MONGABAY

Mapping future hotspots of carbon dioxide emissions from mangrove loss

28 April 2021

Six mangrove-rich regions, including the Bay of Bengal in south Asia, are identified as future hotspots of carbon dioxide emissions from mangrove loss due to various factors, according to a new study.

Emissions from the loss of these 'carbon superstores' could reach 2391 Teragram carbon dioxide (CO2) equivalent by the end of the century, or 3392 Tg CO2 eq when considering foregone soil carbon sequestration — a missed opportunity to capture (sequester) more carbon in losing the mangroves, according to the study.

The team led by Australia's Griffith University compiled global data sets to project baseline global carbon emissions from different drivers of mangrove loss. They focused on the five key drivers of carbon emissions from mangrove loss: clearing of the coast; urbanisation; aquaculture and agriculture; erosion; and extreme climatic events.

The highest emissions were predicted in southeast and south Asia (West Coral Triangle, Sunda Shelf, and the Bay of Bengal) due to conversion to aquaculture or agriculture, followed by the Caribbean (Tropical Northwest Atlantic) due to clearing and erosion, and the Andaman coast (West Myanmar) and north Brazil due to erosion.

Together, these six regions accounted for 90 percent of the total potential CO2 equivalent future emissions in a 'business as usual' scenario.

These regions have been previously highlighted as a global hotspot of mangrove CO2 emissions and have large areas of mangroves (>500,000 hectares), relatively high rates of loss (≥0.1 percent annually) and most have high carbon densities (≥500 Megagram carbon per hectare).

Study authors Chris Brown and Fernanda Adame from Griffith's Australian Rivers Institute and the Global Wetlands Project (GLOW) said the environmental and economic benefits of mangrove forests around the world should no longer go unnoticed. "Healthy mangrove forests capture carbon. So if you lose the mangroves you will not only have carbon emissions, but you are also missing out on a chance to capture more carbon. It is like having your apple tree die just before it fruits. You will lose the apples that were about to grow, and you will also miss out on growing apples for the rest of your life," Chris Brown told Mongabay-India.

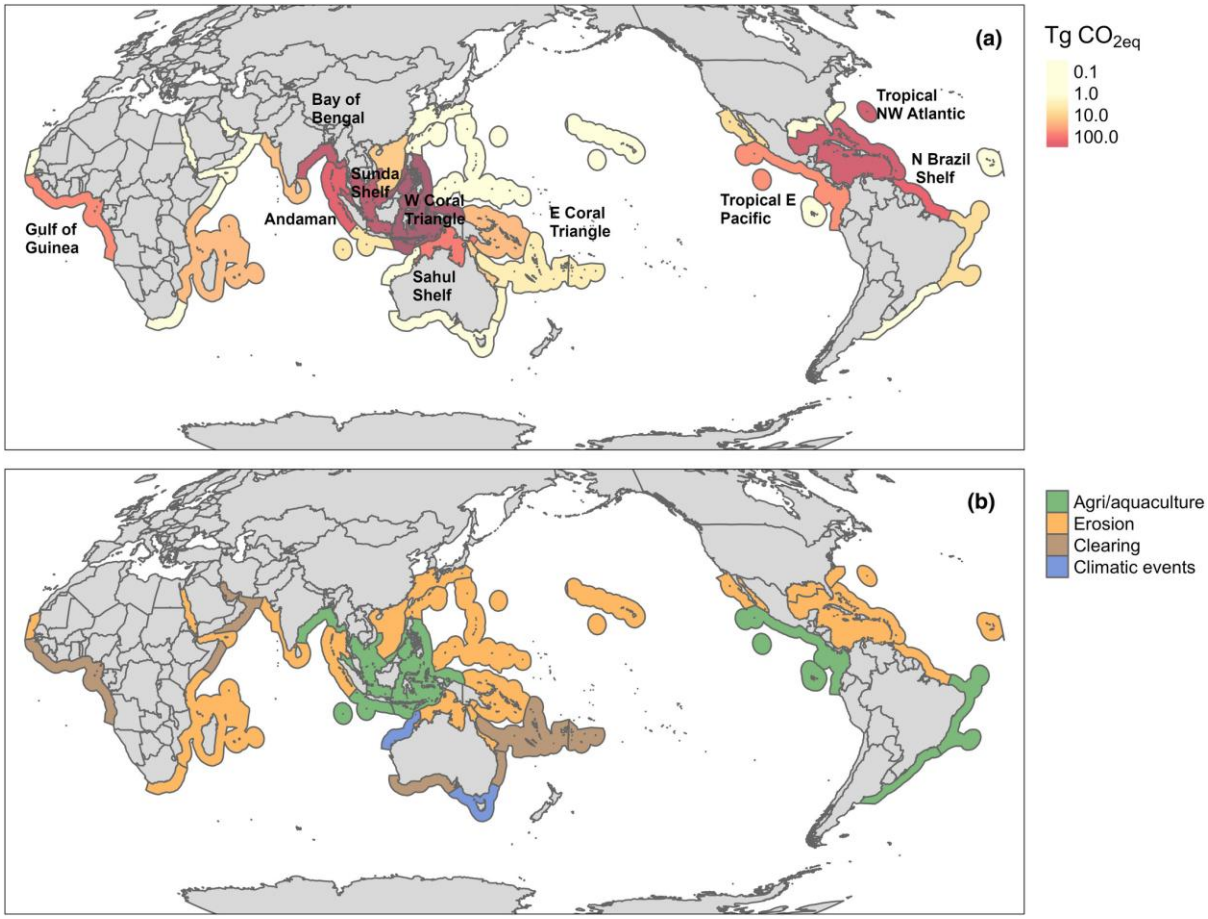
He adds that mangrove loss has been slowing, and global emissions could be more than halved if reduced loss rates remain in the future.

