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Including Blue Carbon in climate market mechanisms

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ABSTRACT

Including Blue Carbon in market-based climate policy mechanisms could result in significant funding for coastal ecosystem protection and restoration. The most promising market mechanisms for Blue Carbon are regulated cap-and-trade schemes, even if some are still in development. The largest is UNFCCC, followed by EU ETS, national schemes and sub-national schemes. Although the voluntary carbon market is a current option, it is much less attractive than regulated markets due to its small size and low prices. For Blue Carbon to be included in major regulated schemes, additional work is needed, including scientific research, policy design, economic analysis and policy advocacy. In particular, three activities should be given priority: reorienting scientific research from the natural sequestration to the emissions that occur upon destruction, estimating global and national aggregate figures for these emissions, and promoting Blue Carbon in key policy fora. It should be recognized that the development of major regulated cap-and-trade schemes with Blue Carbon offsets may take several years. Therefore, in the meantime, efforts should also be made to develop national Blue Carbon policies in the countries with the most relevant habitat.

1. Introduction

The concept of payments to conserve "Blue Carbon," or carbon captured by coastal ecosystems such as mangroves, seagrasses and intertidal marshes, has recently been the focus of reports by the International Union for the Conservation of Nature (Laffoley and Grimsditch, 2009), the United Nations Environment Programme (Nellemann et al., 2009), the World Bank (Crooks et al., 2011), and Duke University (Murray et al., 2011), and there is a growing interest in exploring the potential of including Blue Carbon in existing and emerging policy mechanisms for reducing greenhouse-gas emissions.

However, several factors should be carefully considered and several preconditions should be met before Blue Carbon can be included in many of these policy mechanisms. This article will present various policy options for Blue Carbon. It will then go into more detail on one set of options – regulated cap-and-trade schemes – and describe the factors that should be addressed for Blue Carbon to be successfully included in such schemes.

2. Policy options for Blue Carbon

The most promising climate policy mechanisms for Blue Carbon are regulated cap-and-trade schemes. A regulated cap-and-trade scheme aims to control greenhouse gases by providing economic incentives for achieving reductions in emissions. Under such a scheme, a central authority sets a limit, or cap, on the amount of a greenhouse gas that can be emitted, and the cap is allocated or sold to entities in the form of credits which represent the right to emit a specific volume of the gas. The emitting entities are required to hold a number of credits equivalent to their actual emissions, and the total amount of existing credits cannot exceed the cap. Entities may then trade credits among themselves if they need to increase their emissions or have been able to reduce emissions. Therefore entities that buy credits are paying to emit greenhouse gases, while entities that sell credits are rewarded for reducing emissions. In addition, certain uncapped entities are permitted to create and then sell credits if they reduce their emissions. Credits issued by such uncapped entities are known as offsets.

The most direct way a cap-and-trade scheme could help conserve Blue Carbon would be by including Blue Carbon emissions in the cap – that is, regulating the maximum permitted Blue Carbon emissions. While this may be possible in some contexts, particularly in developed countries, the likeliest role of Blue Carbon in most major potential cap-and-trade schemes is as an offset. That

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is, the scheme would not impose a cap on Blue Carbon emissions but instead would provide an economic incentive to reduce those emissions.

In light of this, the best options for Blue Carbon among greenhouse-gas cap-and-trade schemes are those with the potential to provide the most funding for protection and rehabilitation of coastal ecosystems. The largest policy platform to deploy cap-and-trade is the United Nations Framework Convention on Climate Change (UNFCCC). The UNFCCC is an international treaty aiming for the "stabilization of greenhouse-gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system." The treaty's Kyoto Protocol, in effect through 2012, commits industrialized countries to reduce greenhouse-gas emissions. The Protocol includes flexible mechanisms such as credit trading and offsets from developing countries to allow industrialized countries to meet their emission-reduction obligations. Ongoing UNFCCC negotiations seek to extend the Kyoto Protocol after its 2012 expiration and to launch a new framework in 2020 including more large emitters, notably the U.S. and major developing countries such as China. While there is no certainty that these negotiations will be successful and there has not yet been a compliance market developed for forest carbon credits under Kyoto, a comprehensive replacement of the Kyoto Protocol, or a new post-2020 framework, would likely present much greater opportunities for Blue Carbon than other mechanisms as it would potentially harness very large capital flows for a wide range of emission reductions globally.

