Received: 30 December 2016 | Revised: 22 March 2017 | Accepted: 7 April 2017

DOI: 10.1002/aqc.2793

WILEY

SUPPLEMENT ARTICLE

Pathways for implementation of blue carbon initiatives

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Funding information
Global Environment Facility

Abstract

1. Coastal blue carbon activities are being implemented by a variety of countries, using different approaches. Existing regulatory regimes, including on coastal protection, are still very useful tools to protect and conserve mangroves, seagrasses and saltmarshes, and preserve their carbon value and role. These approaches suffer, however, from 'traditional' issues such as lack of enforcement, human and financial constraints as well as unclear or misguiding government mandates.
2. Successes are witnessed using a community-based carbon project approach, ensuring high stakeholder participation via direct or indirect incentive programmes. Comprehensive coastal zone management approaches seem very promising, but success overall, and regarding carbon specifically, are yet to be reported.
3. The Paris Agreement has introduced new tools which could serve as means to trigger more and better coastal adaptation and mitigation efforts. Their implementation details are, however, still under negotiation and their impacts can only be expected in a few years.

KEYWORDS

best practice, blue carbon, climate change; mitigation, policy

1 | BACKGROUND

It was not until 2009 that the specific value and role of mangroves, saltmarshes and seagrasses for climate change mitigation began to be addressed by climate policy experts. These coastal carbon-rich ecosystems have come to be referred to as 'blue carbon'. It rapidly became clear from scientific foundation publications produced around 2009 (Laffoley & Grimsditch, 2009; Murdiyarso et al., 2009) that national carbon accounting efforts showed a substantial 'blue carbon gap' between knowledge of these carbon sinks and the actions being taken by governments to safeguard their futures.

This paper is a contribution to closing this coastal blue carbon gap by extrapolating current blue carbon policy trends, patterns and differences between countries as well as social, legal and economic systems. It identifies common gaps as well as strategies and options for targeted, more effective, and scaled-up blue ecosystem mitigation interventions. Other marine ecosystems and open ocean processes play an important role in the global carbon cycle (Howard et al., 2017; Laffoley, Baxter, Thevenon, & Oliver, 2014). While proper management responses are needed for these systems as well, this paper focuses on the coastal systems (mangroves, saltmarshes and seagrasses) as they are in clear national jurisdiction, store carbon long-term and their sustainable management can be incentivized through existing climate and carbon policy and financial schemes.

To best understand the opportunities and challenges the paper draws on the results of the recently completed National Blue Carbon Policy Assessments (NBCPAs) conducted in five countries as part of the UNEP/GEF Blue Forests Project: Ecuador (IUCN & CI Ecuador, 2016), Indonesia,[1] Madagascar (IUCN & Blue Ventures, 2016), Mozambique (IUCN & WWF, 2016), and the United Arab Emirates (UAE) (IUCN & AGEDI, 2016). Information from other case studies from around the globe are also used.

2 | AN INTRODUCTION TO BLUE CARBON SCIENCE, MANAGEMENT AND POLICY

Coastal blue carbon ecosystems help mitigate the effects of climate change by sequestering and, more importantly, storing carbon dioxide (CO_2) captured from the atmosphere and ocean (Laffoley &

[1] Currently in review.

Grimsditch, 2009; Nellemann et al., 2009). They sequester carbon at significantly higher rates (up to 6 times more than undisturbed tropical rainforest), per unit area, than terrestrial forests (Mcleod et al., 2011). The carbon deposits accumulated within coastal carbon systems are stored both above ground in the biomass of plants (tree trunks, stems and leaves) and, in particular and much more so than in terrestrial ecosystems, below ground in plant biomass (root systems and rhizomes) as well as in organic carbon-rich soils.

When these systems are degraded, lost or converted to other land uses, massive stores of carbon in the soils of these ecosystems are exposed and released as CO_2 into the atmosphere and/or ocean. Although the combined global area of the three main blue carbon ecosystems – mangroves, saltmarshes and seagrasses – equates to only 2–6% of the total area of tropical forest, their degradation accounts for up to 19% of carbon emissions from global deforestation (Pendleton et al., 2012). In absolute figures: every year an estimated 0.15–1.02 billion tons of CO_2 is released from deforestation and degradation of blue carbon ecosystems.

Many countries have yet to prepare for and implement targeted climate and carbon policies for coastal carbon ecosystems. More research is needed to produce more detailed maps (in particular concerning seagrasses), to make robust estimates of below-ground biomass, and to assess the effects of sea-level rise, among others (Howard, Hoyt, Isensee, Telszewski, & Pidgeon, 2014).

The constructive synergies and overlaps between blue carbon interventions and adaptation efforts are now beginning to inform policy makers worldwide. Conservation, restoration and sustainable use of sensitive coastal ecosystems are increasingly understood in their multiple roles to support livelihoods, store carbon, and increase resilience against climate change. In the preamble to the recently adopted Paris Agreement, the Parties note the 'importance of ensuring the integrity of all ecosystems, including oceans, and the protection of biodiversity'. In addition, a full article is reserved for the Parties' commitment to 'conserve and enhance, as appropriate, sinks and reservoirs of greenhouse gases', with a specific reference to Article 4.1 (d) of the United Nations Framework Convention on Climate Change (UNFCCC), which lists 'biomass, forests and oceans as well as other terrestrial, coastal and marine ecosystems'.

The majority of countries still largely treat coastal conservation and restoration efforts exclusively within the scope of adaptation and resilience, as evident in national climate change strategies and international commitments, also known as Nationally Determined Contributions (NDCs), made in anticipation of the Paris Agreement. However, there are early movers and pioneers that have explicitly mentioned coastal blue carbon ecosystems as part of their mitigation efforts (Herr & Landis, 2016).

An increasing number of governments and non-government institutions have also started to conceptualize specific opportunities presented when linking blue carbon interventions with conservation finance (Credit Suisse, WWF, & McKinsey & Company, 2014) and payment-for-ecosystem services (PES) schemes (Locatelli et al., 2014). Others have looked towards new climate finance tools, such as results-based finance (UNEP & CIFOR, 2014), blue bonds (Richardson, 2016), and debt-swap-for-nature agreements (Resor, 2010) – to fast-track coastal management approaches (see section 6.5). A number of country-specific efforts show that there is growing interest of including the carbon value of these three systems into national policy, planning and decision-making (CI & EIB, 2016; UNDP, 2016).[2]

While the blue carbon rationale is increasingly becoming mainstream, actual interventions and fully implemented actions as well as new policy measures are still rare and often limited to modest mangrove restoration projects. The blue carbon mitigation approach is still of fairly recent origin; just as terrestrial landscape projects needed about a decade to prove operational, blue carbon projects may need a few more years to be professionally set up at a relevant scale. This general consideration aside, the drivers of degradation of mangroves and coastal wetlands – different across nations and regions and in many respects different from terrestrial carbon environments – require smart, cross-sectoral responses, which are not yet consistently conceived, let alone implemented. Pressures on blue carbon ecosystems originate from two directions: seaside and landside. Yet policy regimes and management mandates are usually split and isolated, where strong economic interests – in aquaculture production or timber extraction – clash with terra-nullius (no-man's-land, 'there-to-take') concepts of coastal zones.

