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Mangrove loss may not mean release of all carbon stock: Study



As little as 25 per cent of the carbon stored in tree biomass and soil carbon may be lost following mangrove deforestation. PHOTO: NPARKS

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Research led by scientists in Singapore could affect how carbon credits are calculated

Audrey Tan Environment Correspondent

Mankind may be whittling away at nature but a new study has found that there may be some hope yet for mangroves - critical habitats that can keep large amounts of carbon out of the atmosphere.

The study, which was led by researchers in Singapore, found that while global mangrove area had shrunk over the 20-year study period from 1996, about a quarter of the losses had been offset by the regrowth of mangroves due to human or natural reforestation.

Moreover, the researchers also found that even when mangroves are cleared for agriculture or aquaculture, the land on which they once stood may not immediately relinquish its hold of the stored carbon.

This is because mangroves store most of their carbon underground, and not just in tree biomass such as in the trunks, roots and leaves. So even when the trees are felled in mangroves, the soil can retain some of the carbon.

In fact, as little as 25 per cent of the carbon stored in tree biomass and soil carbon may be lost following mangrove deforestation, the authors noted in the study which was published last month in scientific journal Nature Communications.

Lead author Daniel Richards, a principal investigator at Singapore-ETH Centre, told The Straits Times that while there had been earlier studies done on the rate of mangrove deforestation globally, the latest paper took into account regrowth and expansion of these habitats.

"These processes are likely to have accumulated significant stocks of carbon," said Dr Richards.

Noting that the study also accounted for the carbon remaining in the soil after deforestation, he added: "If we assume that all mangrove carbon is lost following deforestation, we will overestimate the losses in mangrove carbon stocks."

These findings, say the authors, would have implications for climate policies around the world.

IMPLICATIONS

It could, for one thing, affect how carbon credits are calculated, said the study's co-author, Dr Benjamin Thompson from Monash University in Australia.

Changing mangroves

Mangroves can store more carbon than many other natural ecosystems. Their ability to keep carbon in the soil and out of the atmosphere could help reduce global warming, but these habitats are often lost to human activity. A new study led by researchers in Singapore, however, has found some silver linings.

Environment Correspondent Audrey Tan examines their findings.

MANGROVE COVER

By comparing the global mangrove cover in 1996 and 2006, the scientists found that:

The loss of

Mangrove loss did not mean immediate

In 2016

136,717



8,050.4 sq km

of mangroves had been partially offset by natural or human forestation of

2,243.3 sq km

carbon loss. If mangrove forests were converted into agriculture or aquaculture, for example, the soil could still hold the carbon. Models showed that only a net

1.8% of the 1996 carbon stock was lost over the years.

