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Quantification of carbon stocks in *Peltophorum ferrugineum* species in Bilaspur Region

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Abstract
Trees of *Peltophorum ferrugineum was* grown for maximum biomass production under the same climatic (1220 mm mean annual rainfall and 30^0 C mean annual air temperature) and edaphic and conditions in the Bilaspur region (lat. 22.1293^0N, Long. 82.1360^0E) management was very intensive during early growth and establishment phases there were no. of trees present 390. The estimation was done allometric equation. The trees were total no. of 390 and total taken 10 no of sample plot. The total average diameter was came 14.04cm. And average height was 4.6 m. biomass was 68.66 kg. Carbon stock was 34.33kg.

Keywords: biomass, allometric equation, climatic, edaphic

Introduction
Plant plays an important role in an ecosystem. Biomass of plants strongly affects the structure and function of ecosystem. Trees plays vital role in mitigating the diverse effect of environmental carbon degradation and on reducing global warming. Trees promote sequestration of carbon into soil and biomass therefore, tree-based land use practice could be viable alternatives to store atmospheric carbon di oxide due to their cost effectiveness, high potential of carbon uptake and associated environmental as well as social benefits due to as forest maintain over 86% of the terrestrial carbon stock on earth during photosynthesis and storing excess carbon as biomass. An accurate estimate of forest carbon storages including natural forest plantation etc. separately for different trees land of various locality will be of great significant to the research on the productivity of terrestrial ecosystem. Carbon cycle and global warming determination of above ground biomass (AGB) is an important step in planning the protection and sustainable use of deciduous trees resources. Biomass determination can be in or direct way by cutting and weighing all the plants in sample areas. This requires considerable efforts and time. Destroys vegetation in these areas and in some situation is not desirable or may even be illegal. Therefore, allometric relationships for estimating (AGB) of deciduous trees from measurement of stem diameter at breast height (DBH) and tree height (H). Have been devised and reported by a no. by workers. To evaluate such uses and effects data on biomass production and nutrients demands on the site are needed. Here we present results of an experiment in which five tree species were intensively managed under identical environmental conditions to compare their efficiency of biomass production and nutrients utilization. A forthcoming companion article will contain the nutrition aspects of study. Studies such as these are needed to assess species suitability for sustained yield energy plantation in the tropics.

Description
It is a deciduous tree growing to 15–25 m tall, with a trunk diameter of up to 1 m belonging to Family Leguminosae and sub-family Caesalpiniaceaea. The leaves are bipinnate, 30–60 cm long, with 16-20 pinnae, each pinna with 20-40 oval leaflets 8–25 mm long and 4–10 mm broad. The flowers are yellow, 2.5–4 cm diameter, produced in large compound racemes up to 20 cm long. The fruit is a pod 5–10 cm long and 2.5 cm broad, red at first, ripening black, and containing one to four seeds. Trees begin to flower after about four years.

Distribution
Peltophorum ferrugineum is native to tropical southeastern Asia and northern Australasia, in Sri Lanka, Thailand, Vietnam, Indonesia, Malaysia, Papua New Guinea and the islands off the coast of Northern Territory, Australia.

Uses

The tree is widely grown in tropical regions as an ornamental tree, particularly in India, Nigeria, Pakistan, and Florida and Hawaii in the United States. The trees have been planted alternately in India as a common scheme for avenue trees in India alternately with *Delonix regia* (Poinciana) to give a striking yellow and red effect in summer, as has been done on Hughes road in Mumbai**.**

Physiology and Penology- *P. ferrugineum* is fast-growing, and can reach a height of 9 m in 3 years. In the Philippines, panicles appear from May to September, with flowering in March-April. In India, the general flowering period is March to May, although sporadic flowering may occur throughout the year (particularly in young trees), and a second flush of flowers may occur in September-November. As a fast-growing species, young trees raised from seed will, under good conditions, flower from age 4 years (Lemmens and Wuli.

