

Blue Carbon



Coasts and Climate Change

Blue Carbon Habitats:

Mangrove forests
Tropical regions

Seagrass meadows
Global distribution except
Antarctic

Salt marsh
Tropical and sub-tropical
regions

Global Biodiversity Agenda

What is Blue Carbon?

Healthy, natural coastal ecosystems provide an abundance of habitat for biodiversity and a wide range of goods and services for people. Coastal communities directly rely on them for food security and protection from storm surges and shoreline erosion. They also provide people with livelihoods through fisheries and tourism activities. The role of these ecosystems in climate change mitigation has previously been overlooked but is now receiving much interest. Carbon dioxide (CO₂) that is removed from the atmosphere and stored sequestered or released from vegetated coastal ecosystems is commonly referred to as 'blue carbon' (Herr *et al.*, 2012).

Just like tropical forests, coastal ecosystems remove CO₂ from the atmosphere through photosynthesis. Some of this carbon is stored within the above and below-ground biomass of the plant or trees system. The vast majority of the carbon captured by coastal ecosystems slowly accretes within the soil as organic carbon.

These stores build up over thousands of years, making these habitats extremely rich carbon sinks. Blue carbon habitats store up to five times as much carbon as a similar area in tropical forests (Murray *et al.* 2011). Although other coastal habitats such as kelp forests and coral reefs are enormously important for their biodiversity value, coastal habitats with the most significant carbon storage and sequestration potential are tidal salt marshes, mangrove forests and seagrass meadows. (See box on page 2 for more detail on the three different habitats.)

Decomposition of organic carbon requires oxygen and releases trapped organic carbon back into the atmosphere. However, the soil underneath blue carbon habitats is largely devoid of oxygen meaning that very little of the stored organic carbon is decomposed. This is why vegetated coastal sediments are often extremely rich in organic carbon and provide the most effective blue carbon sinks.



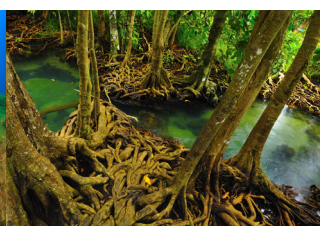
Salt marsh

Image © Danny E Hooks 2013



Seagrass meadow

Image © Rich Carey 2013



Mangrove forest

Image © Karin Wassmer 2013

Source vs Sink

Blue carbon habitats occupy less than half a percent of the ocean floor but account for between 50% and 70% of all carbon storage in ocean sediments (UNEP 2009). Unfortunately, the rate of loss of coastal ecosystems is much higher than any other ecosystem on the planet. One estimate suggests approximately 8,000km²/year of these habitats are being lost and 100% of mangroves could be removed over the next 100 years if the threats are not managed (Pendleton *et al.*, 2012).

Blue carbon habitats continue to suffer from human-induced stressors including coastal development, conversion of mangroves to shrimp farms and the loss of salt marshes and seagrass beds from pollution and eutrophication. When the soil is exposed following the removal or degradation of the overlying vegetation, carbon stored within the soil over thousands of years is at risk of being released back into the atmosphere. These natural carbon sinks can then become a huge source of green house gas emissions. The total amount of blue carbon that is being released from destruction and degradation

of coastal ecosystems could be between 0.15 and 1.02 billion tons of CO₂ annually. This is equivalent to the emissions from entire countries, the upper estimate being equal to Japan, ranked as 5th globally by carbon emissions (Pendleton *et al.*, 2012). The loss of these carbon sinks poses an imminent threat to their crucial role in regulating our climate. Marine vegetated habitats (blue carbon sinks) are some of the most threatened habitats in the Biosphere (UNEP 2009). Coastal vegetation is being lost four times faster than rainforests (UNEP, 2009). Fortunately, blue carbon habitats provide us with an opportunity as well; offsetting 3-7% of current global fossil fuel emissions in the next two decades if further loss is prevented and habitat recovery is supported. This would be a 10% contribution to the reductions needed to keep CO₂ concentrations in the atmosphere below 450 parts per million; widely regarded as the maximum concentration for avoiding dangerous global temperature rise (UNEP, 2009).

