they come for holiday and locals should be continuously educated about the impacts of pollution and climate change and how important it is to safeguard the ecosystems of Seychelles. Environmental Law enforcement should be strictly adhered to and the environment protection policy should be equally applied to all.

There is the urgent need to mainstream perception of their value, particularly amongst users. This does not necessarily have to be in the carbon context, but in the realisation of improved values over time if well respected and looked after (e.g. with fishers understanding the importance of not over harvesting in the seagrass, and the long term effects of trampling and propellor scars, and general public understanding their importance as wave mitigators, biodiversity hotspots and how fragile they are. Of

absolute importance is driving it hard into the different terrestrial players/departments/managers/sectors how land-based events affect the coastal ecosystems).

Thanks for the opportunity to participate.

The term blue carbon is new and quite confusing to many Seychellois. A lot of awareness is needed around the concept.

Not to forget the environmental services we get for free from blue carbon ecosystems. People should understand that. The general public abuse the environment and then complain about that there is less fish in the ocean or about taxes for water filtration systems and clean water or mitigating coastal erosion projects which costs millions.

It's a Subject that needs to be made more public

It is a very important and essential topic, but the concern is that there are very little community involvement in such, and these topics are mainly known by experts and academic persons.

Encourage Creation of Environmental Clubs. Encourage more awareness at school and University level. Those actively involved be given some preference in jobs and or monetary awards.

Research

There is great potential for blue carbon ecosystems to provide economic opportunities for Seychelles and Seychellois people. Importantly, we must first survey the extent of coastal ecosystems in Seychelles. and their carbon stocks. We should dedicate efforts to educate the general public about the importance of these ecosystems - this is imperative to support future restoration and conservation efforts outside currently protected areas.

Lots of studies are required to fully understand the status of the blue carbon ecosystem in Seychelles.

I would love to see the day when the value of these ecosystems are calculated and made public

I think it is very important to understand BC ecosystems and its importance to the entire ecosystem in Seychelles so that the community at large can do their part to ensure that our daily activities have the least negative impact possible.

I do not think that Blue Carbon Ecosystem is the best way to refer to these ecosystems. How about shallow marine ecosystems.

When assessing Blue Carbon ecosystems in Seychelles unvegetated intertidal areas, such as mudflats, should also be included. These ecosystems have been shown to have a carbon storage role similar to seagrass beds and are well represented in Seychelles, within shallow bays and tidal lagoons.

There are extensive areas of mud flats, found within many lagoons and bays in Seychelles, which also represent important Blue Carbon ecosystems.

The focus of Blue Carbon ecosystems conservation in Seychelles should be place in the Outer Islands.

Reference to projects

<https://whc.unesco.org/en/blue-carbon-report>

contact SeyCCAT or SWIOFISH3 project for more info

Wildlife Clubs of Seychelles is a leading, grassroots, self-sustaining environmental organization, dedicated to creating an environmentally conscious population in Seychelles. We provide opportunities for students and their leaders to learn about their environment, participate in environmental action, and be a force for positive change.

Mangrove restoration (EBA) is part of our tradition. WCS implemented mangrove restoration programs through grants to help raise awareness of the importance of wetlands and encourage more clubs and their communities to take better care of the wetlands in their districts. Mangrove clean-ups and planting events were organized for students to learn more about these ecosystems. please visit us <http://www.wildlifeclubsofseychelles.org/projects.html>

UNDP are developing a project proposal for GEF 7 funding for a Blue Economy project that will be implemented by PCU (most likely in 2022). it includes a sea grass and mangrove component

The Seychelles Wetlands Policy and Action Plan 2019-2022 pledges to improve information undertake water, substrate biodiversity and ecological function assessment on selected sites Mudflats and mangroves. Partners involved in delivering this strategy include GVI, MCSS, UniSey, and SNPA. At GVI we are keen to directly contribute through long-term monitoring and would like to re-establish these partnerships for greater future benefit.

Other

Yes, I would like to restore eelgrass worldwide.

I am a non-seychellois and do not reside in Seychelles. However, I would like to connect my students with schools, NGOs or your organization for collaborative research project.

Would love to work with this project in my capacity as a researcher!

I love Seychelles for its natural beauty and the investment by the Government to keep pristine

