

Hiding in Plain Sight: Exploring Seychelles' blue carbon market opportunities within seagrass meadows

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Introduction

Located in the Indian Ocean, the Republic of Seychelles consists of 115 islands. Its land area totals 455 square kilometers but its Exclusive Economic Zone (EEZ) covers over 1.3 square kilometers of sea (Lablache and Uranie, 2014). As such, the country has far more water than land to its name, and has recently sought to re-frame its development as a large oceanic state (Republic of Seychelles, 2020).

With a population of roughly 98,000, limited land cover, an overt reliance on tourism and increasing threats from global warming and climate change, Seychelles opted to move away from prioritizing only its primary terrestrial space to developing its secondary space of resources as well, namely the ocean. With this in mind, the country launched a Blue Economy Framework and Roadmap ('the Roadmap') two years ago (The Commonwealth, 2018).

Seychelles Blue Economy

In the absence of a universal definition for the Blue Economy (BE), stakeholders have generally modelled the concept by placing ocean governance at the forefront of sustainable development pathways (Global Environment Facility, 2016). In line with this approach, Seychelles defined its BE as 'those economic activities that directly or indirectly take place in the ocean, use outputs from the ocean, and put goods and services into ocean's activities and the contribution of those activities to economic growth, social, cultural and environmental wellbeing' (Ministry of Finance, Trade and Blue Economy, 2015: 2). Seychelles' BE approach thus considers an ideal scenario where sustainable development is balanced against socially inclusive economic growth and ecological concerns (Purvis, 2015).

To achieve this balance, the Roadmap outlined four key strategic priorities, namely the creation of sustainable wealth, shared prosperity, strengthening the enabling environment and securing ocean health (The Commonwealth Secretariat, 2018). Notably, this last point introduces the possibility of increasing ocean resilience through mitigation measures such as blue carbon initiatives that could align with the requirements of the United Nations Framework Convention on Climate Change (UNFCCC).

Therefore, Seychelles' BE framework allows for the consideration of blue carbon as a means of further preserving marine ecosystem health and mitigating the risks of climate change. This consideration supports the United Nations' declaration on the Blue Economy which emphasized valuing blue capital and considering blue carbon trading initiatives to further enhance current governance mechanisms (Purvis, 2015). The implementation of blue carbon markets and international climate financing streams could also assist Seychelles in reducing the cost of emission reduction initiatives (SeyCCAT, 2020). However, research around blue carbon initiatives for the country presently remain scant at best.

Defining blue carbon ecosystems in Seychelles

On top of providing food, employment, climatic protection and cultural services, marine ecosystems also deliver an essential service in the form of 'carbon sinks,' where mangroves, seagrass and salt-water marshes can sequester significant amounts of carbon (Nelleman et al, 2009). These so-called 'blue carbon ecosystems' have been found to be more effective carbon sinks than terrestrial rainforests, storing far more carbon per unit area than their terrestrial counterparts (IUCN, n.d.)

Seychelles' blue carbon ecosystems encompass mangroves and seagrass beds only. Given the limited land available for development, blue carbon opportunities within the country's significant EEZ may thus provide crucial development opportunities for emissions trading and carbon offset markets (SeyCCAT, 2020).

Nonetheless, BE stakeholders acknowledge that these ecosystems have declined in quality as a result of coastal development and climate change (SeyCCAT, 2020; Government of Seychelles, 2019). While mangroves have often received national attention for their protection, seagrass does not seem to have garnered the same levels of consideration. Indeed, there seems to be little public knowledge about seagrass and its contribution to the marine ecosystem in general (Nordlund et al., 2018).

Seagrasses are defined as flowering plants and form part of the monocotyledon plant group (Cullen-Unsworth et al., 2018). Typically located in sheltered and shallow locations, they can also be found in areas that are over 60 meters deep; their survival, however, depends on the availability of light (Cullen-Unsworth et al., 2018).

Seagrass provides a number of benefits, including furnishing habitats and food for marine animals and holding sediment in place, thereby mitigating the risk of coastal erosion from large waves and storms (Duarte et al., 2009). Seagrass meadows are formed when the plants cover large areas of the seafloor.

However, it is their potential for carbon sequestration – both through their own biomass and organic material filtration system – that suggests seagrass meadows also carry significant opportunities for blue carbon market development (Chandler, 2019). Research suggests that an acre of seagrass could store about three times as much carbon as a terrestrial rainforest. In line with these preliminary calculations, seagrass meadows may be responsible for more than ten percent of carbon storage in the ocean (Chandler, 2019).