3 | BLUE CARBON COUNTRY EXAMPLES

Using information from Ecuador, Indonesia, Madagascar, Mozambique and the UAE will help to best outline and understand the opportunities and challenges countries are facing in terms of national implementation. These five countries spread over three continents, each rich with coastal mangrove and seagrass ecosystems and each with its own history of human stressors and drivers of degradation. Indonesia holds by far the largest reservoir of blue carbon stocks among the five countries (and indeed globally) with millions of hectares of both mangroves and seagrasses. Mozambique, Madagascar, Ecuador and UAE follow with hectare coverage at a much smaller scale (Table 1).

Coastal carbon ecosystems, apart from their climate mitigation value, also play a very important role in protecting coastlines from the increasing impacts of climate change by absorbing incoming wave energy, providing storm surge protection, and preventing erosion. In some cases, coastal wetlands have proven to be more cost-effective than hard infrastructure like seawalls and levees, as they require less maintenance and may keep pace with sea-level rise (Beck & Lange, 2015; Narayan et al., 2016). Protecting coastal blue carbon ecosystems also comes with a suite of other co-benefits such as providing spawning grounds for commercial fish, water purification, and supporting local livelihoods.

A common feature is the imperfect and incomplete state of blue carbon ecosystem maps and inventories. At the level of climate change research and policy support, this may not least be a consequence of the lack of accurate carbon accounting rules. It was not until 2014 that

[2]Cf. the 'Sustainable Landscapes in Eastern Madagascar' Project, a cooperation between the European Investment Bank and Conservation International, with initial funding provided by the Green Climate Fund to prepare green/blue bond issuance; see also UNDP's project for Vietnam ('Improving the resilience of vulnerable coastal communities to climate change related impacts in Vietnam'), which includes mitigation and adaptation activities rooted in mangrove rehabilitation (funded by the Green Climate Fund).

TABLE 1 Overview extent of coastal blue carbon systems in five countries

Country	Mangroves	Seagrasses	Saltmarshes	Other
Ecuador	157 000 ha	N/A	N/A	
Indonesia	2.9 million ha	3.1 million ha	N/A	
Madagascar	278 078 ha	Unknown	N/A	
Mozambique	300 000 ha	43 900 ha	N/A	
UAE	14 000 ha	150 000 ha	Unknown	Alga mats; Coastal sabkha*

*Coastal sabkha, the phonetic translation of the Arabic word for salt flat, qualify as associated blue carbon ecosystem. This ecosystem is a supratidal formation, formed as a result of sea-level floods that create shallow water features. When these features silt up or evaporate, they leave a flat salt pan, also known as a sabkha (UAE Interact, 2014). N/A - Not applicable.

the IPCC issued a dedicated section on accounting for emissions from conversion and drainage of coastal wetlands (IPCC, 2014). The still patchy data set is responsible for the fact that coastal carbon stocks are often left out when it comes to carbon accounting within the framework of Reducing Emissions from Deforestation and forest Degradation (REDD+). Yet, the lack of data often is more basic. For many countries – including the example countries – fairly simple figures of geographic mangrove locations and size are in doubt (as in Indonesia) or contested (as in Ecuador). Whether countries are home to seagrass habitats is sometimes unknown (as in the case of Madagascar).

Some of the uncertainty, however, is due to habitat changes, some of which are natural (e.g. the Zambezi Delta with its many mangrove movements), most of which are man-made. Ecuador has lost one-third, if not more than half, of its mangroves since the 1970s (Bravo, 2013), Indonesia about 40% since the early 1980s (Republic of Indonesia, 2007). The opposite trend occurred in the UAE, which more than tripled its mangrove areas in the past 40 years through systematic afforestation and reforestation efforts to (over-) compensate for the deforestation of natural habitats (UAE MEW, 2015). Some of the drivers of deforestation and degradation, and their underlying causes, are common to all countries – in particular coastal developments as well as coastal infrastructure projects and increasing pollution, which each put substantial pressure on both mangrove and seven seagrass habitats – but others differ (Table 2). In less developed countries, in particular those with low electrification rates, non-sustainable fuel wood and charcoal extraction is ubiquitous around community settlements (e.g. Madagascar and Mozambique). In countries with higher economic development and integrated international supply chains, aquaculture may represent the biggest threat (as in Ecuador). For countries that are both poverty-prone and integrated in international aquaculture supply chains, conventional threats (fuel wood, wood extraction for construction) and modern drivers of deforestation (aquaculture, in particular shrimp production) are equally destructive (as in some parts of Indonesia).

It is important to have a clear picture of the main pressures and threats to coastal carbon ecosystems (Table 2) in order to identify the best solutions. Pollution, for example, is a common threat to coastal ecosystems. The reduction thereof cannot, however, be triggered by climate policy and incentives, but through other sectoral means of regulations and policies (waste water treatment regulations or recycling control). Logging or coastal development, on the other hand, can be partly de-incentivized through carbon and climate policies and instruments, including carbon markets or regulations (carbon tax). It is important to get an overview of the main and minor pressures in order to explore the appropriate response measure, and to identify whether, and if so, which climate or (blue) carbon policy or financial instrument can work in a specific national context.

4 | THE REGULATORY LANDSCAPE

The regulatory analysis often starts from an enigma: in many, if not most countries, mangrove areas or a country's coastal natural habitats, in general, are explicitly protected by domestic forest, land planning, water supply or coastal management regimes. Art. 50 (3) c of Indonesia's Forestry Code of 1999, for instance, stipulates that 'no

TABLE 2 Main pressures and threats to coastal carbon ecosystems in selected countries

		Land Side				Sea Side			
		Land-Use Changes							
		Upland drainage	Logging	Agriculture	Coastal Development *	Aquaculture	Desalinization	Pollution	Unsustainable/ destructive fishing
Indonesia	Mangroves		Timber / Charcoal	Oil Palm		Shrimp			
	Seagrasses								
Ecuador	Mangroves		Timber		Transportation	Shrimp			
Mozambique	Mangroves		Timber		LNG Development				
	Seagrasses				LNG Development				
Madagascar	Mangroves		Timber / Charcoal						
	Seagrasses								
UAE	Mangroves		Charcoal		Land reclamation				
	Seagrasses				Land reclamation				
	Saltmarshes				Land reclamation				

* Coastal development include real estate, hotels, port infrastructure
Specific activities are highlighted in the boxes.

Main pressures and threats to ecosystems
Minor pressures and threats to ecosystems

one shall be allowed to … cut trees within a radius or distance of up to … 200 (two hundred) meters from the edge of water sources and river banks in a swamp area; 100 (hundred) meters from river banks; 50 (fifty) meters from the banks of streams … 130 (one hundred and thirty) times the difference between the highest and the lowest tide, measured from the coastline…' Ecuador banned mangrove destruction as early as the 1970s. In Costa Rica, mangroves are considered 'natural patrimony of the state' and property of the state (Articles 13, and 14 of the Forestry Code of 1996). Fishery laws across nations ban mangrove destruction and impose strict licensing regimes for coastal areas.