The largest existing cap-and-trade scheme is the European Union Emissions Trading System (EU ETS). Although the EU ETS currently provides only limited opportunities for offsets from Agriculture, Forestry and Other Land Use (AFOLU), the large size of the EU ETS market, and the fact that its existence does not necessarily depend on the UNFCCC, makes it a potentially attractive mechanism for Blue Carbon. Methodologies and frameworks for inserting Blue Carbon would have to be developed. See Table 1 for data comparing total volume, value and price per tonne on various markets.

The next-largest potential cap-and-trade schemes are likely to be national schemes of very large countries. Such a scheme could provide a significant impetus to Blue Carbon within that country or even in other countries if the scheme allows the importation of foreign offsets. So far this does not exist. In 2009, the U.S. House of Representatives passed a major cap-and-trade bill with offset provisions, but this bill did not become law. Also in 2009, Brazil passed a law establishing a cap on future emissions, though a trading and offset scheme has not yet been defined.

The final category of cap-and-trade scheme is at the sub-national level. While several of these exist or are in development, the most promising for Blue Carbon may be that of California, which has passed into law and is set to take effect in 2013. Work is underway to qualify Blue Carbon as an offset category in California's scheme, though it is unclear whether this would be limited to Californian wetlands or whether those of other states or countries would also be allowed.

Other market-based funding mechanisms beyond regulated cap-and-trade schemes do exist, notably the "voluntary market" for carbon credits. This market caters to individuals, companies or governments who seek to buy carbon credits to voluntarily offset their own greenhouse-gas emissions although many of the participants in the voluntary market are buying credits in anticipation of future compliance markets. The benefit of this market is that it exists today, providing an opportunity for Blue Carbon projects to be funded now rather than waiting for regulated schemes to take effect. The principal disadvantage of the voluntary market is that it generally mobilizes much smaller amounts of funding than regulated markets (see Table 1). Consequently, the voluntary market is likelier to facilitate Blue Carbon demonstration projects than it is to make a significant impact on the rate at which coastal ecosystems are being destroyed globally.

A potential non-market option arises from the possibility that national governments will undertake policies to subsidize conservation of Blue Carbon in ways other than via cap-and-trade schemes. For developing countries, such options are referred to under the UNFCCC as "Nationally Appropriate Mitigation Actions" (NAMAs). These are policies and actions countries may voluntarily undertake as part of a commitment to reduce greenhouse-gas emissions. Examples of NAMAs include increased exploitation of alternative renewable energy sources, or reductions in illegal logging of forests. The 2010 Cancun Agreement established that developing countries would implement NAMAs to slow the growth of greenhouse-gas emissions, but it is unclear how many countries will comply or the extent to which this will provide an opportunity for Blue Carbon.

Table 1
Transaction volume, value and price data, global carbon market, 2010.

Market	Total volume ($MtCO_2e$)	Total value (million US$)	Weighted avg. price per tonne CO_2e (US$)
Voluntary markets			
Voluntary over-the-counter	128	414	6
Other voluntary exchanges	2	10	6
Total voluntary markets	*131*	*424*	6
Regulated markets			
EU emissions trading scheme	5529	106,024	19.18
Clean development mechanism	1099	17,229	15.68
Regional greenhouse gas initiative	45	436	9.69
Kyoto assigned allowance units	19	265	13.95
Total regulated markets	*6692*	*123,954*	*18.52*
Voluntary and regulated markets	*6823*	*124,378*	

Adapted from: Peters-Stanley et al., 2011.

3. Preconditions for inclusion of Blue Carbon in regulated cap-and-trade schemes

In order for Blue Carbon to be included in major regulated cap-and-trade schemes, work is needed on several fronts, including scientific research, policy design, economic analysis and policy advocacy.

3.1. Scientific research

The following scientific questions should be answered:

a What is the rate at which carbon is naturally sequestered in the ecosystem?
b How great is the stock of sequestered carbon in the ecosystem?
c When the ecosystem is destroyed or degraded, how much of the previously-sequestered stock of carbon is released to the atmosphere, at what rate, and over what period of time?
d How can changes in the rates of sequestration and emission be independently and accurately measured and monitored?
e What is the natural variation in the carbon pools of these habitats and how can this be measured and compared to human-driven changes? How do these natural variations affect the permanence of carbon stocks?
f What are the potential losses in coastal habitats brought about by climate change and how will this affect carbon stocks and sequestration?
g What are the agents and drivers of change and how can these be controlled?