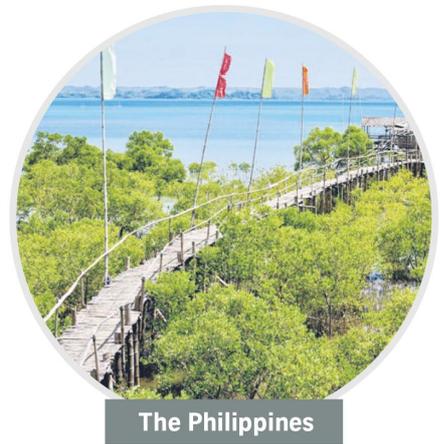
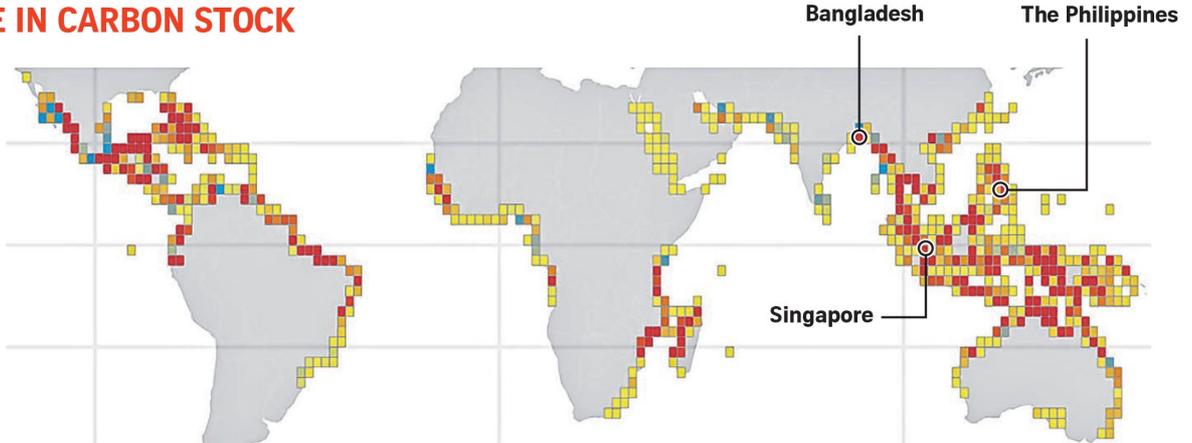
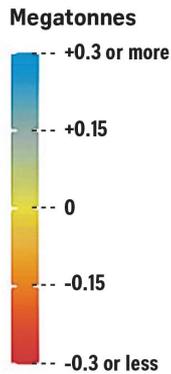
sq km



In 2006

142,865 sq km

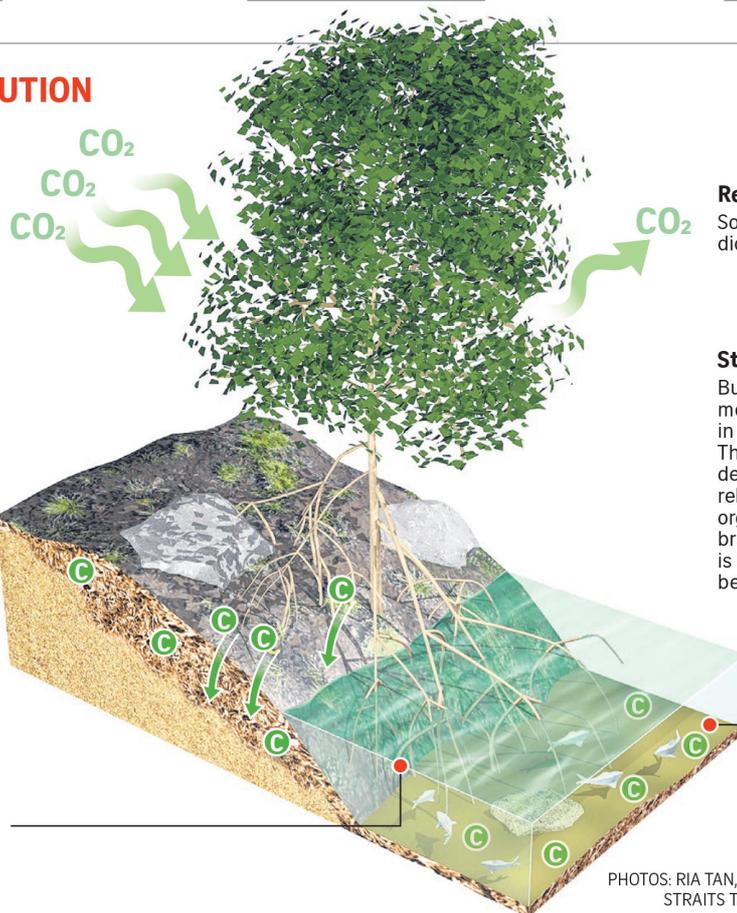
NET CHANGE IN CARBON STOCK



A NATURE-BASED SOLUTION

Sequestration

Mangrove plants take in carbon dioxide from the atmosphere in a process known as photosynthesis. The carbon is locked up in the leaves, branches and roots of the plants.



Respiration

Some carbon is released as carbon dioxide when trees respire.