A wide range of penal provisions have been enacted to enforce mangrove protection regimes. However, these have not hindered fishermen, aquaculture producers, communities, and governments from using, extracting or degrading blue carbon resources any less than other ecosystems. In certain countries and locations, deforestation and other degradation of mangroves has been worse than for terrestrial forests (Valiela, Bowen, & York, 2001). This points to an enforcement problem. Mangrove areas are notoriously difficult to police, and institutions responsible for enforcement often have little capacity. The use of new technologies including satellite monitoring or remote sensing could be novel, albeit expensive, means to increase enforcement. At the same time, historical responsibilities and tenure claims – mostly of local communities – have been cut off (often as part of a country's colonial legal heritage), while the approach to new appropriations can be dysfunctional. In Mozambique, for instance, the right to issue licences for use of mangrove areas is restricted and subject to implementing legislation. Such legislation has never been produced, however, with the effect that local and provincial authorities can issue permits without having regard to any particular targets, thresholds or requirements. Devolution – a standard constitutional reform item of recent decades – sometimes adds a layer of confusion. Where before a single government entity was responsible for the issuance of licences, now it may be several agencies at local, provincial and central government levels (e.g. as in Indonesia). Government clarity on such items is urgently needed to provide clear signals to users and protectors alike.

While most instances of unplanned degradation point to a lack of enforcement capacity, other activities occur in a grey zone of planned and unplanned interventions. Ecuador is a good example of a country in which different public legal regimes co-exist and overlap with contradictory results. Over the past decades, a range of different agencies have been in charge of issuing aquaculture licences, effectively reducing both the Ministry of Environment's power to ensure mangrove conservation and its role in monitoring activities. More often than not, the very Ministry charged with mangrove conservation, then, does not have the data concerning licences and aquaculture installations. This in turn makes it easier for entrepreneurs to move ahead without a licence in the first place. In the end, the government is faced with the choice between accepting widespread non-compliance or offering conditional amnesties (Ecuador decided in favour of the latter).

Seagrasses and other permanently water-bound blue carbon systems have long lacked dedicated protection regimes altogether. Sometimes, they benefited from some form of incidental protection as part of their location (e.g. when located around islands in Mozambique). Yet, in most regulatory environments, these habitats traditionally could only rely on general no-harm provisions. A case in point is the UAE, where Article 17 of Federal Law No. 24 on Environmental Protection calls for the protection of coasts, beaches and seaports from all kinds of pollution and the protection of the marine environment and its living creatures. More recently, however, there has been a trend towards targeted protection, if only location-specific, i.e. through the installation of protection or conservation areas with important seagrass habitats (Marawah Marine Biosphere Reserve in UAE, for instance, established in 2001). This trend should be continued and linked with broader coastal development efforts to ensure comprehensive coastal zone planning with representative ecosystems and a proper balance between protection and use.

The growing number of protected areas across the globe – including in the form of marine protected areas (MPAs) established at local government level, for instance in Indonesia (Conservation International, 2009), and in the form of transboundary efforts, for instance in Mozambique and Tanzania (WWF, 2017) – increasingly benefits blue carbon ecosystems. This is perhaps nowhere better seen than in Madagascar. The island state has dramatically increased the size of its protected areas (from 1.7 m hectares to 5.58 m hectares between 2003 and 2010), with many coastal areas falling within their scope. The protected area status provides both enhanced conservation status as well as, crucially, a dedicated institutional framework that allows better planning and enforcement. Several mangrove habitats have, thus, come into enhanced management focus, including the newly created protected area Menabe Antimena accounting for 7% of the country's mangroves (Fanamby, 2014) and the Samahalaza National Park, created in 2001, which covers mangroves, but also seagrass areas and coral reefs (UNESCO, 2011).

5 | BEST PRACTICES FOR NATIONAL BLUE CARBON IMPLEMENTATION

In response to the ambiguous performance results of command-and-control approaches to blue carbon protection from the more 'traditional' sectors such as Protected Areas, countries have moved to more incentive-based instruments and to community-driven measures (Rotich, Mwangi, & Lawry, 2016). Tools and frameworks of international climate finance – from carbon trading to facilitative tools such as REDD+ (Beresnew & Broadhead, 2016) – are opportunities countries are exploring and implementing in various ways and degrees (Thomson, 2014). A brief overview of their advantages and disadvantage can be found in Table 3.

5.1 | Community-based carbon projects

The crediting of emission reduction (or sequestration) action against a baseline is an instrument first designed as part of the cap-and-trade system established under the Kyoto Protocol (Streck & von Unger, 2016). In order to offset GHG emissions in industrialized countries, the Clean Development Mechanism (or CDM) allowed for the implementation of projects in developing countries to effectively reduce GHG emissions or sequester carbon dioxide. The CDM proved a less-than-perfect tool for ecosystem-based interventions as, most

TABLE 3 Best practices: Overview of advantages and disadvantages

	Success/advantages	Failure/disadvantages
Community-based Carbon Projects	• Site specific • Provide locally (small) benefits to communities • Provide co-benefits from better ecosystem management, including fisheries or alternative livelihoods	• Not a silver bullet • Carbon price can, in some cases, not cover all project costs (including set-up, evaluation and carbon monitoring costs)
REDD+	• International donor support • Advanced land tenure discussions and participatory engagement actions • Nesting approach will simplify blue carbon integration	• Slow process • Level of ambiguity for inclusion of blue carbon environments • Exclusion of below-ground carbon sink, albeit inclusion possible
Domestic and Hybrid Incentive-Based Instruments	• General success • Direct payments to communities both cheaper and more effective than indirect benefits • Climate finance could increase the contributions both in terms of finance and management responsibilities	• Side-lining existing governance structures in favour of newly created ones
Biodiversity Protection	• General guidance and target setting (e.g. restoration targets) • Revision of policies has prospect for more comprehensive and coordinated policy and implementation across sectoral plans	• Currently don't include specific mitigation related activities
Coastal Zone Management	• Comprehensive and inclusive planning tool in theory to support conservation and restoration of coastal ecosystems • Carbon as another argument for sustainable coastal management • Foundation laid in many countries	• Implementation slow and not well documented • Carbon value so far not broadly included in existing efforts

importantly, it did not allow crediting for ecosystem conservation and issued hard-to-trade temporary credits only (Joosten, Couwenberg, von Unger, & Emmer, 2016). Nevertheless, it still triggered the development of more than ten ecosystem-based accounting methodologies (for example on 'Afforestation and reforestation of degraded mangroves' (UNFCCC, 2013) and some 50 projects worldwide, among them 'Protection of Cameroon estuary mangroves through improved smoke houses' (UNFCCC, 2010a) and 'Small-scale and low-income community based mangrove afforestation project on tidal flats' (UNFCCC, 2010b) in Riau Island Province Indonesia). Voluntary carbon standards spread where the CDM did not provide action formats, notably in the area of ecosystem conservation. The Verified Carbon Standard (VCS), in particular, consolidated blue carbon related project approaches (VCS, 2015a).