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These questions should be addressed, as relevant, at global, national and smaller scales, for a range of ecosystem types, for a range of destruction methods, and within reasonable confidence bands.

3.2. Policy design

Blue Carbon policies must be designed to meet several requirements of acceptable offsets. The first is "additionality". It must be demonstrated that the reduction in carbon emissions (i.e. through the protection or rehabilitation of ecosystems) would not have happened without the funding generated by the sale of the Blue Carbon offsets. Only such reductions are eligible for sale as carbon credits. Possibly the best way to address this is with "national accounting." This establishes a business-as-usual baseline of carbon emissions for an entire country based on historical trends, and only reductions beyond the baseline can be qualified as offsets and be eligible for sale as carbon credits. Emission reductions that are within the business-as-usual baseline are ineligible for sale as carbon credits.

Another precondition is to minimize the risk of "leakage", i.e. the risk that activities or actions that occur elsewhere as a result of implementing the project generate increased carbon-dioxide emissions that counter the carbon offset benefit accruing to the project. For example, a coastal mangrove-protection project cannot qualify to generate carbon credits if the driver of the destruction, e.g. a planned shrimp farm, merely moves 5 km down the shore. If an emission-reduction project causes increased emissions in another setting, it cannot be eligible for offset status. National accounting is viewed as a good – though not perfect – tool for addressing leakage risk, as it is deemed less likely that leakage will occur across national borders than within them.

A third precondition is that of "permanence": the need to minimize the risk that carbon-dioxide emissions occur after the carbon offset has been sold. For example, the shrimp-farm developer sells the offset and then later develops the farm anyway. National accounting can be useful here again, as policy may require that any excess emissions after carbon credits have been sold may be debited from a country's national account.

A fourth important precondition is the ability to effectively measure, report and verify reductions in emissions. The emissions reduction must be verifiable both accurately and independently of the entity issuing the carbon offsets. One tool, perhaps used in conjunction with other methods, may be the use of satellite technology for monitoring changes in ecosystem cover. However, the practicality of using satellite technology needs to be carefully researched for coastal ecosystems, especially for those that are intertidal or permanently submerged.

3.3. Economic analysis

Even with excellent science and policy design, Blue Carbon market schemes will not deliver funding – and will not have any impact on the reduction of ecosystems' destruction – if the economics does not work. Simply put, this means that the *revenue* generated by Blue Carbon schemes must be greater than the *cost* of protecting or restoring the habitats.

Revenue is derived by selling carbon offset credits in the carbon markets, and is equal to (a) the *price* of each offset (representing a tonne of decreased emissions) multiplied by (b) the number, or *volume*, of offsets sold. The *price* of a carbon credit is determined by the markets. In 2010, a credit was worth, on average, US$19.18 per tonne of CO_2 on the EU ETS, the largest regulated market, but only US$6 per tonne on the voluntary markets (see Table 1), another incentive for targeting regulated cap-and-trade schemes. However, it must also be taken into account that the regulatory market does not yet include offsets for forests and that demand is driven by regulations. Methodologies and frameworks would have to be developed to include Blue Carbon in the regulatory market. The *volume* of offsets sold is a function of both carbon sequestration and emission. For protection of existing ecosystems, the volume of the offsets is the sum of (a) the avoided loss of natural carbon sequestration and (b) the avoided carbon emissions that would be caused by the destruction of the ecosystem. For restoration of previously-destroyed ecosystems, the volume of the offsets is the sum of (a) the carbon sequestration restored and (b) the carbon emissions halted by the ecosystem's restoration.

Costs attributed to carbon offsets consist of direct costs, transaction costs and opportunity costs.

Direct costs are the cash costs incurred by the offset provider in order to protect or restore the ecosystem – for example, those associated with setting up and running a Marine Protected Area, or (for seagrasses) those of reducing water pollution from upland sources.

Transaction costs are costs associated with monitoring, reporting and verifying carbon credits as well as costs associated with selling credits on the market.

