International Journal of Advance Research in Science and Engineering
Volume No.10, Issue No. 05, May 2021
www.ijarse.com
IJARSE
ISSN: 2319-8354

Carbon Sequestration Capacity Assessment of different Trees

Chetan S. Dhanjode[1]

[1] *Research Scholar (Civil Engineering), GH Raisoni University, Amravati and Assistant Professor (Civil Engineering), KDK College of Engineering, Nagpur, Maharashtra, India*

ABSTRACT

Carbon Sequestration is artificial or natural process by which carbon dioxide is removed from the atmosphere and held in solid or liquid form. It is also defined as the carbon sequestration is capture and conversion of atmospheric CO_2 into a different form, which will not increase the global warming. To achieve this plantation has been an inevitable process. To understand which tree sequestrate how much carbon is required to explore. The present study has been done on 10 different species of treesto know their carbon sequestration capacity. Theabovegroundbiomass and below ground biomass were calculated. Non-destructive technique was applied to determine the above ground biomass. The result obtained is used to predict the carbon storage capacity of individual tree.

Keywords:*Carbon, Sequestration, Girth, Biomass*

INTRODUCTION

Carbon Sequestration is artificial or natural process by which carbon dioxide is removed from the atmosphere and held in solid or liquid form. It is also defined as the carbon sequestration is capture and conversion of atmospheric CO_2 into a different form, which will not increase the global warming. Due to increase in the burning of fossil fuels the greenhouse gases are Increasing that give rise to global surface temperature. At present, the global concentration of CO_2in the atmosphere is increasing. Greenhouse gases emissions are major contributor to the global warming. Greenhouse gases emissions contain about 77% of CO_2.[3] The permissible CO_2 concentration in atmosphere is 350ppm but the mean CO_2 concentration in atmosphere is 400ppm as per the Inter- governmental Panel on Climate Change (IPCC)[3]. Increasingly convincing evidences show that the Earth is getting warmer and in the future warming could have serious effects on affect human. In perennial crops carbon sequestration is the inbuilt mechanism in which the trap CO_2 from atmosphere to transfers it into a range of products varying from flower, fruits, seeds, in doing, so they reduce the atmospheric carbon level. Storing CO_2 underground to curb is known as carbon sequestrationprocess.

Now a days,deforestation and industries are increasing and it is major cause of increasing in CO_2. For decreasing the carbon content on the Earth, we can do plantation for carbon sequestration and minimizing land degradation. For effective utilization, Medicinal and local species can be used. This can also improve the quality of land. Photosynthesis and respiration are the main processes accounting for capture of carbon dioxide by trees. Using the energy of sunlight, photosynthesis converts water and carbon dioxide into carbohydrates and

oxygen which directly results in the reductionofcarbon dioxide in the atmosphere.[9] Mature trees do not absorb extra carbon dioxide, whereas young growing trees do capture carbon dioxide. Depending upon age, climate, type of region and soil, a hectare of trees capture 1-10 tons of carbon dioxide per year. Hence, there is a need to plant more trees and tree plantation need to promote on large scale.

METHODOLOGY

Collection of Data

Following parameters are required to compute the carbon sequestration capacity:

- ✓ Height oftrees
- ✓ Girth oftree
- ✓ Temperature andHumidity
- ✓ Root Shoot Factor

Height oftrees

By using tachometric surveying, Tree height was measured by Theodolite at DBH. The angle between the tree top and eye view at breast height angle (α) and angle of depression (β) is taken for the calculation of height of thetrees.

Girth oftree

Girth is a measurement of the distance around the trunk of a tree measured perpendicular to the axis of the trunk. It is measured at breast height, or at 4 feet above ground level. Temperature and Humidity at the intervals of 1 hr were noted down temperature and humidity of atmosphere.

Root-ShootFactor:

The root-shoot ratio is usually given as the ratio of the weight of the roots to the weight of the top of a plant. For most trees under normal conditions, the root-shoot ratio is 1:5 to 1:6 the top is 5 to 6 times heavier than the roots. If it were not for the weight of the trunk, however, the top and roots would weigh about thesame

Calculations

Measurement of tree height and diameter at breast height (DBH)

To estimate biomass of different trees, non-destructive method was used. The biomass of tree was estimated based on DBH and tree height. DBH can be determined by measuringtreeGirthatBreastHeight(GBH),approximatelymeterabovetheground.TheGBHoftreeshavingdiameter greater than 10 cm were measured directly by measuringtape.[1]

Above Ground Biomass (AGB) Of Tree:

The above ground biomass of tree includes the whole shoot, branches, leaves, flowers and fruits. It is calculated using the following formula:

AGB (kg) = Volume of tree (m^3) X wood density kg/m^3 (1)

$V=\pi r2h$ (2)

where,

V = volume of the cylindrical shaped tree in m^3

R = Radius of the tree in meters

H = Height of the tree in meter

Radius of the tree is calculated from GBH of tree wood density is used from Global density database. The standard average density is 0.6 gm/cm [1].

Estimation Of Below Ground Biomass (BGB)

The below ground biomass (BGB) includes all biomass of live roots excluding fine roots. The BGB has been calculated by multiplying AGB X 0.167 factors as the rootshoot ratio, BGB is calculated by following BGB (kg/tree) = AGB (kg/tree) X 0.167[1].

Estimation of Total Biomass:

Total biomass is the sum of the above and below ground biomass [1].

TB = AGB + BGB (kg/tree).

Estimation of Carbon:

Generally, for any plant species 50% of its biomass is considered as carbon.

