

Carbon stock estimation of agroforestry system in Tawau, Sabah

Abstract

Studies on total aboveground carbon (TAC) and belowground carbon (TBC) stock has been conducted in Balung Plantation, Tawau, Sabah. The main objective of the study was to determine the above and below ground carbon stock in agroforestry system. The combination of agroforestry systems with different ages were investigated, which is oil palm (25 years) and agarwood (7 years), oil palm (20 years) and agarwood (7 years), and oil palm (17 years) and agarwood (5 years). Monoculture of oil palm (16 years) and Tawau Hill Park forest reserve was set as control. A random systematic sampling method was used in conducting field inventory and soil sampling. The size of the sampled area in agroforestry and monoculture is $3 \times 50\text{m} \times 50\text{m}$, while for forest reserve, the sampled area is $3 \times 30\text{m} \times 30\text{m}$. Allometric equations were used to calculate the stand biomass. Sampling for organic and shrub layers were collected in a square frame ($1\text{m} \times 1\text{m}$). Soil samples and bulk density was collected from three different layers which are 0 – 5 cm, 5 – 10 cm and 10 – 30 cm in randomly located sites within the plots. Soil samples, organic and shrub layer were analyzed using CHN628 series for carbon content. Result shows that the amount of total carbon stock in agroforestry was $79.12 \text{ tan C ha}^{-1}$, $85.39 \text{ tan C ha}^{-1}$ and $78.27 \text{ tan C ha}^{-1}$, respectively. Monoculture of oil palm (16 years) has $76.44 \text{ tan C ha}^{-1}$ while Tawau Hill Park forest reserve has total carbon stock at $287.38 \text{ tan C ha}^{-1}$. Forest reserve stand has the highest total carbon stock compared to agroforestry and monoculture systems. But, in terms of soil carbon, forest reserve has the lowest TBC compared to agroforestry and monoculture systems. ANOVA was conducted to explore the impact of planting systems on total carbon stock. There was a statistically significant difference at the $p < .05$ level for soil carbon, living tree and organic layer between agroforestry, monoculture and forest reserve. Good crop and fertilizer management in agroforestry and monoculture systems helps in increasing soil organic carbon (SOC).