A common feature of virtually all blue carbon offset projects – in stark contrast to most credit-intensive energy offset projects – is a strong community-based approach. In Gazi Bay, Kenya, mangrove restoration and reforestation projects are being implemented in collaboration with local communities. The revenues collected from the sale of credits have been invested in project implementation and have supported community development projects, including rehabilitating local schools and buying text books, as well as providing piped water to the community (UNEP & CIFOR, 2014). Blue Ventures in Madagascar is working to gain the scientific knowledge required to make community-led, rights-based blue carbon projects a reality, and to build the capacity of local management associations to protect their mangroves (Blue Ventures, 2015). The Cameroon CDM Mangrove Project, for instance, seeks to improve 350 traditional smoke houses in nine villages, catering for some 4500 people (UNFCCC, 2010a). Under the Aceh Mangrove Restoration Project (VCS), small-scale community-owned areas are reforested, thereby allowing sustainability improvement for thousands of local community livelihoods (VCS, 2015b).

As the CDM is withering and voluntary markets have reached a plateau in terms of market value (even though credit volumes continue to rise and boutique projects still attract high prices) (Ecosystem Marketplace, 2016), project developers increasingly look to new offsetting options under the Paris Agreement.

5.2 | REDD+

Over recent years, REDD+ has emerged as one of the main negotiation blocks between UNFCCC Parties (La Vina, De Leon, & Barrer, 2016). A comprehensive framework – the Warsaw Framework for REDD+ – has been established, and the Paris Agreement specifically encourages Parties to take actions on 'results-based payments' in relation to REDD+ (Article 5.2 of the Paris Agreement). Important progress has been made over the years on many fronts and many technical details, including the calculation of forest emission reference levels, REDD+ safeguards, REDD+ implementation phases and jurisdictional approaches. Strong bilateral and multilateral activities have supported the REDD+ development, among them the United Nations Collaborative Initiative on Reducing Emissions from Deforestation and Forest Degradation (UN REDD) and the World-Bank-managed Forest Carbon Partnership Facility (FCPF). Some 50 (mostly tropical) countries have started building country-wide REDD/REDD+ implementation frameworks, with financial support from developed countries. By 2015, almost USD 9 billion had been pledged by donors to support REDD+ activities (Lee & Pistorius, 2015).

REDD+ and blue carbon share a wide range of characteristics, and in the majority of countries, mangroves are considered forestland. Governments increasingly design REDD+ projects and toolkits for coastal environments, in general, and mangrove forests, in particular (King, 2012; YLB, 2015). The concept of 'results-based' (or 'performance-based') support, in this context, is particularly helpful for both the promotion of transparent impact evaluation (on the basis of measuring-reporting-verification (MRV)) guidelines and the installation of community-focused benefit systems (carbon benefits as well as non-carbon benefits). REDD+ policy development has also advanced land

tenure discussions and participatory engagement actions (including recourse mechanisms), benefiting indigenous populations (Savaresi, 2013). Nevertheless, REDD+ remains a slow process, and most countries have not yet tapped into the scheme's full potential (Lee & Pistorius, 2015). Various governments and NGOs remain sceptical as to the social, if not moral compatibility of REDD+ − seen, in this view, as a foreign (market-speculative) governance tool dispossessing communities, rather than empowering them – and traditional (forest) land management (Bayrak & Marafa, 2016). It is noted, however, that all of the negative case study narratives known to the authors concern terrestrial REDD+ projects, not coastal ones. This may ultimately be explained by the unique set of characteristics – historically higher level of regulation (and thus control), looser accessibility including for communities, and the dual habitat pressure (sea-sides and land-sides), among others – which sets terrestrial REDD+ and coastal REDD+ apart.

It is also noted that REDD+ engagement often holds a certain level of ambiguity for blue carbon environments, which in turn can impede project-level action. First, it is often not clear to what extent blue carbon environments are covered by a country's REDD+ policy framework. At first sight, several countries – including Costa Rica and Indonesia – cover mangroves for the purpose of defining their REDD+ reference levels. Yet, looking deeper, these countries include above-ground biomass only, leaving the enormous below-ground carbon sink in limbo. For other countries, the REDD+ treatment of mangroves remains altogether unclear (e.g. Madagascar). This has repercussions not just for the correct calculation of emission reductions but also has shortcomings for analytical work, stakeholder involvement, and policy planning. In many assessments of REDD+ in Ecuador, for instance, mangrove destruction and the peculiar role of aquaculture play hardly any role.[3] Then, second, as the primary focus of REDD+ is nation-wide or jurisdictional engagement, the role of REDD+ projects remains vague, and carbon project developers have the (at times arduous) responsibility of clarifying whether the REDD+ architecture permits bottom-up development projects in the first place. This said, various countries have started setting up structures for defining the scope of REDD+ projects, and the mechanics of their 'nesting' is also established under voluntary standards (Pearson, Casarim, & McMurray, 2016). Their efforts will also simplify interventions for blue carbon developers.

5.3 | Domestic and hybrid incentive-based instruments

At the national level, countries are increasingly experimenting with different tools of community-focused and incentive-based governance schemes. Mozambique recently launched community-based natural resources management programmes and so-called Community Councils for Fisheries (CCPs). As early as 1996, Madagascar adopted a law on local management of natural resources, widely known as GELOSE (*Gestion locale sécurisée*), (Loi N°. 96–025 relative à la gestion locale des ressources naturelles renouvelables), and in 2001, a simplified form of GELOSE, known as GCF (*Gestion contractualisée des forets*) (Décret No. 2001–122 Fixant les conditions de mise en œuvre de la gestion contractualisée des forêts de l'Etat). Both instruments are designed as horizontal governance mechanisms linking resource management directly to communities. GELOSE specifically allows for the integration of fisheries management.

In many countries, community-based management tools have proved successful, albeit not always consistently. For Madagascar, the picture has been mixed (Brimont & Karsenty, 2016; Rasolofosen, Ferraro, Jenkins, & Jones, 2015; Waeber, Wilmé, Mercier, Camara, & Lowry, 2016). While GELOSE and GFC were meant to simplify the conditions under which the management transfer is implemented, critics voice concern that they may have produced the opposite by side-lining existing governance structures in favour of newly created ones (Pollini & Lassoie, 2011). A separate concern relates to the tendency of programmes to offer communities indirect benefits rather than direct (cash) payments. This may work well in specific situations, but evidence suggests that often direct payments to communities would be both cheaper and more effective (Ferraro & Kiss, 2002).

Within the blue carbon context, a fairly simple cash-for-management scheme has been established in Ecuador. 'Socio Manglar' (literally: 'Mangrove Pact'), a sub-programme of 'Socio Bosque' ('Forest Pact'), offers coastal communities direct cash payments in return for operating mangrove areas sustainably and in compliance with a dedicated management plan.[4] The target of *Socio Manglar* is ambitious: it attempts to have at least 100 000 hectares of mangrove forest under agreement by 2018. Successful candidates receive a mix of fixed and variable payments. The yearly fixed payment amounts to USD 7 000 for areas between 100 and 500 hectares, USD 10 000 for areas between 501 and 1 000 hectares, and USD 15 000 for areas above 1 000 hectares. The variable payments depend on the actual size of the area under agreement and amounts to USD 3 per hectare per year. Continued payments are conditional on successful evaluation. Early evaluation results are promising, and the programme has so far been in robust demand. Within a year, the mangrove area covered by the programme doubled.[5]

These mechanisms are not climate finance specific, rather they combine different policy targets ('hybrids'). Climate finance instruments could help, however, to improve the standard of impact evaluation ('results-based' performance) and to increase the contributions both in terms of finance and management responsibilities. At different locations across the globe, conservationists are testing the grounds for linking mangrove conservation and restoration efforts with various climate finance formats, in particular nationally appropriate mitigation actions (NAMAs). *Socio Manglar* seems to offer a particular opportunity for learning in this respect.

