RESEARCH PAPER | Agriculture | Volume : 4 | Issue : 11 | November 2014 | ISSN - 2249-555X

Dynamics of Carbon Storage and Sequestration in Major Forest Tree Species of Andhrapradesh

KEYWORDS: *Carbon sequestration ,carbon storage.*

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ABSTRACT *Trees are major carbon pools on earth. By photosynthesis mechanism carbon flows in ecosystems and carbon converts by plants in the form of its biomass. Worldwide, decreasing forest cover due to increasing biopressure we are losing the number of trees every year; which leads to the climate change. From the data of tree's girth and height we estimated the carbon storage by non-destructive or allometric method. We estimated the carbon storage in ….. species belongs to AP, India. The maximum carbon storage in 55.95 t C followed by 44.81 tC in is concluded. The lowest carbon storage value estimated in 1.77 tC*

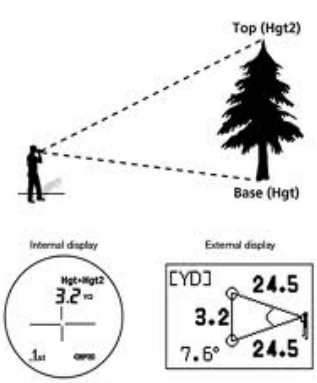
Introduction

Trees are amongst the most significant elements of any landscape, both due to biomass and diversity. Their key role in ecosystem dynamics is well known. However, it is paradoxical that the vegetation has undergone destruction and degradation in the modern times due to industrial and technological advancement achieved by human society. Trees are important sinks for atmospheric carbon i.e. carbon dioxide, since approximately 50% of their standing biomass is carbon itself. While all living plant matter absorbs CO_2 as part of photosynthesis, trees process significantly more than smaller plants due to their large size and extensive root structure. In essence, trees, as kings of the plant world, have much more "woody biomass" to store CO_2 than smaller plants, and as a result are considered nature's most efficient "carbon sinks". Carbon is stored in vegetation and in the soil. Plants store carbon for as long as they live, in terms of live biomass. Once they die, the biomass becomes a part of the food chain and eventually enters the soil as soil carbon. If the biomass is incinerated, the carbon is reemitted into the atmosphere and is free to move in the carbon cycle.

For instance in 2000, forest plantations occupied 116 Mha (million hectare) in Asia, 32 Mha in Europe, 28 Mha in America and 8 Mha in Africa.The forest cover that constituted 22.7 per cent of the total land area in India in 1952 has declined to around 19 per cent as against national objective of 33 per cent. The per capita forest cover is only 0.1 ha against the world average of 1.0 ha.Approximately 260 M ha land in India has biological potential of some use and quite suited to green house gases stabilization because of large surface area, microbial diversity, moisture content and pH buffering. In India during past, plant diversification seems to be changing from natural to artificial annual species leading to the extent depletion of soil carbon losses as 20 to 80 t carbon ha^{-1}, most of which has been released into the atmosphere (Lal, 2000). India with a total area of about 3029 million ha is considered to be one of the 12 mega biodiversity hotspots of the origins and diversity of several plant species. There is need to quantify the CO_2 sequestration content by these species to support the environmental concern. Acacia nilotica, Dalbergia sisso, Eucaltyptus teriticornis, Albezia lebbeck, Pongamia pinnata, Tectona grandis.

Materials and methods

In non destructive samples biomass was estimated by recording the tree height by altimeter and GBH by common tape. These recorded reading are use to estimate the biomass of existed trees by using preceding formulas



Volume : 4 | Issue : 11 | November 2014 | ISSN - 2249-555X

W = Above-ground weight of the tree in kgs

D = Diameter of the trunk in meters

H = Height of the tree meters

For trees with D < 11:

$W = 0.25D^2H$ x wood density

For trees with D >= 11:

$W = 0.15D^2H$ x wood density

DETERMINE THE DRY WEIGHT OF THE TREE

This is based on an extension publication from the University of Nebraska. This publication has a table with average weights for one cord of wood for different temperate tree species. Taking all species in the table into account, the average tree is 72.5% dry matter and 27.5% moisture. Therefore, to determine the dry weight of the tree, multiply the weight of the tree by 72.5%.