Seagrass meadows as a blue carbon market

In this light, seagrass carries significant promise for the development of a blue carbon market. However, blue carbon markets are presently in the early stages of development and implementation (The Blue Carbon Initiative, 2020). Governments and international institutions still have a long way to go in revising carbon monitoring procedures, strengthening institutions and developing robust policy that will encourage private sector investments in offsetting using blue carbon (Bijour, 2020; van Kooten, 2017).

Meanwhile, voluntary carbon markets seem to have signalled a certain level of efficiency in boosting forest carbon credits, given they were the incubators for the development and testing of international accounting methodologies for REDD+ and other programs (van der Gaast, 2016). Indeed, terrestrial forest carbon is now used by voluntary carbon markets and payments through REDD+ or National Appropriate Mitigations Actions (NAMAs) programs. According to the World Bank (2016), voluntary carbon schemes have stabilized in price, but continue to experience low volumes of credit sales. For now, the exploration of seagrass as a harbinger for the emergence of blue carbon emission schemes in Seychelles may need to filter through a voluntary carbon market initiative first. Nonetheless, consideration will also need to be given initially towards marrying differing stakeholder interests with overall national objectives.

While many types of offset programs exist, Seychelles could consider the first-stage implementation of a voluntary blue carbon offset scheme which seeks to preserve existing meadows, incentivize restoration projects and raise awareness around the value of this ecosystem (Oreska et al, 2020). The next step would entail considering typical offset schemes that can be traded in either voluntary markets or as part of a compliance market (Hamrick and Gallant, 2018). Such an initiative would allow the government to facilitate the present and future sequestration of carbon (van der Gaast, 2016; Hamrick and Gallant, 2018).

A scheme of this nature becomes important when one considers how marine ecosystems degrade, versus terrestrial ones. In marine ecosystems, the cutting down of mangroves or the destroying of seagrass leads not only to the loss of previously stored carbon as with terrestrial

ecosystems, but also results in the *active re-emission* of the carbon that was trapped in the soil (IUCN, n.d, emphasis added). A viable blue carbon market scheme which integrates the buy-in of coastal communities may require consideration from a management perspective if Seychelles is intent on preserving its net carbon-sink status in the long term.

Through the launch of a blue carbon market scheme, Seychelles would join a small list of countries that is aiming to restore seagrass populations around the world. In Wales, Project Seagrass aims to trial seagrass restoration methods and raise awareness around this ecosystem, with an initial 1,500 seeds planted in 2015 and more planned for other areas of the United Kingdom (Stewart and Williams, 2019). Similarly, the Seagrass Restoration Project in the United Kingdom aimed to tackle climate change, restore habitat integrity and pave the way for large-scale restoration projects, planting 750,000 seeds in one of the world's biggest seagrass restoration project (Stewart and Williams, 2019; Newman, 2020).

While seagrass restoration projects seem to be less popular and less successful than their mangrove counterparts, schemes that have sought to integrate community engagement seem to have worked out. The Mikoko Pamoja mangrove restoration project engages the Gazi Bay community and provides them with an alternative livelihood (Wylie et al., 2016). Financed by voluntary carbon credits, the project aims to enhance the mangrove ecosystem and promote sustainable income and has completed its first crediting period (Wylie et al., 2016). Such a scheme has seen the successful integration of a concerned community with the potential for wealth creation. The rapid growth of these mangrove-based restoration projects could therefore serve as a beacon for future seagrass schemes, keeping in mind the latter would embody a different set of challenges.

Challenges facing blue carbon market schemes

It is no surprise that blue carbon market schemes are presently nascent in spite of their growing appeal; this is largely due to the complexities that continue to plague the growth of their counterparts on earth (van der Gaast, 2016). Forest carbon schemes have seen a mismatch between theory and practical implementation, investment uncertainties, indeterminate monitoring methods and questionable accounting frameworks (van der Gaast, 2016). Blue carbon schemes for Seychelles will face similar hurdles, not least among which is due to the fact that there appears to be very little public knowledge, appreciation, or legal considerations for these plants.

Eight species of seagrass have been identified so far in Seychelles, but a name for these plants does not exist in the indigenous language of Seychellois Creole (ASCLME 2012; SeyCCAT, 2020). In cultural terms, SeyCCAT (2020) notes that the local population has grouped

seagrass and seaweeds under the single name of ‘*gomon*’, which is traditionally viewed as an annoying coastal plant. It is suggested that this disconnect between the local community and the seagrass ecosystem might have served in severing a sense of ownership, engagement and attachment to preserving it (SeyCCAT, 2020). As such, much needs to be done regarding sensitization of communities and building engagement with blue carbon market initiatives in the future.