5.4 | Biodiversity protection and coastal zone management

National biodiversity plans are to give policy and investment directions while setting priority sectors and activities. Depending on the country,

[3]See, for instance, the description in World Bank/Climate Investment Funds, at https://www-cif.climateinvestmentfunds.org/country/ecuador.

[4]http://www.ambiente.gob.ec/ministra-lorena-tapia-dio-inicio-al-programa-de-conservacion-socio-manglar/.

[5]Current programme figures with the authors.

these documents address a range of themes in terms of process (participatory and decentralized governance) to substance (different ecosystems and species), as well as strategy (sustainable use and development). Ecuador (MAE, 2015), Indonesia (Kementarian PPN/Bappenas, 2016), Madagascar (MEEF, 2002), Mozambique (MITADER, 1998) and UAE (MEW, 2014) all have national biodiversity plans; some are, however, outdated and/or in the process of being renewed (Madagascar, Mozambique).

Activities related to coastal blue carbon ecosystems are manifold within these biodiversity strategies. This includes, for example, the need to finalize coastal zone management plans (Madagascar) or the creation of protected areas or bio reserves (Madagascar, Mozambique, UAE).

Ecuador's national biodiversity plan has a specific focus on mangroves. It seeks to establish 'alliances of co-responsibility' between the State and communities, as well as knowledge platforms, for the conservation of wetlands and mangroves. It also includes mangroves in the 2017 goals to restore 500 million hectares of forests, mangroves and wetlands, and to protect a further 1.8 million hectares. The National Biodiversity Strategy and Action Plan of the UAE includes a number of intervention actions relevant for blue carbon ecosystems linked to various Aichi targets, most importantly an initiative to diversify the mangrove species across the UAE.

The climate change mitigation value of coastal ecosystems was not fully established when most of these strategies were written. While they aim for overall better conservation of coastal biodiversity, they don't include specific mitigation related activities. The ongoing and new revisions of such documents hold not only the opportunity to integrate the mitigation aspect, but also offer the prospect for more comprehensive and coordinated policy and implementation across sectoral plans and efforts touching on coastal carbon ecosystems management. The revisions also ensure coordination between and reporting to the various international conventions that a country is party to.

The conservation of biodiversity is also an integral part of broader coastal planning efforts. Coastal states have engaged in coastal planning for decades (dating back to late 1980s): most have developed national coastal zone management acts and legislation, and many have legal frameworks in place for co-management, such that government agencies and local communities share the burden of management and monitoring. However, information around Integrated Coastal Zone Management (ICZM) in most developing countries, even those which are considered 'successes' – such as Ecuador – rarely appear in the academic literature. Often project-type activities – and more recently mangrove-specific activities – are being singled out rather than integrated into planning approaches and steps. Integrated planning which would include coastal ecosystem's carbon value, alongside other values, could, however, provide a more comprehensive picture to the decision process. Carbon might be able to 'tip the balance' in some cases towards better conservation or restoration of coastal ecosystems rather than clearing certain areas for other purposes. Carbon provides another strong argument, linked to financial and policy incentives, for better coastal ecosystems management which can provide multiple benefits to coastal communities.

Madagascar, for example, embarked on a more integrated and sustainable development path for coastal zones by providing legal regulations towards adopting an integrated management approach of coastal areas (Decree N°2010–137 (*Portant réglementation de la gestion intégrée des zones côtières et marines de Madagascar*, *GIZC*). It lays the foundation for a comprehensive, multi-stakeholder and multi-sector planning approach, which includes coordination between relevant administrative levels and Ministries. With a mandate to explore policy options for better conservation and management of mangroves, the newly created National Committee for Integrated Mangrove Management (*Commission Nationale de Gestion Intégrée des Mangroves*, *CNGIM*) will provide a focused management approach for mangroves.

Mozambique is also currently putting its emphasis on integrated management of one ecosystem – mangroves. Results and recommendations derived from an ongoing consultation process are currently being summarized to eventually inform the future National Mangrove Management Plan. The National Environmental Management Programme (NEMP) already included the principle of ICZM back in 1994, stating that coastal management should be based on an inter-institutional coordination among the relevant stakeholders, and it mandated the development of programmes to further regulate (i) fisheries; (ii) coastal and marine ecosystem management; (iii) coastal and marine protection; (iv) marine parks; and (v) tourism.

6 | NEW CARBON POLICY APPROACHES TO FAST-TRACK BLUE CARBON IMPLEMENTATION

While countries have, or are engaged in, one or more of the tracks described above, new, emerging climate and carbon tools and incentives continue to become available. These could help countries to move further towards the sustainable use, management and finance of their coastal carbon ecosystems. Their potential advantages and disadvantages are briefly summarized in Table 4.

6.1 | National climate change plans

National climate change plans describe the activities needed and/or planned to mitigate as well as to adapt to climate change in a specific national context. They often define the priority activities trying to balance immediate needs and urgency with long-term sustainable development and national planning activities. Ecuador (MAE, 2012), Indonesia (Republic of Indonesia, 2007), Mozambique (MICOA, 2012) and Madagascar (MEEF, 2010) all have such national documents describing their respective needs and priorities. In some cases countries have a separate national adaptation plan detailing the impacts from climate change as well as their adaptive response measures (Madagascar; MEEF, 2006).

Such policy documents provide the direction (e.g. priority sectors) for other state and non-state actors to develop adequate measures and responses. Emphasizing the role of coastal carbon ecosystems for both mitigation and adaption to climate change can help guide different levels of policy makers, donors and implementers. In Madagascar, the 2010 National Climate Change Policy (*Politique nationale de lutte contre le changement climatique*, PNLCC) provides guidance by mentioning the need to explore climate finance options

TABLE 4 New carbon policy approaches: Overview of advantages and disadvantages

	Success/advantages	Failure/disadvantages
National Climate Change Plan	• Set blue carbon as priority and identify financing means	
Nationally Determined Contributions	• Set blue carbon as priority and identify financing means • A means to develop programmatic approaches needed to find large-scale mitigation and adaptation solutions	• Coastal carbon systems have not been uniformly integrated into this effort, especially within mitigation actions
NAMA	• Capacity-building approach in support of public and private sector institutions to implement a number of key activities	
PA Article 6 / ITMOs	• A new carbon commodity	• A new carbon commodity • Market demand needed to stimulate action • Ongoing UNFCCC negotiations
PA Article 6 / Sustainable Development Mechanism	• Must go beyond offsetting and have a net positive mitigation effect	• Market demand needed to stimulate action • Ongoing UNFCCC negotiations
PA Article 6 / Framework for non-market based approaches	• Aims at both mitigation and adaptation • Seeks opportunities for coordination	• Very wide concept • Ongoing UNFCCC negotiations

at all levels, including voluntary carbon markets and REDD+ (MEEF, 2010), opening the door for such activities in coastal blue carbon ecosystems.

