Eden Reforestation Projects
PLANT TREES | SAVE LIVES

# Mangrove Forest Carbon Sequestration

Businesses are increasingly aware of their "carbon footprint" and are actively looking for ways to offset the environmental impact of their operations. In addition, a growing number of consumers look for businesses that offer a way to make a positive impact through their support. Eden Reforestation Projects offers a simple and cost-effective way to deliver this value to your business and your customers.

## Trees and Carbon

One of the key benefits of reforestation is that trees are extremely efficient at carbon sequestration and one of the most effective tools in the fight against dangerous Greenhouse Gases that contribute to climate change and global warming. Trees convert the carbon dioxide ($CO_2$) into plant matter, holding this material for the life of the tree and beyond.

## Why mangroves?

Scientific studies have shown that Mangroves "sequester carbon at a rate two to four times greater than mature tropical forests", and contain "the highest carbon density of all terrestrial ecosystems." (Fatoyinbo et al, 2017). Mangroves are also key part of coastal ecosystems, and "renowned for an array of ecosystem services, including fisheries and fibre production, sediment regulation, and storm/tsunami protection". (Donato et al, 2011) The key to mangroves is the large amounts of biomass stored underground in the extensive root system. These roots support the large trees in muddy coastal areas where mangroves thrive. (Komiyama et al, 2008)

## Calculating $CO_2$ offsets from Mangrove forests

Based on the studies cited below, Eden has established a benchmark of 840 metric tons (t) of Carbon (C) per hectare of mature mangrove forest. This is based on an average tree growth life of 25 years. From this number, we can calculate the amount of $CO_2$ removed from the atmosphere and turned into plant biomass per hectare of forest and estimate the amount of $CO_2$ sequestered per tree based on the growth life and planting density.

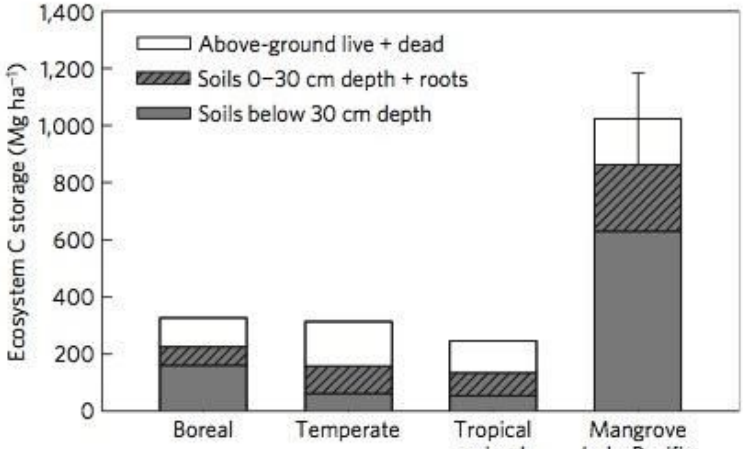


*Figure SEQ Figure * ARABIC 1 – Donato D, et al (2011) Nature Geoscience NGEO 1123*

- First, calculate the ratio of $CO_2$ to Carbon based on the atomic weights of each molecule.

$$3.67 = \frac{(12+16+16)\ (atomic\ weight\ of\ CO_2)}{12\ (atomic\ weight\ of\ C)}$$

- Multiply this ratio by the amount of C per hectare of mangrove forest to get the amount of $CO_2$ sequestered per hectare of mangrove forest.

$$3{,}082.8\ t\ of\ CO_2\ per\ hectare = 3.67 \times 840\ t\ of\ C$$

- To calculate the annual $CO_2$ offset, we divide the total amount of CO2 per hectare by the growth life of the trees, or 25 years.

$$123.312\ tons\ of\ CO_2\ per\ year\ per\ hectare = \frac{3{,}082.8\ tons\ total\ per\ hectare}{25\ years}$$

- Eden plants mangrove trees at a density of 10,000 per hectare. Using this number, we can estimate the average $CO_2$ offset per tree per year, and the total offset per tree over the growth life of the tree. The actual offset is lower in the early years and peaks between 10 and 20 years after planting.

$$12.3\ kg\ of\ CO_2\ per\ tree\ per\ year = \frac{123.312\ tons\ of\ CO_2\ per\ hectare\ per\ year}{10{,}000\ trees\ per\ hectare}$$

## Summary

Mangroves are one of the most effective and economic methods of offsetting carbon emissions. Each mangrove tree planted by Eden Reforestation Projects removes over 308kg (680lbs) of $CO_2$ from the atmosphere over the growth life of the tree. This calculates to an average of 12.3kg per year per tree.

| | Units | Carbon Sequestered (C) | Equivalent in Carbon Dioxide ($CO_2$) |
|---|---|---|---|
| Carbon per Area Planted | Metric Tons / Hectare | 840 | 3082.8 |
| | US Tons / Acre | 374.7 | 1,375.2 |
| Carbon per Tree Planted* | Kg / Year (average) | 3.4 | 12.3 |
| | Kg Lifetime (25 years) | 84 | 308.3 |
| | lbs / Year (average) | 7.4 | 27.2 |
| | lbs Lifetime (25 years) | 185.2 | 679.7 |

Contact Eden Reforestation Projects at Debbie@edenprojects.org to learn how you can offset emissions caused by your business.

**References**

Fatoyinbo T, Feliciano E., Lagomasiano D, Lee S K, Trettin C (2017) Estimating Mangrove Aboveground Biomass from Airborne Lidar Data: A Case Study from the Zambezi River Delta

Donato D, Kauffman J B, Murdiyarso D, Kurnianto S, Stidham M, Kanninen M (2011) Mangroves among the most carbon-rich forests in the tropics. Nature Geoscience NGEO1123

Komiyama A, Ong J E, Poungparn S (2008) Allometry, biomass, and productivity of mangroveforests: A review. Aquatic Botany 89.