The findings tell policymakers, conservationists and other stakeholders how much emissions they can expect to save from conserving mangroves and also how much new carbon can be captured in mangroves. One can also prioritise the actions needed to protect mangroves, prevent emissions and capture more carbon, the scientists note.

For example, the study informs that the West Coral Triangle, Sunda Shelf and the Bay of Bengal had the highest predicted emissions due to mangrove conversion to agriculture/aquaculture at 985 Tg CO2 eq, contributing 73 percent to its emissions. Additionally, erosion was an important driver of mangrove loss in these provinces, accounting for 23 percent, 38 percent and 30 percent of their emissions respectively.

The Bay of Bengal lost 74 percent of its mangroves to aquaculture/agriculture from 2000 to 2016 and most of that is in Myanmar; Myanmar is estimated to have lost 42,836 hectares to

agri/aquaculture over 2000-2016 in comparison to estimates for India of 187 hectares lost to agri-aquaculture.



a) Global projected CO2 eq emissions (Tg) by the end of the century (2010–2100) for the marine provinces of the world from Projections of carbon emissions (Terragrams of CO2 equivalent), figure from Adame et al. 2021 (b) the proximate driver responsible *for the largest CO2 emissions for each marine province (Goldberg et al., 2020).*

The Sundarbans mangroves, shared between India and Bangladesh in the Bay of Bengal, constitute one of the hotspots marked in the study. According to data by the Forest Survey of India, an organisation under India's environment ministry responsible for assessment and monitoring of the forest resources of the country, the mangrove cover in the Indian Sundarbans spans roughly 2112 square km.

'Protect the protector'

India-based oceanographer Sugata Hazra, who works on the region, largely agreed with the GLOW-supported study, adding that the Achilles heels for the sea-soaked Indian Sundarbans mangroves in the Bay of Bengal are high salinity, erosion and conversion to aquaculture.

Rapid intensification of cyclones due to warming oceans has also seen the Indian and Bangladesh coasts battered by consecutive, devastating tropical storms – the most recent being super cyclone Amphan – that add to the thinning of the mangroves – amphibious defenders against extreme climate events. "Now, our slogan is 'protect the protector'," Hazra, Professor at Department of Oceanographic Studies, Jadavpur University, Kolkata, India, tells Mongabay-India.

He has reasons that augment his worry. Hazra and colleagues deduced through remotely sensed data that the Indian Sundarbans region lost 107 square km of mangrove cover in four decades (from 1975 to 2013), at a rate lower than the world average mangrove conversion rate (1.90

percent/year). Erosion washed away as much as 60 percent of those mangroves, mainly in the island peripheries, while 23 percent were converted to barren lands. The rest of the area became agricultural fields, aquaculture farms and built-up areas.

As this depletion went on, the region is estimated to have emitted 1567.98 Gg carbon dioxide during this period (1975 to 2013), equivalent to USD 64.29 million in terms of the social cost of carbon or economic harm from mangrove loss.