Storage

But in mangrove habitats, there is more carbon stored underground in wet soil than above ground. The water slows down the rate of decomposition – a process that releases carbon dioxide. When organic matter, such as leaves or branches fall into the soil, the carbon is locked in its depths instead of being released into the atmosphere.

CO₂ Carbon dioxide
C Carbon

Reclamation

Mangroves have the unique ability to help reclaim land from the sea due to their complex root systems which can trap sediment. Without these habitats, the area covered by mangroves today would be part of the sea.

Sources: DANIEL RICHARDS, BENJAMIN THOMPSON, LAHIRU WIJEDASA
PHOTOS: RIA TAN, SAMIUL MOHSANIN, BENJAMIN THOMPSON
STRAITS TIMES GRAPHICS: LEE HUP KHENG, LIM KAILI

Carbon credits are offered for sale by developers of carbon dioxide emission reduction projects around the world, such as renewable energy or forest conservation projects.

These credits are then purchased by other countries or companies as a way to "offset" their own emissions.

In this context, carbon dioxide becomes a universal currency - one that can be traded between those who produce too much (emitters), and those who are helping to reduce the amount of the heat-trapping gas in the atmosphere (developers of emissions reduction projects).

The findings suggest that the amount of carbon that would be creditable from a hectare of conserved mangrove forest could be less than what was previously expected.

Dr Thompson said: "This is because you cannot generate carbon credits from carbon that would not have been released following conversion."

Similarly, mangroves that expand naturally without any direct human intervention would also not be eligible for such accounting initiatives, he added.

"This is because these events would not have been 'additional' to what would have occurred anyway," he said.

In climate discourse, making clear that carbon credits meet this "additionality" requirement ensures that the reduced emissions are entirely due to projects developed for that specific purpose.

NATURE-BASED SOLUTION

Mangroves are also considered attractive nature-based solutions for their ability to reclaim land from the sea, said National University of Singapore tree scientist Lahiru Wijedasa, who was also involved in the study.

The complex root systems of mangrove trees trap sediment, which can, to an extent, help them keep pace with sea-level rise.

Said Dr Lahiru: "The mangrove areas today would be sea, if not for the habitat."

Mangroves can also store more carbon compared with many other ecosystems, such as tropical rainforests, mainly because of their water-logged environment.

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The leaves of mangrove plants take in carbon dioxide through the process of photosynthesis.

When leaves and other tree debris fall off, they decompose slowly because they are covered by water. This results in more carbon being stored in the soil, resulting in an overall net removal of carbon from the atmosphere, said Dr Lahiru.

But this process can be slow, said the study, noting that it could take decades for a young mangrove to accumulate as much carbon as a mature one.

The study reinforces the need to conserve mangrove forests. "I would stress that the findings of our study in no way endorse mangrove clearing," said Dr Thompson.

While the study did find that less carbon is released following mangrove conversion, it did not mean that no carbon was released.

"A sizeable amount of carbon will still be released to the atmosphere, and deforestation will also remove the potential of the trees to continue to remove carbon dioxide," he said.

Moreover, mangroves provide many other services for coastal communities, helping to support fisheries and protecting the coastline from erosion, he added.

Mangrove expert Daniel Murdiyarso, who was not involved in the study, said he had made similar observations in a paper which is now undergoing review ahead of publication in a scientific journal.

"Above-ground biomass removal accounts for only 20 per cent of the total ecosystem carbon stock as most carbon stock from mangroves is stored in the soil," said Dr Murdiyarso, a principal scientist at the Centre for International Forestry Research based in Bogor, Indonesia.

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He said reforestation could help improve carbon stock across all forest habitats. However, mangrove reforestation has to be more nuanced due to their unique conditions.

Last October, then Minister for the Environment and Water Resources Masagos Zulkifli said Singapore will look to actively restore its mangrove areas to buffer against the threat of rising sea levels.

And last month, the National Parks Board announced that more than 400ha of wetlands, marshes, nature parks and eco-corridors along the northern coast have collectively become Singapore's second nature park network.

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