Other national climate change plans make specific reference to coastal blue carbon ecosystems. Mozambique, as one of their *adaptation* priority actions, aims at the 'increased resilience of fish stocks' through the 'regeneration of mangroves and the implementation of protection measures of algae and seagrasses, corals and other fish reproduction and feeding grounds' (MICOA, 2012; para. 4.6.1.3.2). The list of key *mitigation* actions includes 'planning and managing of biodiversity and coastal ecosystems' through 'the development of sustainable exploration programmes, the regeneration and protection of mangroves, algae and seagrasses associated with the potential to capture and sequester carbon (Blue Carbon)' (MICOA, 2012; para. 4.6.2.3.3.).

In cases where no such documents (i.e. national climate change plan or additional/separate adaptation plan) exist or are under development, this can present an opportunity to ensure coherent development and implementation of mitigation and adaptation measures both at the national and local levels, including those pertaining to blue carbon ecosystems. Including blue carbon activities into national climate change plans underscores their position as part of a country's climate solutions and financing.

6.2 | Nationally determined contributions

Nationally Determined Contributions (NDCs), as part of the UNFCCC Paris Agreement, are a means for countries to independently decide how to lower their emissions. These national level climate action and emissions reduction plans reflect countries' economic and environmental differences. Each successive NDC represents a progression from the previous one, representing the highest possible ambition (Art. 4.3 of the Paris Agreement). Each party shall communicate a revised NDC every five years (Art 4.9 of the Paris Agreement).

An analysis of the 163 submitted NDCs showed that 28 countries have included a reference to coastal wetlands in terms of mitigation, either as part of LULUCF or other forest commitments, or part of general mitigation aims (Herr & Landis, 2016).

The UAE announced the development of strategies and plans to improve coastal blue carbon ecosystems and to minimize anthropogenic impacts through large restoration and plantation efforts of mangroves and seagrasses (UAE, 2015). It refers to the use of the 2013 IPCC Wetlands Supplement and its specific advice on coastal ecosystems to include emissions by sources and removals by sinks from blue carbon ecosystems in their 2016 GHG inventory.

Madagascar's NDC makes specific reference to the dual role of forest, mangroves and biodiversity for ecosystem-based adaptation and mitigation, stating that the sustainable management of forests and mangroves should be paired with a reduction in GHG emissions through limiting deforestation practices. Madagascar looks to increase the absorptions in the LULUCF sector at approx. 61 $MtCO_2$ by 2030, but does not specify the contribution of mangrove management measures to this plan (Madagascar, 2015).

Mozambique does not specifically refer to activities in blue carbon ecosystems but does mention the goal to renew the National Adaptation Plan (see section 5.1). Previous adaptation plans mention the need to identify rehabilitation techniques for dunes and mangroves to mitigate the effects of erosion, as well as the need for 'coastal management centres' to build capacity for training, research and monitoring of the coasts (NPA) (Republic of Mozambique, 2015).

The conservation of marine and coastal biodiversity is identified by Ecuador as a mitigation and adaptation measure. Updating management plans of protected areas and monitoring marine and coastal ecosystems are adaptation measures Ecuador wants to pursue (Ecuador, 2015).

Indonesia has pledged a target of 29% reduction of GHG emissions under business-as-usual level by 2020, with a reduction of up to 41% by 2050 if adequate international support were made available to them (Republic of Indonesia, 2016). Though the contribution from better forest management, including through REDD+, is discussed in detail, there is no specific reference to mangroves in its NDC.

The comparison between not only these five selected countries, but also all NDCs show that coastal carbon systems have not been uniformly integrated into this effort, especially within mitigation actions. Herr and Landis (2016) further highlight that 59 countries include coastal ecosystems and the coastal zone in their adaptation strategies. This is indeed an opportunity for those countries to also include relevant activities in blue carbon ecosystems (programmatic or project-level activities in mangroves, saltmarshes and seagrasses conservation or restoration) to raise their national mitigation ambitions.

In general, the three blue carbon systems – mangroves, seagrasses, and saltmarshes – exist in the UNFCCC mitigation context

as part of multiple definitions and categories, and related climate actions are implemented differently per country. Given the lack of a common definition of blue carbon mitigation activities, it is not always easy to clearly decipher their inclusion in various NDC listed measures. Future NDCs would benefit from outlining coastal adaptation and mitigation efforts in the broader policy contexts of, for example, coastal zone management or, in the case of mangroves, including efforts within national REDD+ strategies. The listing of single mangrove projects in NDCs will not, in the long run, provide the programmatic approaches needed to find large-scale mitigation and adaptation solutions (Laurans, Ruat, & Barthélemy, 2016).

6.3 | Nationally appropriate mitigation actions

The UNFCCC foresees so called Nationally Appropriate Mitigation Actions, NAMAs, by developing countries. They are any action that reduces emissions as part of a national governmental initiative. They range from policies directed at transformational change within an economic sector, to actions across sectors with a broader national focus. NAMAs are supported and enabled by technology, financing, and capacity-building and are aimed at achieving a reduction in emissions relative to 'business as usual' emissions in 2020 (UNFCCC, 2016).

The Dominican Republic registered the first blue carbon NAMA under the UNFCCC's Nationally Appropriate Mitigations Action (NAMA) mechanism. The first of its kind, the submission, is effectively a declaration of intent by the government to mitigate GHG emissions in a manner commensurate with capacity and in line with national development goals. The experience and lessons learned in the Dominican Republic can serve as a pilot project and facilitate the development of blue carbon programmes globally.

The blue carbon NAMA concept is based on a capacity-building approach in support of public and private sector institutions to implement a number of key activities. These include quantifying the carbon sink capacity, developing an inventory of carbon credits, facilitating a national dialogue, preserving or replanting mangroves, developing strategies to support economic development, managing finance mechanisms for key communities, and developing a tool kit that can be used by other countries in designing and implementing blue carbon NAMAs (Herr et al., 2015).

Elsewhere, conservationists and climate change experts are assessing pathways for the development of blue carbon NAMAs. Ecuador offers particular opportunities, as a base incentive scheme for coastal communities is already in place (*Socio Manglar*, see above), as the shrimp industry is well organized and potentially ready to engage in sustainable supply chain improvements, and as the nation's REDD+ strategy provides an interface for concerted action.