The country’s general legislative framework on environmental protection is the Environmental Protection Act (EPA, 2016). There is presently no mention of seagrass in the Act but mangroves are outlined in certain sections relating to marshes and wetland habitats (EPA, 2016). Notably, the latter is specifically mentioned in Section 11 of the Act during any inventory of the state of coral reefs, mangroves and marshes found within the coastal zone when the authorities request a survey of the same. While seagrass clearing is not practiced extensively, such activities require approval from the Department of Environment, and small patches have been cleared to create bathing areas for tourism establishments in the past (ASCLME, 2012). The EPA is in the process of being revised in 2020 and should look to make provisions for the protection of all blue carbon ecosystems identified in the country.

Besides the EPA, the Town and Country Planning Act (1972) is another key piece of legislation dictating Seychelles’ sustainable development in terms of planning. Notably, the Act defines land to include that which is covered with water, including the seabed. However, seagrass again receives no specific mention and does not seem to factor into any further planning considerations. The country’s wastewater management plan may present a good example here. As the National Implementation Plan (2007:125) explains, sea outfalls are used as a ‘point of discharge for wastewater treatment plant.’ However, in their assessment of the impacts of urban wastewater discharge on seagrass meadows, Cabaço et al. (2008) note that this activity is an important source of environmental disturbance and has served to impact the availability of nutrients for seagrass, thus affecting their population structure, morphology and nitrogen content, leading to increased degradation of the ecosystem.

Both Acts were implemented in different time periods and as such, their provisions may not be readily adaptable to the demands of modern-day Seychelles. Enter the Marine Spatial Planning (MSP) initiative, designed to better manage ocean space under the country’s Blue Economy banner. In line with the dictates of the MSP, Seychelles declared 30 percent of its territorial waters as Marine Protected Areas (MPAs) in 2020. In protecting marine ecosystems and habitats under MPAs, the country is seeking to preserve its rich biodiversity, much of which is threatened or vulnerable (Geary, 2020). Some of these threats emanate from invasive alien species, unrestricted coastal tourism development and activity, unsustainable fishing practices and global warming (ASCLME, 2012).

Small Island Developing States (SIDS), in the process of implementing Blue Economy strategies, are in different phases of development and often face unique sets of challenges and opportunities (Roberts and Ali, 2016). In this light, not all BE-related MPAs are created equal. Most are designed with the protection of biodiversity in mind, meaning that carbon sequestration and storage values might not be a top priority during their inception (Howard et al., 2017). With evidence of coastal seagrass degradation in Seychelles, a successful MPA will look to reduce threats to carbon sequestration and should allow for this ecosystem to restore and flourish anew (Seychelles Marine Spatial Planning Initiative, 2017; Geary, 2020). Thus, an understanding of the baseline environment around blue carbon ecosystems and their carbon stocks becomes crucial (Howard, 2017). However, synergies will be required between key legislative frameworks to remove the dissonance presently being demonstrated towards seagrass protection.

Seagrass also faces small-scale threats that hinder their ability to cope with global warming and climate change (Cullen-Unsworth et al., 2018). These are human-based in nature and can range from boating, trampling, dropping of anchors and dredging activities that physically damage the plants or alter their environmental conditions (Cullen-Unsworth et al., 2018). Increased scientific knowledge around seagrass has produced increased recognition of their value in recent years. Despite this, seagrass meadows are currently being lost at a rate of an area equal to two football fields every hour (Duarte et al., 2009). There is thus a need to educate not only the public around the importance of seagrass, but to also sensitize policy makers around the value of this ecosystem as a blue carbon source and related co-benefits, in order to get more support for its protection and inform further decision-making in the management of their ecosystem (Cullen-Unsworth et al., 2018; Geraldi et al., 2019).

Seagrass is also affected by significant changes in ocean temperature and other environmental changes. Studies show that elevated temperatures and reduced flow from rivers were significantly correlated with periods of lower seagrass biomass (Rasheed and Unsworth, 2011). These temperature increases have been accompanied by extreme weather events which have placed further stress on seagrass ecosystems through physical damage, reduction in growth and a general loss in resilience (Brodie and N'Yeurt, 2018). Moreover, physiological responses and the survivability of seagrass' early life stages are argued to be inextricably linked to their genetic characteristics, thus heightening concern around ongoing climate change (Duarte et al., 2018).

