BLUE CARBON: CARBON CAPTURE BY PACIFIC MARINE ECOSYSTEMS

CLIMATE AND OCEAN

KEY POINTS

- The ocean has both buffered and suffered the effects of climate change.
  a. Blue carbon is the carbon captured and stored by the ocean and coastal ecosystems.
  b. The Pacific Ocean contains significant carbon sinks, and these sinks may be increased by restoring degraded ecosystems which also provide other vital services.
- Pacific resilience to climate change depends on healthy marine and coastal ecosystems. Coastal habitats are under threat from land-use change, unsustainable management practices, invasive species, and climate change.
- Pacific island countries face challenges in assessing the magnitude of blue carbon sinks and ways to protect and increase these sinks, including a lack of baseline data. They also need support to integrate sink management with other demands on marine zones.

HOW ISSUE LINKS TO/IMPACTS SDGs BEYOND **SDG14** LIFE BELOW WATER

- SDG1, 2, 3, 6: Poverty reduction, food security and health in the Pacific depend on local agriculture and shoreline fisheries, threatened by climate changes including sea level rise, storm severity, temperature, and ocean acidification. Clean freshwater and sanitation systems are threatened by inundation and salinization.
- SDG5, 10: The impacts of climate change are uneven across gender and location, with impacts more strongly felt by developing nations.
- SDG9, 11: Resilient infrastructure and sustainable cities and communities rely on an understanding of, adaptation to, and mitigation of climate change.
- SDG7, 12, 13, 14, 15: Responsible consumption and production, including clean energy and avoidance of degradation of biodiversity, rely on and are part of climate action.

BACKGROUND

1. **Pacific island countries and territories are highly vulnerable to climate change**, putting at risk the development gains the region has made in recent years. There is a need for action on climate change so that it is better understood, planned for, funded, and coordinated at local, national, regional and international levels.
2. **Ocean ecosystems are part of the global carbon cycle. Humans emit ~11 Petagrams (gigatons) of carbon** per year (~34 gigatons of CO_2). Half of this CO_2 remains in the atmosphere, ~25% is taken up by biomass on land, and the other ~25% is taken up by the global ocean. "Carbon sinks" are locations or environments that capture (incorporate into biomass) and store carbon. If destroyed, these sinks can become "carbon sources", releasing the stored carbon into the atmosphere. The carbon cycle is a balance of sinks and sources, but humans have added a new source of rapid carbon inputs by burning fossil fuels. The ocean takes up CO_2 for us, and the value of this hidden 'ocean service' is estimated at USD 60 to 400 billion per year, but the increased uptake comes at a cost (particularly to our reefs and certain fisheries).
3. **Long-term storage depends on carbon transfer into sediments or very long-lived species**. Carbon sinks are long-term storage and are distinct from more short-term carbon cycling, where carbon is taken up by organisms and by dissolving into the water, causing ocean acidification. Key blue carbon ecosystems include seagrass meadows, mangroves, tidal marshes, macroalgae,[1] and the deep sea. Unsustainable human developments and activities threaten these important carbon sinks.
4. **The behaviour of marine animals also affects carbon transport**. Life in the high seas (areas beyond national jurisdiction) takes up 500 million tonnes of carbon per year, but not all of this is stored long-term.[2] For example, mesopelagic fish feed in the upper layers of the ocean at night and move down during the day, moving the carbon in their prey into the deeper waters.[3] Deep fishing will reduce this carbon transport to the deep sea.

SPREP PROE

UN environment

PROTECT PACIFIC WHALES – OCEAN VOYAGERS

5. **Long-lived whales are carbon sinks and also move carbon** between polar and temperate waters and vertically over depth.[4] Upon death, whales sink, moving carbon to the deep sea and hosting many of the same organisms that live at deep-sea vents. Pershing et al. (2010) estimated that the combined global populations of eight species of whales sequestered 29,000 tonnes of carbon per year through the deadfall carbon pathway. Pre-whaling populations of these same eight species would have contributed closer to 200,000 tonnes of carbon per year.[5] As migratory species, Pacific whale populations need integrated management for recovery.

