

Conservation better than restoration to mitigate emissions

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Conserving the remaining, nearly intact peatlands and mangroves of South-east Asia – the region's green lungs – can absorb far more carbon dioxide (CO₂) than restoring degraded tracts of these ecosystems.

Of the carbon emissions that can be avoided and removed by peat forests and mangroves, 86 per cent will come from conserving and protecting untouched habitats, according to a new study led by the National University of Singapore (NUS). The remaining 14 per cent will come from restoring degraded habitats through replanting, for example.

The researchers calculated that conserving and restoring these habitats can reduce about 770 megatonnes of CO₂ equivalent annually. This amount is nearly double Malaysia's greenhouse gas emissions in 2023, they said.

These findings were published in scientific journal *Nature Communications* on Jan 28. Scientists from the Nanyang Technological University (NTU) and James Cook University in Australia also contributed to the study.

Mangroves can store up to five times as much carbon as tropical forests. Although swampy peatlands cover just 3 per cent of the earth's land surface, they store twice as much carbon as all of the world's forests combined.

But peatlands have for decades been viewed as unproductive wasteland, eyed by agriculture giants and farmers for conversion into plantations and farmland. Between 2001 and 2022, about 40 per cent of peat swamp forests in South-east Asia in 2000 were lost.

By 2017, the annual rate of loss of these forests had been 108,458ha a year, the study found. The size of that annual loss is larger than Singapore's land area, which is over 71,000ha.

Peatland fires caused the 2015 haze that shrouded Singapore and the rest of the region, producing emissions higher than the levels in the whole of the European Union.

Therefore, losing more of these carbon reserves to forest fires and agricultural use will pump enormous amounts of carbon dioxide

into the atmosphere.

"Conservation is the most effective strategy to mitigate emissions from peatlands and wetlands. So it's an easy win if we just conserve these ecosystems, as opposed to developing a lot of funding and projects in restoration that provide fewer benefits when compared to conservation," said Assistant Professor Pierre Taillardat, a co-author of the paper and scientist at the NTU Asian School of the Environment's Wetland Carbon Lab.

At the same time, avoiding deforestation of peatlands allows more carbon to be absorbed, compared with regrowth in the short term, particularly in the context of countries' net-zero goals by 2050. This is because of the extended time taken by a regenerating forest to reach maturity and achieve maximum carbon accumulation, stated the paper.

Its senior author, Associate Professor Massimo Lupascu from the NUS Department of Geography, also noted that restoration is costlier than conservation.

Restoring peatlands costs up to US\$7,000 (\$9,500) per hectare, compared with a few thousand dollars per hectare for conservation. It is also known to be difficult to successfully reforest a degraded mangrove or peat forest due to technical complexities and governance barriers.

"Maintaining a high water table in tropical peatland is one of the key elements to prevent carbon loss, but it's very difficult. Restoration involves replicating ecological conditions that have developed over centuries. And mangroves depend on tidal dynamics. In many of the degraded areas, the hydrology and physical conditions of the coasts have been altered," explained Prof Lupascu.

"And on top of that, peatlands have the risk of fires. As for governance challenges, many restoration projects struggle to succeed because there are overlapping land claims, unclear tenure rights and weak law enforcement."

A 2024 global study found that planted mangroves fall short in carbon storage compared with natural mangrove forests. Although planted mangroves can store up to 73 per cent of the carbon found in an intact mangrove forest of the same coastal environment, this level of carbon storage is achieved only after around

20 years of growth, the study showed.

While conservation should take higher priority, restoration still has a role, said the researchers, given the huge amounts of carbon both ecosystems store.

According to the Asean Peatland Management Strategy 2023-2030 report, there are very few, if any, pristine peatlands left in the region. Some projects on the ground incorporate both conservation and restoration.

Commenting on the research, Dr Lahiru Wijedasa, an ecologist at environmental consultancy and agroforestry firm ConservationLinks, said that what needs to be done on the ground is to map out the completely intact peatlands, slightly degraded sites, and completely degraded ones under threat.

"Prioritise the easy ones first, and get those conserved, with the idea that these are not just for carbon source and environmental health, but also the seed stock for restoration later," he said.

Conservation is not easy. Dr Lahiru said the amount of money generated by large plantations and smallholder farms is so significant that no amount of conservation programmes will generate the funds needed to replace them.

"But the only thing that's going to ever generate the money to do that is the carbon market," he said.

However, generating carbon credits from conserving peatland – that is, putting a price on avoided emissions – is tricky. For one thing, the project needs to prove that the land is genuinely at risk of deforestation and logging, said Prof Taillardat.

And even though Indonesia has a forest-clearing ban for plantations, deforestation has continued to be reported by environmental groups.

Conservation is not just about leaving the forests untouched. It also requires proper systems in place to prevent fires, encroachment and poaching.

Dr Lahiru added: "For a huge protected area that the government needs to run, they don't really have the people, money and infrastructure to do this."

He and the researchers also said conservation needs to be balanced with community livelihoods. One way is to help communities switch to crops suitable for wet peat, thus preventing the draining of peatlands for agriculture and small-scale oil palm.

Prof Lupascu said: "If we propose to switch to water spinach, sago or jelutong (wood), from a business point of view, it's not that appealing for small-scale farmers because they generate lower profits. So there needs to be some incentive to make that switch happen."

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