Assessment of Carbon Sequestration Potential of Tree Species

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***Abstract*—Plantation tree crops play a key role in terrestrial carbon sequestration, which efficiently convert CO_2 into biomass, besides improving soil carbon pools. Thus, it is a win-win strategy to establish tree plantations for stabilizing the GHGs. Every country is taking measures to reduce the GHGs emission by different methods of sequestering carbon in the soil, trees and water.**

***Index Terms*-carbon sink, tree species, CO_2 conversion, soil, biometric analysis.**

I. INTRODUCTION

Climate change or global warming is largely dictated by carbon dioxide (CO2). Rising concentration of greenhouse gases (GHGs) in the atmosphere could lead to a change in solar energy balance and consequently the world's climate. Among the anthropogenic GHGs, CO2 is the most abundant and responsible for half of the radioactive rays forcing associated with the greenhouse effect that leads to global warming (Gavali *et al*., 2016). In the wake of global efforts to address climate change, considerable interest has been generated about carbon sequestration potential of trees. Tree plantations are being considered as a mitigation option to reduce atmospheric CO2and climate change (Balasubramanian *et al.*, 2017).

Plantation tree crops play a key role in terrestrial carbon sequestration, which efficiently convert CO2into biomass, besides improving soil carbon pools. Thus, it is a win-win strategy to establish tree plantations for stabilizing the GHGs. Every country is taking measures to reduce the GHGs emission by different methods of sequestering carbon in the soil, trees and water. One such major initiative taken by the Tamil Nadu Government for carbon sequestration by trees was accomplished by implementing Tamil Nadu Biodiversity Conservation and Greening Project (TBGP) in the state of Tamil Nadu. Hence, the present research investigation was carried out to quantify the carbon sequestration potential of trees which were planted under State Forest Research Institute, Kolapakkam, Chennai.

II. METHODOLOGY

A. Study area and planting material

This study was conducted at State Forest research Institute, Vandalur research range Zone I & Zone II experimental plots. The soil was red loamy type with the pH of 5.8 and electrical conductivity with 0.24 dS m-1.

B. Collection of soil samples

A pit of V shape is formed. Its depth should be 0-15 cm or 0-22.5 cm or 0-30 cm. Take out the soil- slice of m inch thick from both the exposed suffice of the pit from top to bottom. To collect the soil-slice spade may be used. The soil sample is collected in both the depths 0-15 cm and 15-30 cm depth.

C. Organic Carbon

Soil organic matter contains living and dead microbial tissues, microbial synthesized compounds and derivatives of these materials, produced as a result of microbial decay.

Calculating the percentage of the organic carbon in the soil is by

N x (B-T) x 0.003 x 100/ Weight of Soil Sample

D. Biomass Estimation

The biometrical parameters like height, basal diameter (DBH) was recorded. Leaf litter biomass was calculated by using Shade net sample plot in the monthly interval. Collected leaf litters Fresh weight and Dry weight (Oven dry) were recorded. The carbon stock in the above ground biomass, below ground biomass, litter and dead organic matter was computed by using the formula given below.

$AGB = 34.4703 - 8.0671D + 0.6589D2$

$BGB = AGB \times (15/100)$

Total biomass of individual trees will be the sum of their above- and below-ground biomasses, respectively, given by the following equation:

Total Biomass = AGB + BGB

Generally, for any plant species, 50% of its biomass is its carbon content

Carbon Content = 0.5 × Total Biomass

CO_2 equivalent is then calculated using the below given equation:

CO_2 (eq.) = (Carbon content × 44)/12

III. RESULTS

The present study was carried out to estimate carbon (Table 1) (Figure 1, 2 & 3) present in the biomass of existing experimental plots in State Forest Research Institute.

Figure 1: Soil sample Collection

Table 1:

Species	AGB (kg)	BGB (kg)	TB (kg)	Carbon (kg)	CO2 EQ (kg)	CO2 EQ (tons)
Mimopsis elengi	691.19	103.68	794.86	397.43	1457.25	1.46
Khaya senegalensis	4258.25	638.74	4896.99	2448.49	8977.81	8.98
Melia dubia	2205.60	330.84	2536.44	1268.22	4650.15	4.65
Sweitenia mahagony	2544.09	381.61	2925.70	1462.85	5363.79	5.36
Eucalyptus tereticornis	1766.07	264.91	2030.98	1015.49	3723.46	3.72
Tectona grandis	2419.00	362.85	2781.84	1390.92	5100.05	5.10
Bambusa vulgaris	5214.67	782.20	5996.87	2998.43	10994.26	10.99
Bambusa tulda,	4983.06	747.46	5730.51	2865.26	10505.94	10.51
Bambusa bamboo	4645.52	696.83	5342.35	2671.17	9794.31	9.79
Bassia latifolia	2598.32	389.75	2988.07	1494.03	5478.12	5.48
Pterocarpus santalinus	5057.75	758.66	5816.41	2908.21	10663.43	10.66
Dendrocalamus giganteus	5332.45	799.87	6132.32	3066.16	11242.58	11.24

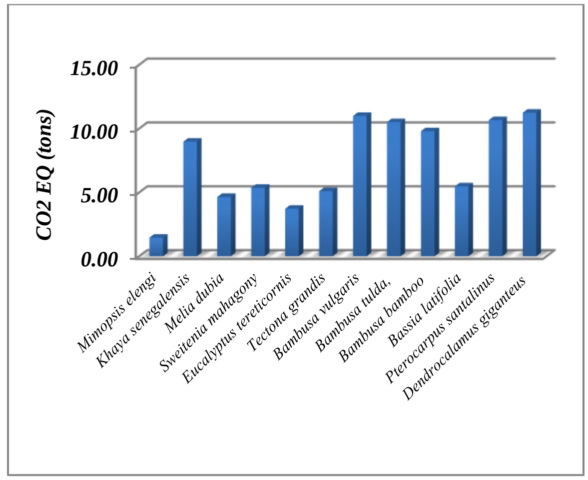

Figure 2: Annual CO_2 Sequestered by tree species

Figure 3: Biometric analysis of trees

The present work is a sustainability initiative to inventory the trees of State Forest Research Institute, Kolapakkam, Chennai and compute their carbon storage capacity. AGB and BGB were also estimated using the non-destructive method. A total of 120 trees belonging to 12 different species have been recorded with the carbon sequestration potential of 87.95 tons.

IV. CONCLUSION

In the study site, *Dendrocalamus giganteus* results the highest carbon content of 11.24tons/year followed by *Bambusa vulgaris* (10.99 tons/year), *Pterocarpus santalinus* (10.66 tons/year), *Bambusa tulda* (10.51 tons/year), and *Mimopsis elengi having* low carbon sequester rate of 1.46 tons/year.

V. REFERENCE

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