Carbon Sequestration Assessment of Campus Trees

Introduction

Climate change is a major global challenge. To mitigate this, multidimensional approaches are practiced and recommended by the various expert committees. Reducing the production and emission of greenhouse gases are major among them.

Carbon dioxide is the most commonly produced greenhouse gas. Carbon sequestration is the process of capturing and storing atmospheric carbon dioxide. It is one method of reducing the amount of carbon dioxide in the atmosphere.

This report of Sri DharmasthalaManjunatheshwara College (Autonomous) Ujire, accomplishes the collection, analysis, and assessment of carbon sequestration taking place in the entire campus of the institution.

Area covered under the study

The campus flora of Sri DharmasthalaManjunatheshwara College (Autonomous) Ujire has been considered to collect, analyze and assess the carbon sequestration.

A visual survey of the campus has been conducted to segregate the whole area into different blocks. Area, Density of plantation, Nature of landscape are the key characters considered for identifying the blocks.

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Table 1: Details of the blocks considered in the present study.

Block No	Location	Approx Area (sq.ft)	Landscape
1	College Backside	30,854	Tree plantation
2	Botanical Garden	19289	Tree plantation
3	Front lawn	58,676	Lawn & Garden
4	Indraprastha	108,657	Tree Plantation
5	College Quadrangular	48,798	Tree Plantation
6	Polypetalae Block	24,595	Tree Plantation
7	Gamopetalae Block	8,272	Tree Plantation
8	TriphalaVana	18,664	Tree Plantation
9	In situ Forest	25,908	Natural Forest
10	Thematic blocks	85,342	Tree Plantation

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Methodology

Collection of data

To collect the data required to calculate carbon sequestration, a group of students was selected, trained to measure the diameter at breast height (DBH) of the trees usingappropriate methods, Guided to identify the plant species either with a common name or with its botanical name.

Data has been collected from all the ten designated blocks through a Google form made for this purpose.

The above method was used for all the blocks except for the front lawn area where the sequestration data was collected by measuring the approximate area with the help of Google Earth.

Analysis of Data

The method of analysis has been designed based on the available data on the internet as there is less availability of data on specific standard methods.

The analysis was done by using Google sheets with the help of relevant functions appliedbased on the below parameters.

1. Determine the total (green) weight of the tree.
2. Determine the dry weight of the tree.
3. Determine the weight of carbon in the tree.
4. Determine the weight of carbon dioxide sequestered in the tree
5. Determine the weight of CO2 sequestered in the tree per year

The approximate age of the plant has been assigned using indirect non-destructive dendrochronological methods.

Determine the total (green) weight of the tree

the algorithm to calculate the weight of a tree used in this study is:

W = Above-ground weight of the tree in kg

D = Diameter of the trunk in inches

H = Height of the tree in feet

For trees with D < 11: W = 0.25D2H

For trees with D >= 11: W = 0.15D2H

Depending on the species, the coefficient (e.g. 0.25) could change, and the variables D^2 and H could be raised to exponents just above or below 1. However, these two equations could be seen as an “average” of all the species’ equations.

The root system weighs about 20% as much as the above-ground weight of the tree. Therefore, to determine the total green weight of the tree, multiply the above-ground weight of the tree by 120%.

Determine the dry weight of the tree

To determine the dry weight of the tree, multiply the weight of the tree by 72.5%. As per recommendation from an extension publication from the University of Nebraska.

Determine the weight of carbon in the tree

The average carbon content is generally 50% of the tree's total volume.5 Therefore, to determine the weight of carbon in the tree, multiply the dry weight of the tree by 50%.

Determine the weight of carbon dioxide sequestered in the tree

CO_2 is composed of one molecule of Carbon and 2 molecules of Oxygen. The atomic weight of Carbon is 12.001115.

The atomic weight of Oxygen is 15.9994.

The weight of CO2 is C+2*O=43.999915.

The ratio of CO2 to C is 43.999915/12.001115=3.6663.

Therefore, to determine the weight of carbon dioxide sequestered in the tree, multiply the weight of carbon in the tree by 3.6663.6

To determine the weight of CO_2 sequestered in the tree per year by dividing the weight of carbon dioxide sequestered in the tree by the age of the tree.

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Assessment Results

Total 9.85 acres of the green cover area comprising more than 1450 individual trees were Identified and measured for their DBH and height. The details can be obtained through this link Co2 Sequestring Data (Responses)

Blockwise carbon sequestration contribution has been represented in the form of a graph.

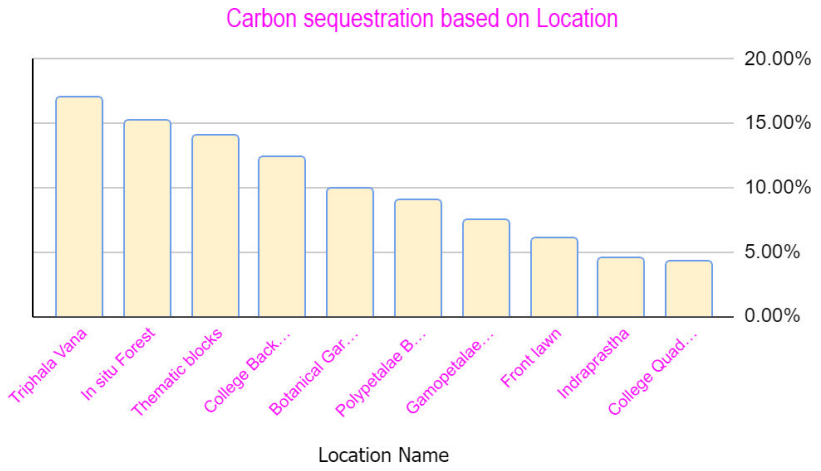

Image 1: Graph showing Carbon sequestration based on location- The College campus has an average density of **276 trees per Acre**. Which are able to sequester **13,553 kg of carbon per year**.

Block No	Location	CO2 Sequestration /Year (KG)	Contribution	Total Plants	Area in Acre	Density
1	College Backside	1681	12%	188	0.708	265.4
2	Botanical Garden	1351	10%	122	0.443	275.5
3	Front lawn	817	6%		1.347	NA
4	College Quadrangular	569	4%	48	2.494	19.2
5	Indraprastha	616	5%	86	1.120	76.8
6	Polypetalae Block	1227	9%	167	0.565	295.8
7	Gamopetalae Block	1020	8%	113	0.190	595.1
8	TriphalaVana	2311	17%	284	0.428	662.8
9	In situ Forest	2061	15%	247	0.595	415.3
10	Thematic blocks	1898	14%	305	1.959	155.7

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Conclusion

The above data suggests that the college has maintained very good tree cover in the campus on par with any agroforestry system (276 trees/acre). These trees can take almost 20,000 L of Carbon dioxide from the atmosphere to sequester around 37 kg of Carbon per day. This essentially magnifies that nearly 7.5 lakh L of carbon dioxide gets fixed within the campus. This is a good contribution to reduce the emission of greenhouse gases into the atmosphere which gets involved in climate change. The tree cover also gives the opportunity to conduct an open classroom, reduces the use of fans by cooling the surrounding air, and also aesthetic value to the campus.

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