DETERMINE THE WEIGHT OF CARBON IN THE TREE

To determine the weight of carbon in the tree, multiply the dry weight of the tree by carbon content from individual sample and pool together to caliculate total corbon content in tree.

DETERMINE THE WEIGHT OF CARBON DIOXIDE SEQUESTERED IN THE TREE

CO2 is composed of one molecule of Carbon and 2 molecules of Oxygen.

The atomic weight of Carbon is 12.0

The atomic weight of Oxygen is 15.9

The weight of CO_2 is C+2=43.9

The ratio of CO_2 to C is 43.9/12.0 =3.6

Therefore, to determine the weight of carbon dioxide sequestered in the tree, multiply the weight of carbon in the tree by 3.6

DETERMINE THE WEIGHT OF CO_2 SEQUESTERED IN THE TREE PER YEAR

Divide the weight of carbon dioxide sequestered in the tree by the age of the tree.

STASTICAL ANALYSIS

The data obtained from experiment were subjected to standard methods of statistical analysis as given Snedecor and Cochron (1967) using in house software package at computer center, Acharya N G Ranga Agriculture University, Rajendranagar, Hyderabad.

Name of tree species	GBH (meter)	Height (meter)	Wood Density (Gcm^{-3})	Fresh Tree Biovolume (Kg)	Dry weight (Kg)	C (Kg)	Co2 (Kg)
Acacia nilotica	0.90	2.6	0.88	4633	3359.07	1679.535	6046.326
Azadiracta indica	0.41	2.8	0.69	8119	588.6442	294.3221	1059.56
Bombax ceiba	0.45	3.7	0.33	6181	448.1452	224.0726	806.6613
Eucalyptus tereticus	0.40	7	0.64	1792	1299.2	649.6	2338.56
Albergia lebbeck	0.50	6	0.55	2062	1495.313	747.6563	2691.563
Pongamia pinnata	0.33	7.4	0.58	1168	847.1603	423.5802	1524.889
Tectona grandis	0.30	5.1	0.50	5737	415.9688	207.9844	748.7438
Cyzygium nitidum	0.21	6.7	0.74	5466	396.2991	198.1496	713.3384
Dalbergia sizzo	0.65	9.5	0.75	7525	5456.191	2728.096	9821.145
Sterculia	0.52	8	0.67	36233	2626.936	1313.468	4728.485

Morinda tinctoria	0.61	4.7	0.52	22735	1648.31	824.155	2966.958
Emblica officinalis	0.53	5.8	0.80	32584	2362.369	1181.185	4252.264
Terminalia arjuna	0.62	7	0.68	45743	3316.411	1658.206	5969.54
Terminalia tomentosa	0.40	5.5	0.73	1606	1164.35	582.175	2095.83
Ziziphus zuzuba	0.50	8.1	0.76	3847	2789.428	1394.739	5020.988
Ziziphus talanai	0.33	7.5	0.53	10821	784.3905	392.2952	1412.263
Samanea saman	0.48	6	0.43	1553	1127.32	563.76	2029.536
Tamarindus indica	0.60	5.3	0.75	3577	2593.888	1296.944	4668.998
Adenanthera pavonina	0.42	2.5	0.56	6174	447.615	223.8075	805.707
Madhuca indica	0.66	6	0.53	3463	2510.69	1255.345	4519.241
Ficus religiosa	0.39	4.2	0.39	142547	1033.963	516.7817	1860.238
Ficus indica	0.60	2.6	0.28	6552	475.02	237.51	855.036

