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What is the current and future carbon sink potential of recovering secondary and degraded forests across the humid tropics?

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The Forest and Land use Declaration negotiated at the 26th climate Conference of the Parties (COP) in Glasgow, November 2021, confirmed that Tropical Moist Forests (TMFs) are a vital nature-based solution to addressing the climate and ecological emergencies. TMFs are estimated to be a net sink of carbon, storing approximately 0.8 Pg C yr^{-1} [1]. However, the size of this sink is declining due to human activities such as deforestation and forest degradation through logging and fire, as well as climate variability and change[1]. Tropical forests are therefore a patchwork of undisturbed, degraded, and secondary forests, creating regionally complex patterns of growth and carbon storage.

While there have been numerous studies exploring and quantifying the recovery rates of secondary forests, quantifying the recovery rate of degraded forests has been largely unexplored on a pan-tropical scale. In this study, we address this knowledge gap by quantifying the carbon accumulation in recovering degraded forests as well as secondary forests, which collectively, we have termed “Recovering Forests”.

Recent advances in remote sensing products have made it possible to (i) observe and distinguish degraded forests from undisturbed and secondary forests[2]; and (ii) estimate the carbon sequestration rates within these forests[3,4].

Here we use a combination of remote sensing derived products in a space-for-time substitution

approach to quantify the carbon accumulation rates in recovering forests. This includes recovering degraded forests and secondary forests in the three major tropical biomes: the Amazon Basin, Island of Borneo and Congo Basin.

Our results show growth rates to be the highest in Borneo, in recovering degraded forests[5]. We attribute these inter-biome/forest variations in growth to differences in disturbance and find that environmental variables such as water deficit and temperature influence the recovery of forests in unique ways across the tropics. We also provide estimates of the current and future carbon sink of recovering forests across the three biomes.

We find that recovering degraded forests have a large carbon sink potential, owing largely to their vast areal extent (10% of forest area). Secondary forests, regrow across a smaller land area (2%) but have faster growth rates (up to 30% faster in the Amazon basin) compared to degraded forest recovery. Additionally, we find that 35% of degraded forest are subject to subsequent deforestation[2,5], emphasizing the need for continuous monitoring as well as their protection to safeguard the carbon stock in all recovering forests. Our results provide insights into the dynamic patterns of tropical forest recovery, influenced by interactions of humans and the environment that have the potential to improve global vegetation models as well as help to inform national forest inventories.

References:

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