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Mangroves, Carbon and Climate Mitigation

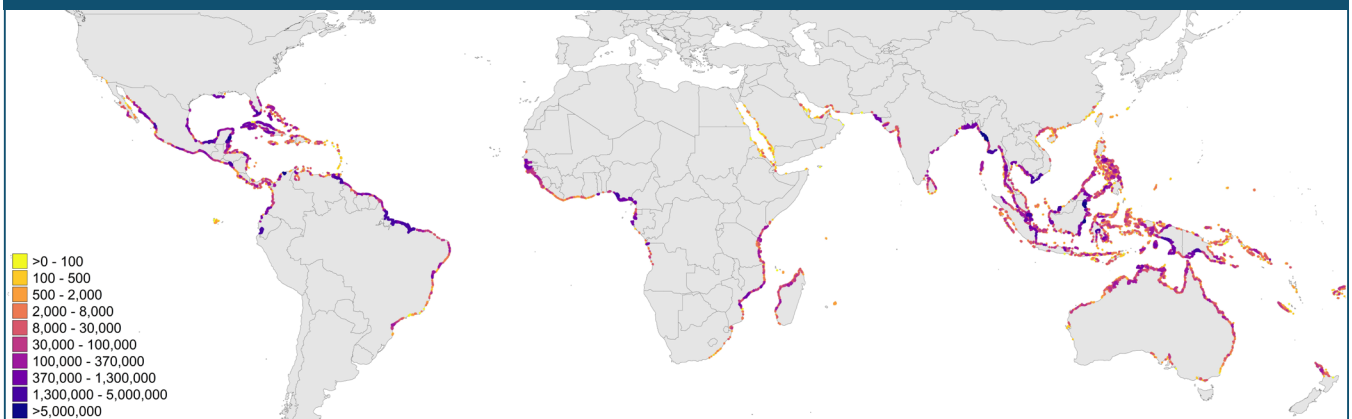
Mangrove forests are one of Earth's most effective ecosystems for carbon sequestration and storage. They can store three to four times more carbon on an area basis than most terrestrial forests and, if undisturbed, mangrove soil carbon remains stable for centuries to millennia.

Conversely, mangrove loss can lead to carbon being emitted back to the atmosphere, with mangroves contributing up to 10%¹ of global emissions from deforestation. The Mangrove Restoration Potential Map (MRP Map) explores the estimated carbon mitigation

benefit of mangrove restoration, both in soil storage and above ground biomass. The latter is the living plant material – trunks, branches and leaves – that makes up a constant carbon store while continuing to add dead matter to the soils below.

The MRP Map shows that restoration of lost mangroves worldwide could lead to the storage of an extra 69 million tonnes (0.069 gigatonnes) of carbon in aboveground biomass and would also help to avoid further emissions of some 0.296 gigatonnes of soil carbon. Such numbers convert to the equivalent of annual emissions from 25 million US homes in sequestration and 117 million homes in avoided emissions².

Soil Carbon: gains from mangrove restoration will be a combination of novel carbon sequestration and avoided losses. The map shows potential soil carbon stores (in tonnes) in the upper metre of soils in potential restoration areas.



¹ Donato, C.D. et al. 2011. Mangroves among the most carbon-rich forests in the tropics. <http://dx.doi.org/10.1038/ngeo1123>

