Carbon Sequestration Potential of Himalayan Forests

We estimate that sequestering 1 Tonne of CO2 over 10 years requires planting about 14 trees.

The amount of carbon sequestered by forests is highly variable, depending on species composition and biodiversity, climatology and microclimate, altitude, and local environmental factors (soil composition). However, we can estimate a rough range based on measurements from other forests in Nepal.

In the Himalayas, altitude is a significant factor because it simultaneously encodes many other factors that affect sequestration. While high altitude can slow growth and therefore sequestration rates, total carbon stock of mature forests in the Himalayas generally increases with altitude (Marifatul Haq, 2022), up to a certain altitude between 3500 and 4000m. This is also supported by Nepal Department of Forest Research and Survey Reports accounting total carbon stock in Nepal to be 176.95 Mg C/ha while High Altitude forest stock is 272.2 Mg C/ha. This is primarily because changes in weather and climate at higher altitudes slow the rate of decay and other processes that release carbon back into the atmosphere.

Estimates of sequestration in different forests across Nepal include the range of 2.4 to 5.6 Mg C/ha-yr (Rana, 1989), 1.47 to 6.23 and 1.07 to 6.66 Mg C/ha-yr for degraded and non-degraded Oak and Chir Pine forests (Jina, 2009), to 1.3 to 3.21 Mg C/ha-yr (Baral, 2009). Total forest biomass carbon stock in established subalpine forests with shared species were between 140-150 Mg C / ha (Marifatul Haq, 2022), although sequestration rates were not estimated.

Per Tree Sequestration Estimate

Given the high altitude and currently degraded nature of the Samagaun reforestation area, we assume that the current sequestration rate will be at the lower end of the observed rates, around 1.3 to 2.4 Mg C/ha-yr. A tonne of sequestered carbon is equivalent to 3.67 Tonnes of sequestered CO2. Assuming roughly 700 trees per hectare, over 10 years, an average tree will sequester 13/700 Mg C to 24/700 or 0.068 Mg CO2 to 0.13 Mg C02. Therefore, sequestering 1 Mg CO2 over a decade requires planting between 8 and 14 trees. Due to uncertainty about the impact of local factors, we assume that the forest will have sequestration rates at the lower end of the observed spectrum; therefore, it will require about 14 trees to sequester 1 tonne of CO2 over 10 years.

Note: this is only an estimate of possible sequestration levels, not a certified assessment.

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