Estimation Of Carbon Sequestration By Some Selected Dominant Tree Species Of Devarayana Durga Forest Region Of Karnataka.

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ABSTRACT
This study aimed to assess the carbon content of selected tree species at Devarayana Durga Forest Region of Karnataka by evaluating their aboveground and belowground biomass to estimate carbon sequestration. A total of 252 trees belonging to 20 different species were identified within a designated area of the Durga Forest Region in Tumkur district of Karnataka. Non-destructive techniques were employed to measure the total biomass and quantify the carbon stored by each tree species. The organic carbon present in both aboveground and belowground parts (tons per tree) was calculated for each species, along with the overall organic carbon stock. The total carbon stored by the various tree species was found to be 18794.69 tons. The results from this study will help to estimate levels of atmospheric CO2 that could be sequestered by tree in Devarayanadurga forest region of Karnataka. Therefore, an attempt has been made to collect the data on biomass and carbon sequestration potential in selected plant species. The present findings may be used as baseline information for developing prediction models for probable effects of different forest land, future intervention and sustainable management of land use systems in this region.

Key words: Biomass, Carbon sequestration, Non-destructive and Ground Biomass

1. Introduction

Carbon, the fourth most abundant nonmetallic element in the universe, is essential for all living things on Earth, from the atmosphere to the sea and land. Carbon is a basic component necessary for life to function and is found in various reservoirs on Earth, including the atmosphere, lithosphere, oceans, and regions. Carbon dioxide (CO2), a gas composed of carbonic acid, accounts for approximately half of the carbon in the atmosphere, and can also occur as paraffin (CH4) and carbon monoxide gas (CO)(Korhonen, R et al., 2002).

The carbon gift on the surface is divided into three types: elemental, inert, and carbon-based. The fundamental carbon in soils and deposits is primarily derived from incomplete incineration destruction from earth science springs or distribution during excavation, processing, and incineration (Schumacher, B. A., 2002). Soil contains inanimate carbon primarily in carbonate minerals like carbonate (CaCCb) and dolomite (CaMg). The disintegration of shrubberies and animals leads to the presence of biological carbon forms. Good-form topsoils contain litter from recently dumped greeneries, insects, and twigs, as well as unpleasant organic matter like humus (Buringh, P. 1984). Herbal clutter or microbic biomass are crucial for biological matter soil production, as they utilize carbon as an element in photosynthesis, respiration, burning, or burial processes of organic matter(Kumar, N., & Kumar, J. 2023).

Photosynthesis converts carbon dioxide into essential carbohydrates like sugar and cellulose. Trees, which store large amounts of carbon in their wood, are unique sources of carbon. Carbon must be removed from the atmosphere and stored in another location. Plant tissues like wood can permanently store carbon dioxide through carbon sequestration. Carbon dioxide absorbs half of terrestrial radiation responsible for the greenhouse effect. As atmospheric CO2 concentrations increase, emissions of carbon dioxide are on the rise, and the Kyoto Protocol aims to address this issue (Ravindranath, N. H. et al., 1997) and The UN Framework Convention on Climate Change (UNFCCC) has not effectively addressed the issue of reducing atmospheric CO2. Succulent plant life, soil, and ocean water all contribute to the global effort to reduce CO2. Trees, which absorb and store CO2 during growth, are a major sink for carbon dioxide. Urban tree planting could help reduce atmospheric CO2 concentrations by storing carbon dioxide in the form of biomass. Trees in urban areas provide direct carbon storage and reduce CO2 emissions, stabilizing the natural ecosystem and maintaining climatic conditions through biogeochemical processes. Urban vegetation, when managed properly, has greater effects and values than non-urban forests due to faster growth rates and increased tree proportions.
Non-destructive and allometric methods estimate carbon storage, including bole volume and tree biomass. Techniques exist for estimating tree biomass, either destructively or nondestructively (Loetsch, F et al., 1997).

Figure 1: Devarayanadurga Hill Forest Map.

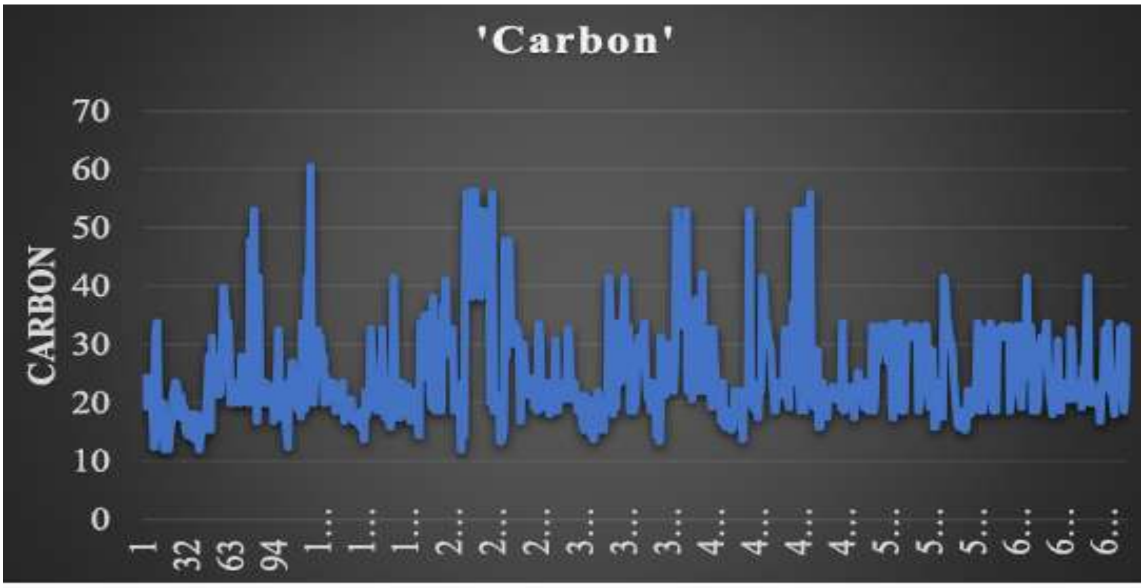

Figure 2: It was the denoted that that the total carbon in the form of the EKG (Electrokardiogram lines).