² US EPA Carbon Calculator

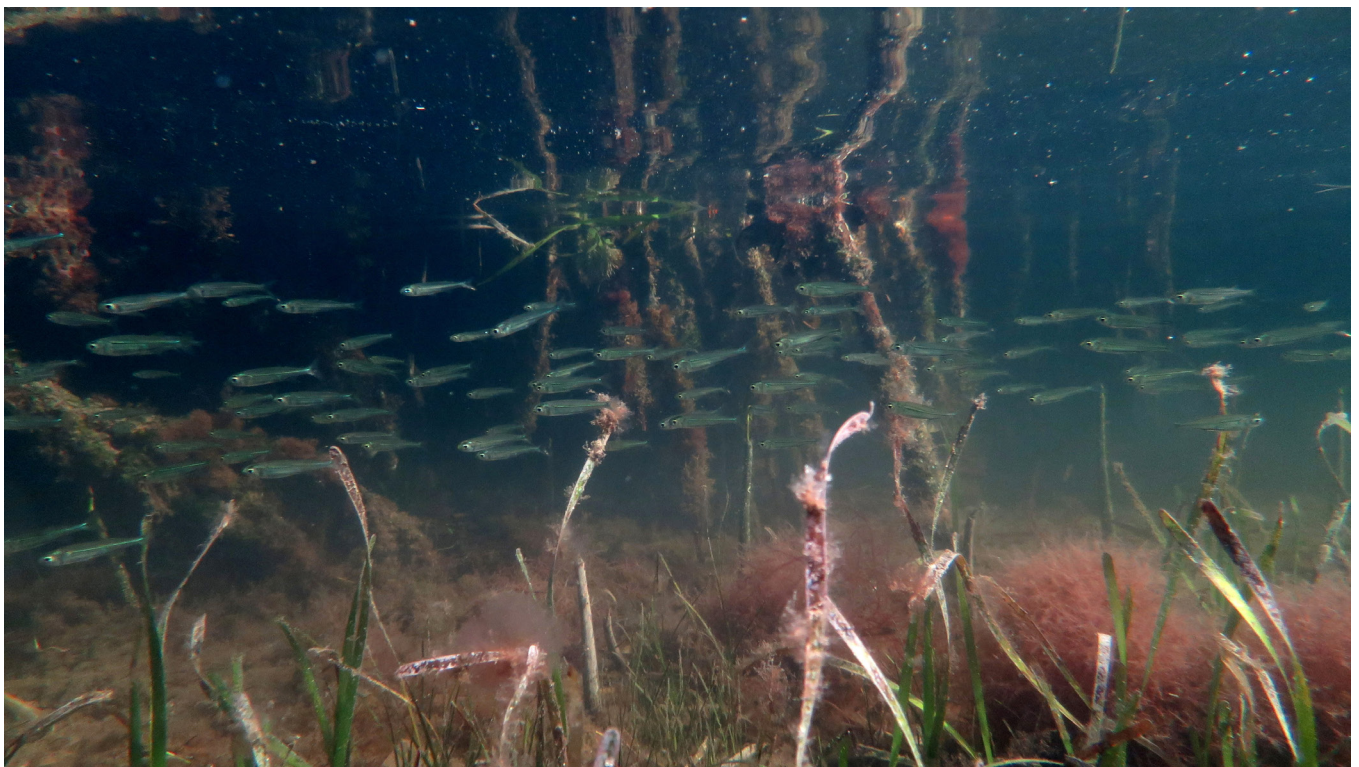
Mangroves, Coastal Protection and Climate Adaptation

For thousands of kilometres of the world's coastlines, mangroves form the frontline between the ocean and the land. Mangroves present a critical barrier, rapidly diminishing the energy of incoming waves and slowing the flows of storm surges. Current mangrove cover is estimated to protect 12.5 million people from flooding every year, notably in densely populated areas of Vietnam, India, Bangladesh, China, and the Philippines. Mangroves have also been estimated to reduce the costs of flood damages worldwide by US\$82 billion each year³. The level of protection provided by restoration is highly dependent on the precise location and dimensions of restored areas and therefore not possible to map at global scales. However, the MRP Map enables users to see locations where well-targeted restoration efforts might have the greatest positive impact.

Mangroves, Essential for Fish and Fisheries

Mangrove forests are fish factories. Their complex networks of channels, fringed with interlocking roots, provide a critical shelter, while their extraordinary productivity ensures rich food supplies. Numerous fish species breed in the mangroves or use them as nursery grounds, venturing into adjacent ecosystems as they mature. Others, including many crabs and molluscs, never leave.

