EGU21-7956
https://doi.org/10.5194/egusphere-egu21-7956
EGU General Assembly 2021

Quantifying the spatial patterns of Secondary Forest carbon sequestration potential in the Brazilian Amazon

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Overall, global forests are expected to contribute about a quarter of pledged mitigation under the Paris Agreement, by limiting deforestation and by encouraging forest regrowth.

Secondary Forests in the Neo-tropics have a large climate mitigation potential, given their ability to sequester carbon up to 20 times faster than old-growth forests. However, this rate does not account for the spatial patterns in secondary forest regrowth influenced by regional and local-scale environmental and anthropogenic disturbance drivers.

Secondary Forests in the Brazilian Amazon are expected to play a key role in achieving the goals of the Paris Agreement, however, the Amazon is a large and geographically complex region such that regrowth rates are not uniform across the biome.

To understand the impact of key drivers we used a multi-satellite data approach with the aim of understanding the spatial variations in secondary forest regrowth in the Brazilian Amazon. We mapped secondary forest area and age using a land-use-land-cover dataset – MapBiomas – and, combined with the European Space Agency Aboveground Carbon dataset, constructed regional regrowth curves for the year 2017.

We found large variations in the regrowth rates across the Brazilian Amazon due to large-scale environmental drivers such as rainfall and shortwave-radiation. Regrowth rates are similar to previous pan-Amazonian estimates in the North-West (3 ±1.0 MgC ha^{-1} yr^{-1}), which are double than those in the North-East Amazon (1.3 ±0.3 MgC ha^{-1} yr^{-1}). The impact of anthropogenic disturbances, namely fire and repeated deforestation prior to the most recent regrowth only reduces the regrowth by 20% in the North-West (2.4 ±0.8 MgC ha^{-1} yr^{-1}) compared to 55% in the

North-East (0.8 ±0.8 MgC ha^{-1} yr^{-1}). Overall, secondary forest carbon stock of 294 TgC in the year 2017, could have been 8% higher with avoided fires and repeat deforestation. We found that the 2017 area of secondary forest, which occupies only ~4% of the Brazilian Amazon biome, can contribute significantly (~5.5%) to Brazil's net emissions reduction targets, accumulating ~19.0 TgC yr^{-1}until 2030 if the current area of secondary forest is maintained (13.8 Mha). However,this value reduces rapidly to less than 1% if only secondary forests older than 20 years are preserved (2.2 Mha).

Preserving the remaining old-growth forest carbon stock and implementing legal mechanisms to protect and expand secondary forest areas are key to realising the potential of secondary forest as a nature-based climate change mitigation solution.