Where does this leave a blue carbon market scheme for the Seychelles? Much work needs to be done in the areas of improving legislation, resolving conflicting stakeholder interests and building the required capacity and skills for any feasible scheme. To this end, the country has recognized the need to start with a baseline assessment. The extent, distribution and status of seagrass ecosystems in Seychelles is presently unknown (ASCLME, 2012). Given the need to

fill this gap, SeyCCAT (2020) recently announced the launch of a blue carbon ecosystem mapping project with the intention to fully map the seagrass ecosystems in the country in order to assess their carbon value. The country has stated that it intends to integrate seagrass ecosystems into its next NDC report, thus providing a model for other SIDS that wish to conduct similar assessments and inform policy. However, with no international regulatory framework or convention protecting the value of blue carbon ecosystems presently, benefits of blue carbon have yet to be fully recognized and integrated into policy and financial mechanisms (United Nations, n.d). Additionally, The James Michel Foundation, in partnership with Deakin University of Australia, Constance Ephelia Resort, the Ministry of Agriculture, Climate Change and Environment is also undertaking the first study of blue carbon stocks within the Seychelles archipelago (Nation, 2020). The present projects being proposed for Seychelles' blue carbon ecosystems – seemingly led by mangrove-based studies for now – may lay the foundation in directing future initiatives around blue carbon markets in Seychelles.

Seagrass could very well hold the key to unlock further economic diversification in Seychelles. The mechanisms provided through carbon schemes have created spill-over benefits in the form of job creation, environmental sustainability through habitat preservation and creation of new markets (Lavery, 2013). Critics may argue that seagrass ecosystems within Seychelles' MPAs are largely protected. Some may see a benefit in leaving these meadows untouched, given that these plants are difficult to transplant or re-vegetate (Lavery, 2013). Conflicting stakeholder interests may further destabilize blue carbon initiatives. For example, will coastal communities in Seychelles welcome seagrass restoration projects? In this vein, it can then be argued that the process of monitoring and measuring carbon values in seagrass, coupled with inadequate institutional structures and poorly outlined legislation, may be the key ingredients in a recipe for disaster in a future that may be best left unexplored (van Kooten, 2017).

Conclusion

Ideally, in the Seychelles policy context, priority should be extended towards the protection of mangroves and seagrass meadows. If carbon financing is the endgame, not only will this scientific data become essential, but policy frameworks that support and regulate this financing, including partnerships and training for feasibility assessments, may be required (Howard, 2017). A comprehensive accounting of the country's carbon stocks would greatly assist Seychelles in remaining a net sink and achieving its Nationally Determined Contribution (NDC).

However, no global estimates of seagrass habitat coverage exist and very few pilot projects have attempted to tackle this (SeyCCAT, 2020). While mechanisms such as the REDD+

program have articulated that every square kilometer of forest lost releases 1.6 tonnes of carbon into the atmosphere, blue carbon values for seagrass continue to remain fairly elusive (Lavery, 2013). It is presently estimated that seagrass meadows can store up to 520 megagrams of carbon dioxide per hectare, but their degradation has led to a release of an average of 0.15-1.02 billion tonnes of carbon dioxide annually (Bijoor, 2020). The conservation of these blue carbon ecosystems therefore can provide long-term economic gains over the short-term benefits that come from their destruction (United Nations, n.d). However, discussions around blue carbon should be integrated not only at policy level within international frameworks, but also at the regional and local levels with local community considerations in mind.

Reducing the human-induced impacts on seagrass will go a long way in supporting this ecosystem's ability to fight global warming and climate change (Cullen-Unsworth et al., 2018). This will require stakeholders who may hold conflicting interests to work together in improving outdated legislation to include specific consideration for seagrass, raising awareness around the value of seagrass meadows from both a public and business community perspective, providing demonstrations of their ecosystem services and engaging with the community in finding ways to protect them from further undue stress without hampering their livelihoods and income (Brodie and N'Yeurt, 2018). This could take the form of a Clean Development Mechanism (CDM) in Seychelles to help fund climate mitigation activities such as ecosystem conservation (The Blue Carbon Initiative, n.d).

Seychelles is slowly coming to recognize that the protection of blue carbon ecosystems is crucial because they can store vast quantities of carbon that will be beneficial for the mitigation of climate change (Republic of Seychelles, 2020). In the meantime, urgent attention must be paid to preventing further degradation of the country's seagrass. Coles and Fortes (2001) note that defending seagrass is difficult without detailed data on this ecosystem and its economic values, including community support. Therefore, further impacts might be mitigated through sensitization programs for coastal communities around the benefits of seagrass, with a view towards developing future codes of conduct around seagrass-rich areas (Borum et al., n.d). Additionally, launching scientific data collection exercises with public support could also help with the identification of key areas for future planting activities and rehabilitation exercises. For now, the country is taking its first steps in the right direction, which might reveal a bright blue carbon future that was hiding in plain sight all along.



The author acknowledges Stuart Laing

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