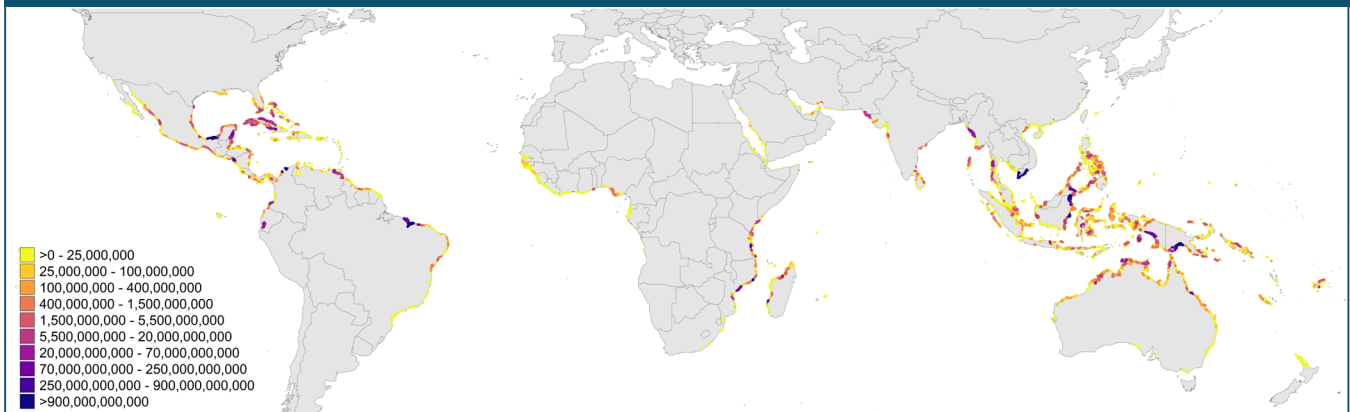
Thus, mangroves are a tremendous resource for fishers. The complex channels provide a sheltered fishing ground, yielding fish for the fishers themselves, and for markets where species such as oyster, clam, shrimp and crab claim a premium price. Even beyond the mangroves, the constant supply of fish and invertebrates from the mangroves to offshore ecosystems, including large-scale commercial fisheries such as shrimp trawling, has an immense value.



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³ Losada, I.J., et al. 2018. The global value of mangroves for risk reduction. Technical Report. The Nature Conservancy, Berlin. www.nature.org/GlobalMangrovesRiskReductionSummaryReport

Benefits of restoration in terms of increasing finfish numbers to mangrove units



The MRP Map provides details of the enhancement that mangroves provide to 39 important commercial fish and invertebrate species. It calculates the additional numbers of animals that will be added to a system annually because of the presence of mangroves. These numbers are mostly still juveniles, and natural mortality will reduce their numbers prior to their reaching commercially harvestable sizes, but in other ways the model is highly conservative,

plotting only a subset of the likely hundreds of species enhanced by mangroves. The enhancement of these fish and invertebrates by the current mangrove cover is some 422 trillion individual finfish per year and some 594 trillion individual invertebrates per year.

The MRP Map shows that restoration could add a further 23 trillion finfish and 40 trillion invertebrates each year to the waters in and around mangroves.

Ecosystem service benefits associated with mangrove protection and restoration					
Region	Sum of soil carbon restorable (Tonnes C)	Sum of restorable AGB (Tonnes C)	Total population protected	Annual finfish enhancement through restoration (millions)	Annual invertebrate enhancement through restoration (millions)
Australia & New Zealand	10,504,989	2,255,775	17,453	221,137	162,960
East & Southern Africa	9,820,102	2,606,629	651,890	2,170,344	1,363,861
East Asia	157,916	35,421	423,114	37	26
North & Central America & Caribbean	77,854,092	15,294,162	870,489	3,928,401	10,690,549
Pacific Islands	6,977,819	1,884,140	19,499	3,318,343	2,597,629
South America	35,484,949	8,812,221	408,748	3,937,903	11,409,449
South Asia	7,197,369	2,411,592	5,018,319	37,111	91,189
Southeast Asia	133,201,195	31,719,960	4,084,800	9,578,026	13,394,677
Middle East	341,216	60,759	63,267	1,668	0
West & Central Africa	14,490,035	3,480,750	991,455	4,640	N/A-
Grand total	296,029,680	68,561,410	12,549,034	23,197,609	39,710,340

Achieving Commitments Under the Paris Agreement

Given the high carbon content of mangroves, their role in coastal protection and even their potential to maintain and ensure food security and livelihoods, mangrove restoration represents an optimal opportunity for climate mitigation and adaptation. One key directive to support such change is the Paris Agreement of the United Nations Framework Convention on Climate Change (UNFCCC). This Agreement (Article 4.2) requires all Parties to set out their post-2020 mitigation and adaptation actions and targets in the form of a Nationally Determined Contribution (NDC). The NDC is essentially a national action plan that reflects the country's climate action ambition.