Study site

The study was conducted in the Bilaspur region Chhattisgarh Lat.22.1293^{0}N, 82.1360^{0}E at less than 264m elevation. The climate is pleasant and mild in the winter minimum temperature 10^{0}C and maximum temperature 45^0. The relative humidity is higher during the monsoon season being generally over 75%after monsoon season humidity decreases and during the winter air is fairly dry. The month of July and august the heaviest rainfall month and nearly 95% of annual rainfall is received during June- September months. The rainfall is unevenly distributed and also the amount of rainfall varies from year to year and experiences and a not semi humid climate.

Materials and Methods

Volume of the tree was measured by the formula

$$V = \pi r^2 h \qquad \text{.........} (1)$$

Where, V= volume of the tree in m^3, r= radius of the trunk in m, h = Height of the tree. As very less taper was observed in trees, hence average volume was estimated by using above formula.

AGB (Above ground biomass) includes the all living biomass above the soil. AGB are calculated by multiplying volume to the green wood density of the tree species.

$$AGB= V \times D \qquad \text{..........} (2)$$

Where, AGB= Above Ground Biomass, V= Volume of the tree in M^3 and D= Wood Density of species. Wood density is used from global wood density database. The standard average density of 0.6 g/cm^3 is applied wherever the density value is not available for tree species.

BGB (Below Ground Biomass) has been calculated by the multiplying the AGB by 0.26, as per factor prescribed by Hangarge *et al*.

$$BGB= AGB \times 0.26 \qquad \text{..........} (3)$$

TB (Total Biomass) has calculated by the sum total of AGB and BGB.

$$\text{Total biomass}= AGB+BGB \qquad \text{.........} (4)$$

In present study, we have calculated carbon with assumption, that any tree species contain 50% of its biomass.

$$\text{Carbon storage} = \text{Biomass} \times 50\% \qquad \text{..........} (5)$$

Biomass estimation of *Peltophorum ferrugineum*

Species: *Peltophorum ferrugineum*

No. of trees Present: 390 trees.

Sample taken: 10 trees.

Diameter		Height		Volume	biomass
(in cm)	(in inch)	(in m)	(in feet)	(in m³)	(in kg)
12.10	4.76	05	16.40	0.038	51.20
9.23	3.63	04	13.12	0.021	23.48
11.78	4.63	04	13.12	0.034	38.22
19.10	7.52	06	19.68	0.135	151.23
14.96	5.88	04	13.12	0.052	61.64
14.01	5.51	04	13.12	0.048	54.12
14.33	5.64	4.5	14.76	0.056	63.79
13.37	5.26	04	13.12	0.044	49.32
18.47	7.27	06	19.68	0.123	141.34
13.05	5.14	4.5	14.76	0.047	52.98
14.04 cm		4.6m		0.0598m³	68.66 kg

Result and discussion

The estimation of the aboveground and belowground biomass in the selected tree species was performed by estimating carbon percentage and by measuring the tree height, DBH and wood density. The carbon concentration of different tree parts was rarely measured directly, but generally assumed to be 50% of the dry weight on the basis of literature (Chavan and Rasal, 2011 [4] as the content of carbon in woody biomass in any component of forest on average is around 50% of dry matter (Paladinic *et al.*, 2009; Chavan and Rasal, 2011; 2012a; 2012b) [4].

The trees were total no. of 390 and total taken 10 no of sample plot. The total average diameter was came 14.04cm. And average height was 4.6 m. biomass was 68.66 kg. Carbon stock was 34.33kg.

Conclusion

Research on carbon aboveground estimations in seedlings and reforested areas in the tropics is still in an early stage. Therefore, this study is a valuable contribution to increase knowledge on this topic. This study is possibly the first of its type in Ecuador and is of crucial importance for establishing a base line for future monitoring campaigns on the reforested areas of the project, but as it is the first estimation (only one point in time) the scope of the analysis remains limited.

The above ground biomass estimations based on allometric equations for secondary forest introduced error in the estimations performed. Firstly, because these equations were performed for consolidated forest, and secondly because the equations used diameter a breast height as single predictor variable and this parameter was not available in all of the cases as the majority of trees were smaller than 1.3 m. Also, the correction used for DBH in the allometric models introduced another source of the error in the estimation. As an alternative, basal area and tree height performed well as biomass indicators.

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