Biomass X 50 %[1]

Determination of the Weight of Carbon dioxide Sequestered in The Tree:

The weight of CO_2 is C + 2 X O = 44.01

Hence, the ratio of CO_2 to C is calculated as: 44.017/12.0107 = 3.664

Where, Weight of CO_2 is 44.01 g/mol Weight of C is 12.0107 g/mol

Therefore, in order to determine the weight of carbon dioxide sequestered in the tree, the weight of carbon in the tree is multiplied by3.664[1].

Result

Table 1 shows the carbon stored by trees of 10 different species it has been found that Azadiractaindica (Neem) is tree species, which sequestrates carbon in large amount. In addition, it has been found that Mesuaferrea (Nag chafa) is sequestrating less amount of carbon.

SN	Name of Tree	Nos	Average Carbon Sequestration (Kg)	Density of Tree	Carbon Sequestration per m^2	Total CO_2 Sequestration in tons
	Badam (Prunus dulcis)	9	7.16	0.000	0.001	0.580
	Nilgiri(Eucalyptus obliqua)	33	34.16	0.000	0.017	37.200
	Iron wood (Casuarine)	1	21.75	0.000	0.000	0.022
	Kavath (Limoniaacidissima)	17	0.346	0.000	0.000	0.100
	Bakayan (Melia azedarach linn)	1	13.78	0.000	0.000	0.014

	Golden rain Tree (Golden rain tree (casio))	9	0.51	0.000	0.000	0.041
	Madhumalti (Combretum indicum)	2	0.47	0.000	0.000	0.002
	Nag Chafa (Mesua ferrea)	15	4.15	0.000	0.001	0.934
	Areca palm (Dypsislutescens)	12	0.367	0.000	0.000	0.053
	Saptaparni (Alstoniascholaris)	9	7.72	0.000	0.001	0.625

Table 1 Carbon sequestration

CONCLUSION

Plantation is a natural process of capturing carbonfrom the atmosphere. From this case study it has been found that Azadiractaindica (Neem) is sequestrating maximum amount of carbon from the atmosphere. Therefore, it has been suggested that to plant morenumber of Azadiractaindica (Neem) treetokeepsurroundinghealthy.

REFERENCES

1. Mary Saral, et al. “Carbon Storage And Sequestration By Trees In VIT University, Vellore” , Material Science and Engineering, 2017, 263,.
2. Chu-Lin Cheng, et al.“Impact of the capillary pressure-saturation pore-size distribution parameter on geological carbon sequestration estimates”, School of Earth, Environmental & Marine Sciences, Dept. Civil Engineering, University of Texas-Rio Grande Valley, Edinburg, 2017, TX 78539.
3. Farahiyah Abdul Rahman et al, “Pollution To Solution: Capture And Sequestration Of Carbon Dioxide And Its Utilization As A Renewable Energy Source For A Sustainable Future”
4. Chinchu Ann James, et al. “Assessment of Spatio-Temporal Changes In Terrestrial Carbon Sequestration Due To Kochi Metro Rail Project”, IOP Conf. Series: Urban Climate, 2017.
5. Wenjie Wang, et al. “Ranking Thirteen Trees Species Based On Their Impact On Soil Physiochemical Proper- ties, Soil Fertility, And Carbon Sequestrations In North- Eastern China”, IOP conf: Forest Ecology and Management, 2017, 214-229.
6. Chu-Lin Cheng, et al.“Impact of the capillary pressure- saturation pore-size distribution parameter on geological carbon sequestration estimates.” School of Earth, Environmental& Marine Sciences, Dept. Civil Engineering, University of Texas-Rio Grande Valley, Edinburg, 2017, TX 78539
7. Prerak Bhatnagar, et al. “Carbon Assimilation Potential Of Nagpur Mandarin”, International Journal of Science, Environmental and Technology, Vol. 5, No.3, 2016, 1402- 1409.

8. Vinod Krishna Sethi, et al. "An Innovative Approach for Carbon Capture & Sequestration on a Thermal Power Plant through Conversion to Multi-Purpose Fuels – A Feasibility Study in Indian Context", 13th International Conference on Greenhouse Gas Control Technologies, GHGT-13, 14-18,2016.
9. Ing-Marie Gren, et al. "Policy design for forest carbon sequestration: a review of the literature", Forest Policy and Economics 2016, 128–136.
10. KeredinTemamSiraj,etal,"PotentialDifferenceofTree Species on Carbon Sequestration Performance and Role of Forest Based Industry to the Environment" AdamaScience and Technology University,Ethiopia2016
11. Jinxun Liu, et al. "Estimating carbon sequestration inthe piedmont eco-region of the United States from 1971 to 2010" carbon balancemanage2016.
12. Peter Folger, "Carbon Capture And Sequestration : Research,Development,AndDemonstrationAtThe
13. U. S. Department Of Energy", Congressional Research Service 75700, 2014
14. Dennis Y.C. Leung, et al, "An Overview of Current Status Of Carbon Dioxide Capture And Storage Technologies" Department of Mechanical Engineering, The UniversityofHongKong,2014
15. PanchsheelaNogia, et al, "Capturing Atmospheric Car- bon: Biological And Non-Biological Methods", International Journal of Low-Carbon Technologies 2016, 266-274
16. Prachi Ugle, et al. "Carbon Sequestration Potential Of Urban Trees", Lake 2010:Wetlands, Biodiversity and Climate Change, 2010.
17. Jelly G Minnen, et al. "Quantifying the Effectiveness of Climate Change Mitigation through Forest Plantations and Carbon Sequestration with an Integrated Land Use Model" carbon balancemanages, 2008.