6.4 | Article 6 of the Paris Agreement

Whether or not international emissions trading and offsetting will account for a substantial part in the future climate finance framework depends on a number of factors. The firm negotiation – during the last days of the Paris conference – of Article 6 of the Paris Agreement (PA) was a reminder that emissions trading did not die with the demise of the CDM. Article 6 provides for a variety of offset or reward mechanisms (Streck, Keenlyside, & von Unger, 2016), namely

- *Cooperative approaches*. Parties may engage in *voluntary cooperation* (Art. 6.1) and *cooperative approaches*, using *internationally transferred mitigation outcomes* or 'ITMOs' in climate parlance (Art. 6.2) to achieve their consolidated NDC targets. Market enthusiasts have been quick to refer to 'ITMOs' as a new carbon commodity (Sharma, 2016).
- *Sustainable development mechanism*. Based on an intervention by Brazil and the E.U., the PA also defines a sustainable development mechanism that allows private and public entities to support mitigation projects that generate transferrable GHG emissions (Art. 6.4). Programmes and projects – the PA avoids using either term – developed under this new mechanism can generate *emission reductions* which may be used by another Party to *fulfil* its NDC. The mechanism is implemented under the *authority and guidance* of the CPA, which according to the Paris Decision is to develop relevant *modalities and procedures*. Paris Decision, para 37 and 38. The provision in the Paris Decision links back to the mechanisms of the Kyoto Protocol, namely the CDM and Joint Implementation (JI), when requesting that the new mechanism be built on their experience (para 38.f). Similar to the CDM, the mechanism addresses subnational public and private entities, and it foresees a *share of proceeds* to cover both administrative costs and adaptation needs for nations most vulnerable to climate change (Article 6.6). This opens a future for the Adaptation Fund, created under the Kyoto Protocol.

However, unlike the CDM, the new mechanism must *deliver an overall mitigation in global emissions* (Art. 6.4.d), that is, it must go beyond offsetting and have a net positive mitigation effect. Also, emission reductions may be accounted for only once in the context of NDCs, either by the host Party or by another Party (Article 6.5).

- *Framework for non-market approaches*. The Paris Agreement recognizes *the importance of integrated, holistic and balanced non-market approaches* (Art. 6.8) to assist Parties with implementing their NDCs, in the context of sustainable development and poverty eradication. It aims at both mitigation and adaptation, *enhance*[s] *public and private sector participation* and seeks opportunities for coordination *across instruments and relevant institutional arrangements*. The conceptual scope and meaning of non-market approaches – as opposed to the kind of instruments, which are seen (if no longer called) market mechanisms and for which there is precedence in the Kyoto mechanisms – is hard to gauge. In a technical paper of 2014, the UNFCCC secretariat summarized non-market approaches as *any actions that drive cost-effective mitigation without relying on market-based approaches or mechanisms* (i.e. without resulting in transferable or tradable units) (UNFCCC Secretariat, 2014). The technical paper listed as examples from country experience fiscal instruments (such as carbon taxes) and regulation, but also voluntary agreements on mitigation action, and results-based payments for REDD+. The concept, in this interpretation, is very wide, indeed, and there will

be much work ahead for SBSTA, which is charged with preparing a draft work programme until next year's session (Paris Decision, paras 40 and 41).

Eventually, all three mechanisms may provide important incentives for blue carbon activities. It may take years, however, for detailed rules to materialize. These technical challenges aside, market (or non-market) demand will be needed to stimulate action. The CDM was able to rely on the market demand from Europe's emissions trading system, before that source largely closed in 2012. The extent to which national emissions trading schemes will be prepared to offtake future emissions reduction and sequestration action remains uncertain at this stage.

The basis for fresh demand from other sources, in the meantime, was recently set out by the International Civil Aviation Organization (ICAO). During its 39th assembly session in 2016, ICAO's member states voted to install a global carbon offsetting scheme for the international aviation sector. The 'Carbon Offset and Reduction Scheme for International Aviation' (CORSIA) will start in 2021 on a voluntary basis, with 65 states having committed to join from the start. It is still unclear what kind of offsets will be allowed and who will decide on it, but blue carbon proponents should prepare to advocate their cause.

6.5 | Other climate-finance tools

One source of financing proves often not enough to develop a carbon offset project or sustain a long-term conservation effort. Examples from around the world, however, show innovative financing ventures to restore, conserve and protect coastal blue carbon ecosystems.

The Government of the Seychelles, for example, set up a Debt Swap for Conservation and Adaptation with the Club of Paris. Developed through the platform of the Global Island Partnership, with technical support from The Nature Conservancy (TNC), the goal is to develop a long-term funding stream for conservation activities, which will help build climate resilience (Amla, 2015).

Capital markets allow multilateral organizations, governments, corporations and projects to access substantial financial sources. In 2014 so-called 'green bonds' under the Climate Bonds Initiative (Climate Bonds, 2016) raised over USD 30 bn, giving institutional investors such as pension funds an opportunity to support low-carbon growth through their investment choices (Herr et al., 2015). 'AFOLU-related investments' expressly include management of wetlands and mangroves and coastal and riverine fisheries, thus financings in this area can be considered blue bonds.

Risk transfer mechanisms such as insurance are one of the range of market-based financial tools to consider for sharing and even reducing climate-related risks. The insurance sector has been a leader in working to accurately price risk (and risk reduction measures) in their products, which can enable public and private incentives to reduce risks. These incentives might include public investments in preventative risk reducing and preparedness measures (including land use planning and nature-based solutions) (Herr et al., 2015).

Fujita et al. (2013) argue that a suite of markets and financial tools ('ecomarkets') could be used to develop different investment portfolios that use coastal ecosystems services while maintaining ecosystem structure and function. Ecomarkets that could help bring high investments to conservation measures include direct payments for ecosystem services, catch shares for fisheries, water quality markets, insurances for flood control and shoreline, ocean energy, and markets to capture aesthetic and recreational services.

There is also a growing opportunity for making a business case to donors, investors and the private sector regarding products associated with the sustainable use and conservation of coastal wetlands and associated ecosystems. Of particular potential relevance are initiatives where companies, and in some cases governments, are making commitments to source products, such as soy, palm oil, beef and leather from 'zero deforestation' landscapes, in some cases as the result of negative publicity and/or threats of consumer boycotts by environmental and other watchdog organizations. It is possible that such approaches could also be applied and adapted in future to seafood and aquaculture/mariculture production to reduce pressures on mangrove and coastal wetland landscapes (Herr et al., 2015).

In Ecuador, for example, work is underway to improve the management of shrimp farms already in place. In a pilot project, Blueyou Consulting is working with its local partner, Omarsa, at the shrimp farming and processing levels in order to improve shrimp farm management, practices and farming inputs, and to reduce environmental and social impacts of marine shrimp farming (FITFund, 2015). The specific goal of the project is to ensure that there is full traceability back to the farms and that each farm complies with the new Aquaculture Stewardship Council (ASC) shrimp standard (IUCN & CI Ecuador, 2016).

Governments could also require companies that have a history of illegal management practices in the aquaculture and agriculture sectors to participate through financial contributions to programmes such as *Socio Manglar* and habitat conservation and restoration, with the threat of legal sanctions acting as an incentive for participation and compliance. The success of such an approach would largely depend upon the quality of legal enforcement, and the activities of national and international watchdog and media organizations.

Marine Spatial Planning (MSP) is on the agenda of many governments and could be used to support specific financing mechanisms for conservation and ecosystem services delivery. Specific wetlands (carbon) banking areas could be established to mirror already-created special zones as marine biodiversity banks (Agardy, 2008). One could readily see how carbon-banking areas might become yet another zone in a marine spatial plan – laying the groundwork for additional carbon financing. The identification of priority areas under spatial plans can lend itself to a blueprint for locating PES, offset, and even certification schemes that generate new fund flows. The common denominator in all these financing schemes is that the special values of the coastal wetland are recognized, and this information is then used to incentivize improved management so as to preserve the future delivery of valuable ecosystem services (Herr et al., 2015).