Opportunity cost is the economic value that is foregone by protecting or restoring the ecosystem. This could include, for example, the loss of real-estate or agricultural development that would occur if the land were not protected. Once such values are estimated, they should be reduced by the estimated value of the ecosystem services that are maintained by protecting the ecosystem. These might include the ecosystem's function of providing food from fisheries or of protecting the shore from storm surges. So the net opportunity cost is (a) the economic value that is foregone by protecting or restoring the ecosystem, minus (b) the economic value of the ecosystem services that would be lost if the ecosystem were destroyed.

It is possible that, under a Blue Carbon scheme, some private landowners and governments will view the economics of Blue Carbon to be attractive, and will therefore undertake conservation and restoration measures, if the potential revenue exceeds only direct and transaction costs; however, it is more likely that they will not do so and will require that the potential revenue exceed direct, transaction and opportunity costs.

The economics of Blue Carbon, including all these factors, must be better understood if Blue Carbon is to be a viable option in any policy-based context. Some initial economic analysis has been done (Murray et al., 2011); further analysis may be needed as more scientific data on the sequestration and emission fluxes become available.

3.4. Policy advocacy

Policy advocacy should be done by international non-governmental organizations, inter-governmental agencies and United Nations bodies. This should include recruiting key governments as sponsors of the idea, advocating that Blue Carbon qualify for offset status in existing and emerging cap-and-trade schemes and other policy mechanisms, and ensuring that Blue Carbon sequestration and emission fluxes are included in the global carbon accounting of the Intergovernmental Panel on Climate Change and in relevant national greenhouse-gas accounts.

4. Blue Carbon and REDD+

Reducing Emissions from Deforestation and Forest Degradation, or REDD+, is a policy initiative whose purpose is to create economic incentives to reduce forest destruction and degradation and

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associated carbon emissions. REDD+ has been heavily studied and discussed for several years and, based on recent negotiations, seems likely to be included in a UNFCCC post-Kyoto scheme if one is agreed upon. As proposed, REDD+ carbon credits would allow funding from industrialized countries to compensate reductions in deforestation, conservation of standing forests and rehabilitation of degraded forests in developing countries.

REDD+ is in many ways a progenitor of Blue Carbon. For example, the concepts of additionality, leakage and permanence and the national-accounting approach have been deeply studied and developed for REDD+. Also, the inclusion of REDD+ in a climate policy mechanism will aid the economics of Blue Carbon. Because most mangroves are considered forests and therefore would be eligible for REDD+ treatment, the protection or restoration of mangroves should generate REDD+ offsets, though the soil-carbon component of mangrove offsets would have to be further developed. That said, it seems less likely that REDD+ would ever cover intertidal marshes and seagrasses because REDD+ is focused on forests. Therefore it appears that Blue Carbon advocacy should not focus solely on amending REDD+, but should instead consider inclusion in and creation of other offset mechanisms.

5. Priorities

All of the activities cited in this paper are necessary preconditions for Blue Carbon to be included in a major regulated cap-and-trade scheme. That said, three activities should receive high priority:

1. *Reorient research to emissions*. Because the emission fluxes are generally much greater than the sequestration fluxes, the viability of Blue Carbon depends on the emissions (Murray et al., 2011). Yet most of the scientific data currently available relates to sequestration. Therefore, to the extent possible, research efforts should be reoriented from sequestration to emissions.
2. *Estimate global and national aggregates*. Policymakers will consider Blue Carbon important enough to take action if they see that aggregate emission and sequestration fluxes are meaningful in relation to their total greenhouse-gas budgets. Therefore estimates should be made of these aggregate figures, at global level and also for key nations.
3. *Promote Blue Carbon in key policy fora*, including IPCC, UNFCCC and the governments of nations that would benefit the most from Blue Carbon payments.

It should be understood that it may take several years for Blue Carbon to be included in a global, regional or major national regulated cap-and-trade scheme, both because it will take time for the science of Blue Carbon to be developed and because it may take years for a major new regulated cap-and-trade scheme to be adopted. However, given the size of the prize – the very large potential funding flows for ecosystem protection and restoration – positioning Blue Carbon for inclusion in major regulated cap-and-trade schemes should be the main objective. In the meantime, though, efforts should also be made to develop national Blue Carbon policies and focused taskforces in the countries with the most relevant habitat, as such countries may be able to establish policies before a major international cap-and-trade scheme is in place.

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