RESULTS AND DISCUSSION

Table

Results and discussion

The present article records 98000 trees , which pertain to 22 genera of 20 families of flowering plants. Myrtaceae is the dominant family species, followed by Lamiaceae , Fabaceae, Mimosaceae, Rutaceae . Tiliaceae , Meliaceae , Cordiaceae , Lauraceae. The present tree species under study most of them belongs to tropical decidues and ever green which are dominant in global carbon sequestration phenomena. The tree species under study wood density higest in Acacia nilotica 0.88 g cm^{-3} and lowest with 0.33 g cm^{-3} it imparts to its genetic nature. In tree biomass criteria lowest recorded in Samanea saman 1555 kg tree at silimiar climatic conditions of A.P. other tree species tree biomass varied from 1555 to 8119 kg tree in accending order from Samanea saman to Azadiracta indica . tree carbon content highest recorded in Dalbegia sissoo 2728.096 kg c $tree^{-1}$ it imparts to its high energy conversion efficeny and high photosynthetic rate of tree cells. In remain tree species under study Acacia nilotica recorded more carbon accumulation 1679.535 kg c $tree^{-1}$ followed by Ziziphus zuzuba 1394.71 kg c $tree^{-1}$ and lowest being recorded in Cyzygium nitidum 198.14 kg c $tree^{-1}$ it imparts to it slowgroing

Volume : 4 | Issue : 11 | November 2014 | ISSN - 2249-555X

nature of tree species. Highest carbon sequstraion recoreded 9821.145 kg co_2 $tree^{-1}$ in Dalbergia sissoo followed by acacia nilotica 6046.326 kg co_2 $tree^{-1}$ Terminalia arjuna 5969.54 kg co_2 $tree^{-1}$ and lowest recorded in Cyzygium nitidum 713 kg co_2 $tree^{-1}$. the tree species under tropical deciedues nature showed medium range of carobon sequesrtrain levels 2966.958 to 1059.56 kg co_2 $tree^{-1}$ when compared to tropical ever green tree species which varied from 5020.988 to 4252.264 kg co_2 $tree^{-1}$ and lowest carbon sequestratin recoded in 855.036 to 713.3384 kg co_2 $tree^{-1}$ .the varitation in carbon sequestion level imparts to tree genetic nature and place of its existence and showed a great impact in in Co2 sequestration of existed tree species.

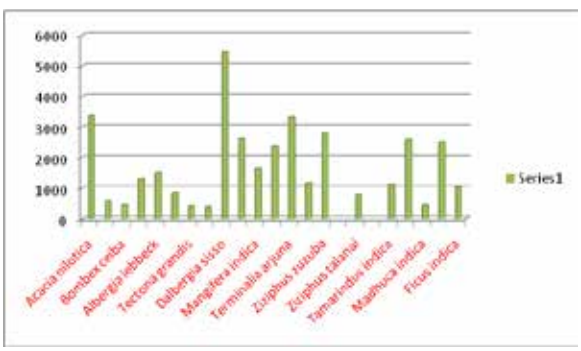


Table:1 Tree species wood density variance.

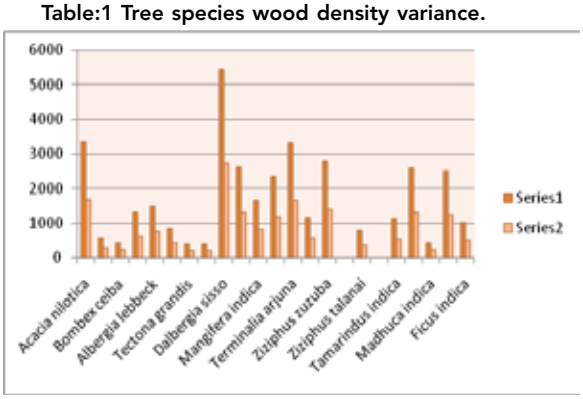


Table2 : Carbon content and co2 of tree species.

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Volume : 4 | Issue : 11 | November 2014 | ISSN - 2249-555X

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