Blue Carbon Habitats and Their Importance

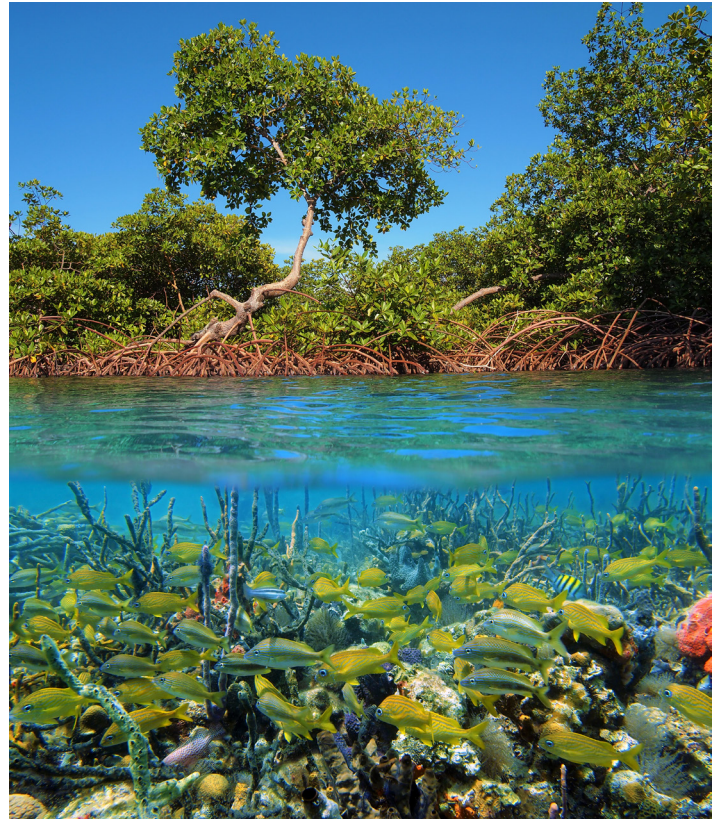
Mangroves: a variety of woody trees and shrub adapted to a saline environment, which grow at the sea/land interface in tropical and sub-tropical environments.

Seagrasses: the only true marine flowering plant. Grass like plant which grows in soft sediments in shallow coastal waters globally (except Antarctica). They have complex root structures, which distinguishes them from algae, and can grow in depths of up to 40m depending on the light availability (Kaiser *et al.*, 2005).

Saltmarshes: coastal wetland habitat periodically flooded by the tides. Dominated by dense, salt-tolerant plants including grasses, herbs and low shrubs. Found in the upper intertidal zones of temperate environments, they replace mangroves in these higher latitudes (Marine Biodiversity and Ecosystem Functioning EU Network of Excellence (marbef), 2009)

These habitats support food webs and provide a 'nursery' habitat for juvenile fish and invertebrates including commercially important species such as prawns and snapper (Mumby, 2003).

All three ecosystems provide protection from storms by buffering them from high energy waves including storm surges and Tsunamis (Danielsen *et al.*, 2005). These coastal ecosystems also play an important role in absorbing and binding pollutants, helping to mitigate eutrophication (high nutrient pollution) (Kaiser *et al.*, 2005).



Mangrove forest seen from above and below the water's surface
Image: © Vilainecrevette 2013

Blue Carbon and Policy

It is clear that protecting and restoring these ecosystems present significant opportunities for climate change mitigation although these have not yet been factored into carbon credit accounting or the financial architecture for carbon markets. Sustaining blue carbon sinks will be crucial for ecosystem-based adaptation strategies

that reduce vulnerability of human coastal communities to climate change. Assessing the financial cost of green house gas emissions from habitat degradation can provide a strong economic incentive for their preservation and help avoid their conversion from green house gas sinks to sources. Of the existing carbon markets, regulated

cap-and-trade schemes such as the United Nations Framework Convention on Climate Change or the European Union Emissions Trading System are promising avenues for investment in blue carbon. However, the only carbon trading that is currently ready for blue carbon credits is the Voluntary Carbon Market (VCM) (Benessaiah, 2012).

Blue Carbon Tools

UNEP-WCMC is supporting blue carbon science in a variety of ways, one of which is through the development of a range of online validation and assessment tools. These tools will help decision makers assess their blue carbon stocks and weigh up the costs and benefits of different management scenarios. For example, understanding the carbon storage and sequestration rate of a particular area of interest can allow for regional planning to ensure they minimise losses of stored carbon stocks.

The blue carbon habitat maps and associated carbon stock and sequestration rates can be continually updated through an administrative site. Here, registered data managers and field scientists can work together to improve the accuracy of the information through a tablet-based field application and desktop-based toolkit. The underlying data layers used in these assessment tools are available through the Ocean Data Viewer and are in the process of being updated. These innovative new tools are helping to support governments and businesses in sustainably managing coastal ecosystems and supporting global carbon market trading schemes. Governments are interested in ensuring they support the

ecosystem goods and services blue carbon habitats provide to their citizens and minimising losses of carbon back into the atmosphere. Businesses will be able to use this information to evaluate the impact of their development and assess mitigation strategies to offset blue carbon habitat loss or provide additional carbon sequestration capacity.



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