“What we have been stressing is the need to restore the hydrological regime in this region – for example rejuvenating the dying rivers –like Jamuna, Matla, Icchamati to revive freshwater supply to tackle the salinity and ensure a steady sediment supply to the plants. The rate of sea-level rise (>5mm per year) is more than the sediment supply and accumulation rate that is needed for healthy mangroves. In the east Indian state of Odisha, this is not the case and you will see healthier mangroves; in Bangladesh too the mangroves are healthier because of the freshwater and sediment supply; the mangroves in the Indian side are the worst off,” Hazra notes.

However, he added that over the last two decades, new mangrove stands spanning 55 square km in human habitations in the Indian Sundarbans have sprung up due to community participation efforts which will help offset the loss of carbon from mangrove depletion to an extent. The health of mangroves is crucial for them to store carbon. Their group is working out potential future mangrove losses and ways to protect the royal Bengal tiger habitat.

As for the western Indian coast, the GLOW-supported study finds that erosion and extreme weather events (tropical storms) play a major role in mangrove loss leading to carbon dioxide emissions.

In Gujarat’s arid Kachchh/Kutch along India’s west coast, G. A. Thivakaran, chief principal scientist of coastal and marine ecology at the Gujarat Institute of Desert Ecology, chalks up the threats to the mangroves to a profusion of ports, harbours and jetties and other human-made coastal structures that interfere with coastal sediment budget.

Gujarat, has the highest number of ports in India; 99 percent of mangrove formations consist of single species stand of *Avicennia marina* that can endure the punishing environmental conditions of very low rainfall, high water and soil salinity, and poor soil nutrients; but their sequestration ability, compared to other mangrove species, is relatively less, adds Thivakaran, who was not associated with the study.

While some data is available on the carbon sequestration potential of arid mangroves such as Kachchh, more needs to be generated for better understanding. To enhance carbon sequestration potential in Kachchh mangroves, Thivakaran bats for converting all sparse and degraded mangrove patches into dense ones by restoration/rehabilitation instead of plantation exercises as more than half of mangrove formations are sparse and degraded. National strategies and policies have been framed since 1966 to tackle erosion in coastal states but not enough has been done to control it, he adds.

Limits to mangrove blue carbon financing

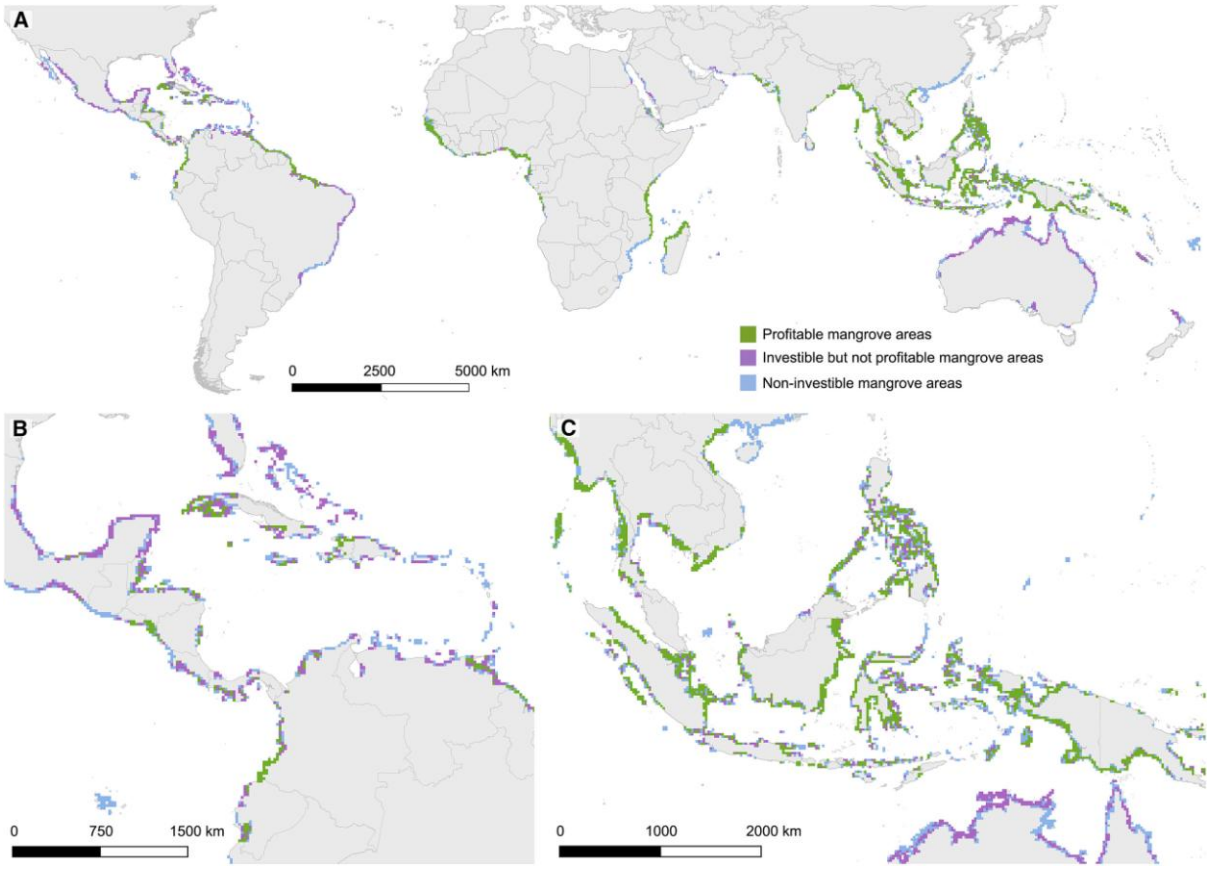
The protection or restoration of blue carbon — organic carbon sequestered and stored over long timescales by coastal vegetated ecosystems such as mangrove forests, seagrasses, and saltmarshes — is steadily gaining prominence as a key natural climate solution.