6. **Wetlands are particularly important for carbon storage**. Mangroves, tidal marshes and seagrass meadows are the key coastal Blue Carbon ecosystems, and also provide other ecosystem services related to, *inter alia*, food security, tourism, and storm damage mitigation. Seagrasses cover less than 0.2% of the ocean floor but store ~10% of the carbon annually buried in ocean sediments. The world's seagrass meadows capture 24.9 million tonnes of carbon each year. An average hectare of seagrass stores 126.7 tonnes of carbon in its soil.[6] Mangroves presently cover ~0.7% of the global land surface. Carbon emissions from mangrove deforestation form up to 10% of global deforestation emissions, while healthy mangroves export ~10% of particulate terrestrial carbon to the ocean.[7] The Pacific islands have 3% of the global mangrove area.[8]

7. **However, wetlands are being lost at a rate of 1 to 2% per year** and have lost more than half of their historical coverage. The global extent of wetlands declined between 64% and 71% in the 20th century, and wetland losses and degradation continue worldwide.[9] Coastal habitat loss is between 0.5% and 3% of their global area per year, releasing 0.15–1.02 billion tonnes of CO_2 annually (equivalent to burning 424 billion litres of petrol).[10] Valuable habitats include both vegetated and non-vegetated zones; e.g. the high biodiversity and biomass in tidal sand flats is key for ecological function.[11] Preservation of coastal habitats is globally valuable as a climate change mitigation measure.

8. **There is no regional wetland inventory for the Pacific**. Much of the global wetland mapping data come from other regions. Most countries in the Pacific lack up-to-date national wetland inventories and baselines.

9. **Pacific capacity must be supported for regional knowledge collection and analysis**. Pacific technical knowledge and decision-making capacity would significantly benefit from regional and national attention to improved data on baselines of wetland types, their extent, and services they provide, such as carbon storage.

10. **Pacific blue carbon management will benefit from a focus on biodiversity conservation and reduced global emissions**. Blue carbon can provide a source of carbon credits but is associated with broader benefits also. The benefits to ecosystem health, food security, sustainable development, and reduced emissions from resilient coastal and marine ecosystems will likely outweigh any national gains from carbon credits for PSIDS. Mechanisms such as REDD+ have stringent obligations which require substantial investments in governance frameworks and the management of liability. Key marine and coastal carbon sequestration systems are also sensitive to changes beyond the local capacity to control, complicating asset auditing and management. Perhaps most importantly, carbon trading can distract global focus from the necessary goal of reduced global carbon emissions.

11. **The establishment of a regional blue carbon default baseline value will benefit countries** by allowing them to account for the carbon sequestered by these habitats in their national GHG inventories and annual carbon emissions reporting. Carbon-sequestering ecosystems and species in the region are under serious threat. They should be protected, enhanced where possible, and maintained as an excellent climate change buffer and adaptation measure at the national level. Because many countries have lost significant areas of critical blue carbon habitat in recent decades, the baseline date and levels—which would then become our management targets—would need to ideally be set at a point prior to recent losses.

1 Krause-Jensen & Duarte 2016. Substantial role of macroalgae in marine carbon sequestration. Nature Geosci 9:737–742
2 Global Ocean Commission. 2016. The High Seas and Us
3 Irigoien et al. Large mesopelagic fishes biomass and trophic efficiency in the open ocean. Nature Communications 5:3271
4 Monbiot G. 2014. Why Whale Poo Matters. The Guardian
5 Martin A. 2016. Fish poo and the climate challenge. The Marine Biologist April 2016: 20–23
6 Fourqurean et al. 2012. Seagrass ecosystems as a globally significant carbon stock. Nature Geosci 5:505–509
7 Alongi et al. 2014. Carbon cycling and storage in mangrove forests. Annu Rev 6:195–219
8 Gilman et al. 2006. Pacific island mangroves in a changing climate and rising sea. UNEP Regional Seas Rep Stud No. 179
9 Gardner et al. 2015. State of the World's Wetlands and their Services to People: A compilation of recent analyses. Ramsar Briefing no. 7
10 Spalding et al. 2016. Atlas of Ocean Wealth. The Nature Conservancy
11 Sheaves et al. 2016. Biotic hotspots in mangrove-dominated estuaries: macro-invertebrate aggregation in unvegetated lower intertidal flats. Mar Ecol Prog Ser 556:31–43

USEFUL LINKS

- thebluecarboninitiative.org
- bluecarbonportal.org
- bluecarbonpartnership.org
- Blue Carbon – The Role of Healthy Oceans in Binding Carbon: GRID-Arendal Collection