7 | ROADMAP TO SUPPORT BLUE CARBON ACTION AT THE DOMESTIC LEVEL

Beyond new policy signals, a key opportunity for better management of blue carbon ecosystems lies in increased data collection and

knowledge, especially in understanding the causes of loss. New collaborations with mobile technology providers (using both satellite and seabed cable infrastructure) should be sought to overcome monitoring and data challenges and gaps. Increased monitoring through the implementation of ICZM and MSP efforts, in coordination with year-to-year inventories of mangroves and other coastal ecosystems, would also help identify synergies and gaps with coastal carbon and climate policy making.

The development of new or revised national plans, whether they be climate, or biodiversity focused, could benefit from synergistic conceptualization and writing, and has the opportunity (1) to highlight the role of mangroves and other coastal carbon ecosystems for climate change mitigation (and adaptation), (2) to highlight the economic value of these systems and their contribution to sustainable development, education and health, and (3) to ensure that the management of blue carbon habitats be addressed in a cross-cutting manner, via the various laws and initiatives available in the country.

All action lists and intervention plans should target the key drivers of degradation comprehensively and conceive both ring-fenced command-and-control and incentive mechanisms, depending on a country's focus. At the legal level, blue carbon objectives should be much better defined and clearly stated across key legal regimes, including forest, fisheries, agriculture, nature protection, and laws governing environmental impact assessments. Any form of habitat usage should be administered with due respect to these objectives. The administration in charge should ideally be a single authority. Alternatively, where there are several, each should work on the basis of up-to-date permit inventories accessible to all authorities concerned and, to the extent possible, the public.

Policy processes should be more inclusive of local people and include them at different stages of development. Accepting input from multiple stakeholders at the developmental stage may help to encourage policy reform to create more realistic or effective policies.

Not all countries have pronounced overall restoration targets. Especially in Asia, a continent witnessing a large amount of abandoned shrimp ponds, pronounced restoration targets could help accelerate implementation efforts, and be linked to global initiatives such as the Bonn Challenge (IUCN, 2016). Such efforts would have to go hand-in-hand with legal and policy changes, to ensure proper land ownership titles for example.

Sustainable Use and Custody Agreements and *Socio Manglar* have shown considerable potential for mangrove conservation. Simplification of such processes and renewal arrangements may help to enhance the roll-out and the linkages between REDD+. Other community-driven schemes, such as *Socio Bosque/Manglar*, could be beneficial as well. Long-term technical support for the management of concessions as well as with reporting or other administrative duties could provide needed support to local communities. This could be provided by, for example, NGOs or universities.

A combination of schemes such as *Socio Manglar* and a project-carbon-based approach, extending explicitly to mangrove reforestation, within the framework of an internationally supported NAMA may be an appropriate and effective way forward.

A way to improve implementation may be to integrate local communities into maintenance activities, including surveillance, reforestation and erosion protection inside and outside conservation areas. This community participation could be linked to special concessions for sustainable fishing and timber harvesting rights. Public-private partnerships with the shrimp farm industry (big producers, mid-level producers and small ones) for example could be intensified towards more sustainable value-chain products. The continuous improvement of shrimp farm management operations could help to reduce pressure on remaining mangroves.

Countries pursuing REDD+ can use the related MRV (Measurement, Reporting and Verification) efforts system to fill data gaps, create transparency and allow for comparability with other REDD policies in other countries. REDD+ requires robust data collection and monitoring systems to reliably account for the changes in the amount of forest carbon over time. Blue carbon interventions could also be coupled with interventions in climate-smart agriculture and energy supply (e.g. cook stove programmes).

The recent report *National Blue Carbon Policy Assessment Framework – Towards effective management of coastal carbon ecosystems* (Herr, Himes-Cornell, & Laffoley, 2017) aims to help countries undertake a first-order analysis leading to a more comprehensive and integrated approach to coastal management, with clear answers for if and when climate and carbon related policies and mechanisms make sense for them, and how they can be aligned with existing coastal regulation and policies.

8 | CONCLUSION

This paper has shown that blue carbon represents a key and politically-resonant opportunity for countries to strengthen their efforts in coastal ecosystems management. The case studies from Ecuador, Indonesia, Madagascar, Mozambique and the UAE, as well as a few selected others, show that there is no single solution to how best to incorporate blue carbon into coastal management. The opportunities can take different forms with countries taking different approaches to deliver on blue carbon, depending on their national and local legal, policy and social conditions.

While blue carbon is yet to be fully integrated in all relevant aspects of national to local policy making, some best-practices already exist that have been documented here. Awareness of these best practices can help policy makers and project developers draw early lessons learned while exploring new carbon-driven incentives. For some countries climate policy and financial instruments (e.g. NAMA or the new cooperative approaches and the sustainable development mechanisms under the Paris Agreement) might be the better choice; for other countries the extension of existing incentive-based tools (e.g. GELOSE or *Socio Manglar*) might be the more appropriate route to take. The Roadmap in section 6 tried to outline the multi-faceted options countries have in the blue carbon 'tool box'. Additional guidance, such as the *National Blue Carbon Policy Assessment Framework* (Herr et al., 2017) are meant to help countries identify the policies and approaches most suited to their circumstances.

One common thread however observed broadly throughout government coastal polices and efforts is that the majority of countries still largely treat coastal conservation and restoration efforts

exclusively within the scope of adaptation and resilience, or separately through their biodiversity planning efforts. Looking at the mitigation value of coastal carbon ecosystems can help countries bring together and enhance the synergies between their different sectorial management approaches (climate change mitigation and adaptation, biodiversity conservation, fisheries) and use planning tools such as ICZM for more integrated conservation and sustainable use of these areas. It will be important in the future to integrate action much more by 'bundling' or 'stacking' the benefits of ecosystem services, of which carbon is just one. In so doing, and recognizing the fuller value of these ecosystem services, greater account of their worth should heighten action for their conservation through coastal management planning. It is critical that such a policy move is now achieved to fully realize the opportunity to shift management towards greater longer-term benefits and away from the short-term often single-sector impacts that continue to cause loss of these valuable coastal ecosystems. This shift will take further leadership from governments so coastal management objective are set, and management subsequently delivers, in the national interest.

ACKNOWLEDGEMENTS

The authors would like to thank Juliet Blum for supporting the development of this document.

The funding of the UNEP/GEF Blue Forests Project also made the writing of this paper possible. This paper contributes to the deliverables of the UNEP/GEF Blue Forests Project 'Synthesis of Blue Carbon Policy Approaches'.

CONFLICT OF INTEREST

The authors declare no conflicts of interest. DH, DL and MvU received funding from the UN Environment/GEF Blue Forests Project to support national blue carbon policy assessments and for conducting this synthesis review. AM supported the project in her role as Marine Officer for IUCN.

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How to cite this article: Herr D, von Unger M, Laffoley D, McGivern A. Pathways for implementation of blue carbon initiatives. *Aquatic Conserv: Mar Freshw Ecosyst*. 2017;27(S1): 116–129. https://doi.org/10.1002/aqc.2793