**Northern Borneo’s mangrove forests are disappearing, along with our blue carbon stocks**

Environment | Forests

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Published August 30, 2021

**An island where palm oil plantations cover land as far as the eye can see, Borneo’s tropical rainforests are not the only forests under threat of deforestation. Between 2000 and 2015, 25,500 hectares of mangrove forests have disappeared.**

The Malaysian aquaculture sector contributes 12.5% to the country’s GDP, harvesting around 391,000 tonnes of marine organisms annually and calculated to be worth USD 700 million in 2019. For the past five decades, the rainforests and mangroves in Borneo have been disappearing at an alarming rate as a result of industrial-scale logging.

Mangroves are extremely influential ecosystems. Their root systems are dense and help hold coastal soil together. These same roots filter phosphorus and other pollutants, creating cleaner river, estuary and ocean systems. Mangroves also provide spawning grounds, nurseries and homes to a wide range of marine biodiversity.

[Image 1: Male proboscis monkey male eating mangrove (Sonneratia sp.) leaves. | Bernard Dupont / Flickr]

Mangroves play a vital role in blue carbon storage (carbon stored in marine ecosystems), carbon up-cycling and carbon sequestering. Mangrove ecosystems can store up to five times more carbon than any other forest ecosystem. However, 20% of the world's mangroves have been lost between 1980 to 2005, and continue to experience a deforestation rate of 0.16% to 0.39% annually.

In the 1970s, the Malaysian government granted two large Japanese companies permission to clear mangrove forests in Sabah, Borneo for wood chip production. This included 43,000 hectares of mangrove forests in Sandakan and Tambisan, as well as a further 80,000 hectares in Tawau.

Today, the local government takes a more of a passive approach when it comes to mangrove conservation; their reasoning being that because the land deforested in the 1970s for wood chip production has since recovered, mangroves can be cleared and recovered without human intervention. Over 58.6% of Malaysian mangroves are found in Sabah, Borneo, thus maintaining its health is essential to the region’s overall well-being.

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However, in recent years extensive mangrove ecosystems have been cleared to make room for 75 commercial shrimp farms and 50 shrimp processing plants in Sabah—and this number is only increasing. This industrial expansion has brought about numerous conflicts with those local communities who depend on mangroves for their livelihoods, despite the farms employing 20,000 local workers.

A study by Wong and colleagues investigated the changes in *above ground biomass* (AGB) of mangrove forests in Sabah, Borneo, located in the Malaysian part of the island. Sabah has a 4328 kilometre coastline, which is mostly covered by mangroves. The team used remote sensing to measure both the land cover and forest height of the mangroves, as certain systems can penetrate forest canopy at different depths to create an accurate image on the forest body.

Their results showed that between the years 2000 and 2015, 58,262 hectares of mangrove forests have disappeared. At the same time, mangrove forest cover in other areas increased by 32,687 hectares—resulting in a net loss of around 25,500 hectares. In the year 2000, there were a total of 294,207 hectares of mangrove forests in Sabah, which had an AGB of value of 43,615,501 megagrams.

[Image 2: Man holding shrimp in Kinabatangan, Sabah, Borneo. | The Kingfisher]

The 25,500 hectare loss meant that there was a decrease of 3.96 million megagrams of AGB during the study period. Wong and colleagues also found that the annual average rate of mangrove land cover loss in Sabah, of around 0.58% or 1,705 hectares per year, is notably higher than the global average estimates of 0.16% to 0.39%.

Above ground biomass is the amount of the flora (measured in its mass) which stands above the ground. This is important to measure, as it has direct implications on how much carbon dioxide the plant can sequester from the atmosphere. It is normal for an individual mangrove tree to range from an AGB value as low as 98.4 megagrams per hectare in the Kota Marudu district to as high as 319 megagrams per hectare in Sandakan district.

The standardised estimate for carbon storage potential of mangroves is found by multiplying its AGB value by 0.5, as approximately 50% of the AGB is dry weight and the other 50% is carbon. According to Meng (2021), however, exact measurements of carbon stock potential depend on the mean temperatures and precipitation in the region, as well as age and latitude of the forest. Another study by Estrada & Soares (2017) found that 70% of mangrove carbon stock variability is due to age of the forest, and that carbon stock potential also increases towards the equator.

[Image 3: Male proboscis monkey at Kinabatangan river, Sabah, Borneo. | The Kingfisher]

Sulistiyono and Hudjimartsu calculated the carbon stock potential of mangrove forests in Lubuk Kertang, Indonesia, a very similar climate, latitude and temperature to Sabah, Borneo. They estimated that the carbon storage potential of these forests were approximately 46% of the AGB, meaning that 46% of the biomass is the amount of carbon that these mangroves can sequester and store from the atmosphere. Plants convert carbon dioxide into organic material, such as glucose, via photosynthesis in order to grow.

Applying Sulistiyono and Hudjimartsu’s 0.46 factor conversion, which may be more accurate for the climatic conditions of Sabah, rather than the global standardised 0.5 factor conversion, leads to a loss of approximately 1.82 million megagrams carbon storage between 2000 to 2015 (or 1.98 million megagrams of carbon if using the 0.5 factor conversion).

Mangroves are critical to the Reducing Emissions from Deforestation and Forest Degradation programme, organised under the United Nations Framework Convention on Climate Change. We **must** stop logging our carbon sinks, as they are a huge factor in mitigating the amount of greenhouse gases we emit into the atmosphere. If we continue our rate of deforestation, the forests which are meant to be acting as our carbon absorbers will become primarily carbon emitters as well.

Mangroves are able to store up to five times more carbon than other forests, as their underwater soils have less oxygen content. Inland terrestrial soil has more oxygen, allowing for more aerobic carbon oxidation, which rather than storing carbon, releases it back into the atmosphere. Additionally, Sabah mangroves are not only home to an array of fish biodiversity, but to iconic Bornean animals like the proboscis monkey or the estuarine crocodile.

**‘The replanting of mangrove saplings have a survival rate of 58% to 95%.'**

Whilst more than 38% of mangroves in Malaysian Borneo are in protected forest, around 17% remain in production forest, which is subject to continuous logging. In northeast Borneo, most of these mangrove forests are at risk of being converted into fish ponds and shrimp farms. Additionally, in 2015, of the 2,000,000 hectares of mangrove forests in the Indonesian part of the Island, West Kalimantan, 72,445 hectares were dedicated to mining concessions.

Many studies have found that depending on the regions, the replanting of mangrove saplings have a survival rate of 58% to 95%. First replanting projects in Sabah began in 2006 and 2011, and by 2018 the Sabah Forestry Department rehabilitated 1408 hectares of mangrove forests. Although these are small strides, they show a high success rate. It is vital that these programs significantly expand in scale and that local governments have a more proactive rehabilitation approach, rather than their longstanding *‘do nothing’* attitude.

It is also essential that land-use change of old mangrove forests and inland rainforests stop, as the world cannot afford to lose any more help in mitigating greenhouse gas emissions. Countries must collaborate to find a way to shift their economies to both green, as well as blue economies, via sustainable practices and seascapes.

Featured Image: Aldino Hartan Putra | Unsplash

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