Current aggregated NDCs are not enough to reach the emissions reductions goals of the Paris Agreement and this global emissions gap creates a need for, and indeed an opportunity to, scale up nature-based solutions as part of many countries' current NDCs. The restoration and/or protection of natural ecosystems such as mangroves can make a significant contribution to this.

Under the Paris Agreement, in 2020, and every five years thereafter, nations will be

requested to re-submit their NDCs – each time with revised and more ambitious actions and targets. This provides considerable potential to work with mangrove restoration. So far, 29 nations have identified mangrove restoration as a part of their commitments for climate mitigation under their NDCs. It is clear from the MRP Map, however, that restoration could be significantly increased, both within these 29 countries, and by many others.

Restoration under the Sustainable Development Goals (SDGs)

Mangroves also provide a significant opportunity to help achieve multiple SDG targets. SDG 13 requires countries to take urgent action to combat climate change and its impacts, including the target of “strengthening resilience and adaptive capacity to climate related hazards and natural disasters in all countries”. SDG 1 calls for “no poverty”, while SDG 2 calls for “zero hunger”. An ecosystem that provides an efficient and self-sustaining sea defence, while at the same time adding trillions of fish each year to coastal waters, is clearly a critical component of achieving these goals for all mangrove countries.

Moving to Action

This work, and the associated MRP Map App, allows countries to see the potential mitigation and adaptation gains from mangrove restoration, including:

- Detailed appraisals of the carbon mitigation and adaptation potential by mangrove units for every country;
- Detailed appraisals of the fish gains by mangrove units for every country; and
- Estimates of the broad location and extent of restorable areas.



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Countries can use these to:

- Integrate, or strengthen the integration of, mangroves in NDCs, for ecosystem-based mitigation and adaptation;
- Integrate, or strengthen the integration of, the climate mitigation and adaptation benefits of mangrove restoration efforts into implementation activities to achieve other national commitments and pledges, including SDGs, CBD Aichi Targets (e.g. on designation of new MPAs) or the Ramsar Convention on Wetlands;
- Account for mangrove restoration in terms of positive impacts on fish and fisheries in decision-making processes (i.e. integrated coastal zone management); and
- Develop local-scale plans for actual restoration projects by refining the global maps with local knowledge.

References and further reading:

Seddon N., et al. 2018. *Nature-based Solutions and the Nationally Determined Contributions: a synthesis and recommendations for scaling up ambition for nature*. A report prepared by IUCN and Oxford University to support the Talanoa Dialogue and the Global Stocktake of the Paris Agreement. October 2018.

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<https://www.iucn.org/news/forests/201701/mangrove-restoration-offering-two-one-solutions-climate-change>

Explore the Mangrove Restoration Potential Map at
maps.oceanwealth.org/mangrove-restoration

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THE MANGROVE RESTORATION POTENTIAL MAP

The Mangrove Restoration Potential Map is a unique interactive tool developed to explore potential mangrove restoration areas worldwide and model the potential benefits associated with such restoration. The mapping tool was developed by The Nature Conservancy and IUCN, in collaboration with the University of Cambridge, and can be found on maps.oceanwealth.org/mangrove-restoration



How Mangrove Restoration Can Generate Local and Global Benefits

The Mangrove Restoration Potential Map can help countries to:

- Identify areas with potential for sequestering high amounts of carbon, and for avoiding further carbon losses from the soil of former mangrove areas;
- Predict the potential gains to fisheries from mangrove restoration in different locations;
- Highlight places where the flooding of coastal populations may be reduced through restoration;
- Support pledges on climate mitigation and adaptation actions as part of the Paris Agreement and NDCs;
- Support pledges on the United Nations' Sustainable Development Goal (SDG) 13 (Climate Action); and
- Refine, as appropriate, the inclusion of mangrove restoration activities as part of national and sub-national REDD+ efforts.