

## Region's mangroves under threat from deforestation, climate change

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Efforts to safeguard South-east Asia's mangroves as a source of carbon credits could be undermined if carbon prices are not high enough, a new study has suggested.

This is because clearing mangroves for commodity production – turning them into oil palm plantations, rice fields or aquaculture ponds – could be more profitable than relying on revenue from carbon credits based on current prices, heightening the risk of land conversion within the next 25 years.

Overall, some 1.3 million ha of mangroves in South-east Asia – an area about 18 times the size of Singapore – are in danger of commodification, the spatial analysis led by University of Queensland PhD student Valerie Kwan has found.

This amounts to about 63 per cent of the total mangrove area in South-east Asia that can supply carbon credits to the global carbon market.

Nature-based carbon credit projects ensure that a forest or mangrove that is at risk of being cut down remains standing. In doing so, emissions from the impending deforestation are prevented from being released, and are sold as carbon credits.

Each credit represents one tonne of planet-warming emissions that is prevented from being released into the atmosphere, and buyers are companies who want to offset their carbon footprint.

There are about 4.7 million ha of mangroves in South-east Asia, but only 2.1 million ha can be protected as carbon projects as they are at risk of being cut down.

A forest that is not threatened cannot supply carbon credits to the carbon market.

If a forest does not face a deforestation threat, issuing credits for its conservation is not considered "additional", and is akin to paying for an outcome that would have happened anyway. This concept of additionality is used to assess the quality of a carbon project.

For the analysis, the researchers used a base price of US\$29.72 (S\$40) per mangrove carbon credit. This was the selling price in June

2023 for carbon credits from a mangrove protection project in Pakistan.

A higher carbon price could help to lower the risk of mangroves being converted for production, said the researchers, although the study did not attempt to calculate a price floor.

Other approaches, including ensuring that local communities have alternative livelihoods, could also help to lower the risk of land conversion for socio-economic reasons, the researchers added.

Assistant Professor Zeng Yiwen from NTU's Asian School of the Environment, who supervised the study, said local communities should receive benefits fairly and equitably from the establishment and running of a carbon credit project.

"If projects can incorporate mechanisms for benefit sharing with local stakeholders, some of the socio-economic permanence risks can be mitigated," said Prof Zeng. "This can help to increase the project's ability to provide long-term biodiversity and climate benefits."

The study was published on Jan 28 in the journal *Communications Earth And Environment*.

It spotlights a critical issue in global discussions on protecting nature – the "permanence" of nature-based solutions, or how securely ecosystems can store carbon for the long term without the risk of it being released back into the atmosphere.

Nature-based solutions refer to efforts to protect natural habitats so their carbon-sucking abilities can be tapped in humanity's fight against climate change.

But many factors could affect the permanence of a nature-based carbon project, where the stored carbon in the ecosystem does not remain sequestered indefinitely.

Besides land clearance, other factors that could affect permanence include climate change impacts over the longer term – 75 to 100 years.

For the study, the researchers also looked into how rising sea levels and tropical cyclones could threaten the permanence of mangroves – coastal ecosystems that exist where land meets sea – in South-east Asia.

Previous studies have shown



that tropical cyclones rated Category 3 and above can cause mangrove forest structure damage, said Ms Kwan.

Climate scientists have predicted that climate change and warming oceans will fuel more intense cyclones.

Mangroves have a unique ability to keep pace with sea level rise, since their tangled webs of roots allow them to trap sediment. But Ms Kwan said this ability hinges on

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there being adequate sediment brought in by the tides.

She noted that an earlier study had found that sediment delivery at almost 70 per cent of study sites within the Indo-Pacific was inadequate for supporting high rates of sediment accretion, due to dams and other human activities.

At these sites, the rate of sea level rise will likely be faster than soil surface elevation gain in mangroves, compromising the perma-

**Mangroves at Sungei Pua in Pulau Ubin. Some 1.3 million ha of mangroves in South-east Asia are in danger of commodification – such as turning them into oil palm plantations or rice fields. PHOTO: COURTESY OF ROBYN GWEE**

nence of these ecosystems, she said.

The study recommended that mangrove carbon projects factor in future climate impacts by allowing mangroves to migrate inland – a process that can happen naturally, as long as there are no infrastruc-

tural projects blocking their landward path.

Overall, the study found that 1.8 million ha – or 85 per cent of mangrove areas that are considered "investible" as mangrove carbon projects – are likely to experience some form of permanence risk

from both socio-economic and climate factors.

Prof Zeng said: "Our study suggests that socio-economic and climate change permanence risks to blue carbon projects can be potentially extensive, and that some areas could experience greater risk than others."

Blue carbon refers to carbon stored in coastal and marine ecosystems, including mangroves.

Prof Zeng said the loss of mangroves in a carbon project will not only impact a carbon project developer's profitability, but will also compromise the services that nature provides to people and biodiversity – such as by removing carbon from the atmosphere or providing habitat for wildlife.

"Addressing the risks to a mangrove's permanence can help to improve the likelihood of a project remaining conserved in the long term," he said.

"Ultimately, this will impact the benefits to local communities and biodiversity, which tends to require the long-term persistence of these natural ecosystems."

Ms Hoon Ling Min, investment director at Temasek-backed investment platform company GenZero, which invests in decarbonisation solutions including nature-based ones, said permanence is a critical factor in assessing carbon projects.

Other factors – including additionality and leakage considerations – are also taken into account, she added. Leakage in the implementation of nature-based solutions occurs when efforts to protect one area shifts deforestation to another location.

"These factors affect the durability and integrity of the carbon projects, which, in turn, impact investor and buyer demand for the carbon credits generated from these projects," said Ms Hoon.

Ensuring permanence requires thoughtful project design, given that various physical and human factors could affect the long-term stability of carbon sequestration, Ms Hoon said, pointing to how forests can also face fire and illegal logging risks.

She said that carbon registries and methodologies require the allocation of a portion of carbon credits from projects towards a buffer pool, to cater for potential reversal risks.

To create this buffer pool, a proportion of carbon credits generated must be withheld from sale and released only if project integrity is maintained for a fixed number of years.

Ms Hoon added: "Project developers are also required to implement land use management practices and involve local communities through stakeholder engagement, to ensure that the interventions are maintained throughout the entire project duration."

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