Among its primary targets, India has pledged to create an additional carbon sink of 2.5-3 billion tonnes of carbon dioxide equivalent through additional forest and tree cover by 2030 in its Nationally Determined Contribution (NDC) in 2015 under the Paris Agreement. But "severe data limitations" need to be addressed if the role of blue carbon in meeting the targets of the Paris Agreement has to be robustly demonstrated, according to a September 2020 policy brief on *Scope and Potential of Coastal Ecosystem Towards Mitigating Climate Change* authored by The Energy and Resources Institute researchers.

They note that Indian mangroves can be considered as a potential site for implementing carbon finance projects and for trading carbon in the voluntary market and that the government must negotiate with the United Nations Framework Convention on Climate Change (UNFCCC) for recognising the carbon sequestered through coastal ecosystems (blue carbon) at the national level in achieving India's NDC targets and mitigating climate change.

India has 189 square km of 'profitable mangroves' that qualify for blue carbon financing and are financially sustainable over 30 years, according to a 2021 paper that mapped the global potential and limits of mangrove blue carbon for climate change mitigation. It states that as much as 20 percent of mangrove forests globally can qualify for blue carbon financing and 10 percent of global mangrove is financially sustainable over 30 years; despite this limited global potential, mangrove blue carbon can be a financially viable means of meeting national-level climate goals.

Source:https://india.mongabay.com/2021/04/mapping-future-hotspots-of-carbon-dioxide-emissions-from-mangrove-loss/



“Roughly 189 square km of mangroves can be financially viable for protection under blue carbon finance. This mangrove extent (189 square km that are financially viable), may contribute to meeting 0.007 percent of the NDC goal every year (based on the current carbon price of USD5/tCO2),” study co-author Yiwen Zeng, Centre for Nature-based Climate Solutions, National University of Singapore (NUS), told Mongabay-India.

Returns from investments (ROI) in blue carbon projects centred on these profitable mangroves may amount to 6,553,000 USD per year. ROI (or returns/net present value) was calculated based on a combination of financial information, amount of carbon locked in the mangroves and the degree of threat.

Mangroves also contribute to “broader policy goals” including eco-disaster risk reduction, which aligns with many goals in the Sendai Framework for Disaster Risk Reduction, as well as several targets in the Sustainable Development Goals, beyond climate change mitigation, emphasised Dan Friess, co-author of the GLOW-supported paper and the mangrove blue carbon limits paper.

“One of the biggest advantages of nature-based solutions compared to engineered solutions is that they provide a range of additional benefits. Many of these benefits, such as coastal protection or fisheries, directly benefit local coastal communities. Carbon should be seen as a way of protecting habitats and the broad range of ecosystem services they provide, not a replacement for them,” explained Friess, Deputy Director, Centre for Nature-based Climate Solutions, NUS.

“It is important that finance generated by nature-based solutions is equitably distributed to coastal communities and forest users who are being asked to protect their mangrove forests and the carbon they contain. It is also important to the success of a nature-based solution that local stakeholders are involved in their management,” Friess told Mongabay-India.