Tree volume is determined using an allometric equation, which measures tree biomass by multiplying its volume by its density. Researchers have developed various equations, based on factors like forest type, density, and tree height range (Tiwari, A. K., 1992). An allometric model of a hardwood oak forest in the northern Sierra de Oaxaca was developed to determine the most suitable equation.

SI . No	Scientific name	Number of tree
1.	*Acacia nilotica*	32
2.	*Albizia lebbeck*	30
3.	*Azardirachta indica*	28
4.	*Bauhinia raemosa*	24
5.	*Butea monosperma*	22
6.	*Cassia fistula*	21
7.	*Dalbergia sisso*	12
8.	*Delonix regia*	9
9.	*Eucalyptus citriodora*	9
10.	*Eucalyptus globulus*	7
11.	*Ficus bengalensis*	7
12.	*Ficus religiosa*	7
13.	*Hyophorbe amercaulismort*	6
14.	*Leucaena latisiliqua*	6
15.	*Mangifera indica*	6
16.	*Peltaforum pterocarpum*	5
17.	*Pithecellobium dulce*	5

18.	*Polyalthia longifolia*	5
19.	*Pongamia pinnata*	5
20.	*Tamarindus indica*	5
Grand total		252

Table 1: Field data of trees studied from Devarayanadurga forest area.

A traditional allometric model was developed in northern Mexico to estimate expansion factor and biomass accumulation. Brazil's total aboveground biomass is 3.6 0.8 Pg, including non-forest biomass. Plant height and diameter are critical factors in determining above-ground biomass (AGB) (Navar, J., 2010).

2. Material and Methods

2.1 *Study area*

The Devarayanadurga was prominent hill peak (1,169m) of Tumkur District. It is located 15km away from Tumkur city. Alluvial and Red loamy soils in this region have a high fertility level and are flat and rich. With an average annual rainfall of around 901 mm, the temperature ranges from 10 ^{0}C to 42 ^{0}C. Every now and then, the South west Monsoon, western disturbance also showers the region with a few winter showers.

2.2 *Estimation of biomass*

In the Devarayana Durga hill forest a non-destructive method to estimate tree biomass, calculating the diameter of the trunk at chest height and the height of the tree from February through March. Ecologists used both destructive and non-destructive approaches to estimate university biomass. The destructive method requires all trees to be cut down, which is not suitable for mature forests. Instead, allometric equations can be used to calculate tree biomass without harming them.

The tree's biomass is calculated by combining the biomass of its roots, leaves, trunk, branches, fruits, and flora. To obtain the correct degree of biomass, the method can be reduced, allowing for the calculation of wood biomass in a more accurate manner. The study uses the ocular approach to measure the peak of a tree, which can be measured using a 1.5 m or 5ft height, which could be 154 cm. The total distance from the tree base is calculated from a distance of approximately three meters. A wide variety of 1.5 m sections from the base to the tree pinnacle are counted and improved using the 1.5 method to get the peak of the tree in meters (Sreejesh, K. K., 2013).

2.3 *Height measurement of tree*

The biomass of a tree can be calculated using a mathematical prototype, which measures the diameter, breast height, and girth of the tree without the need to cut it (Chavan, B. L., & Rasal, G. B., 2010).
Diameter is taken up to approx.: _ 1.5 m.
For the height of tree:
Place the distance from the object = L (Consider).
Angle of elevation = 90^0.
Height of tree from eye level = d.
Tan X=$\frac{l}{h}$ (l = distance between yourself and object).
(h = height of Object).
H $\frac{1}{tanX}$
Total.H = $\frac{1}{tanX}$ + d (d = height of eye from the Ground).

2.4 *Exceeding ground biomass*

The Exceeding Ground Biomass (EGB) of the soil can be calculated by multiplying the biomass volume and using the wood density calculated based on the diameter and height taken (Pandya, I. Y., et al, 2013).

2.5 *Beneath ground biomass of tree*

The beneath ground biomass (BGB) of a tree can be calculated by multiplying the present roots and finest rots with the assumed shoot or root ratio of 0.26, as per the given method (Houghton, R. A., et al., 2012).
Beneath ground biomass (BGB) = 0.26 × Exceeding ground biomass.

2.6 *Total biomass*

The total biomass calculation involves adding both the tree's above ground biomass and beneath biomass.
Total Biomass = Exceeding Ground Biomass + Beneath Ground Biomass.

2.7 *Estimation of carbon in tree*

The estimation of carbon in any plant species can be based on 50% of the biomass or on a specific pattern.
Carbon can Storage in tree = Biomass multiply 50% or we can use the Biomass can divided by 2.
Total carbon storage = 0.5 × Total biomass.

3. Results

The 252 number of 20 species of trees present on Devarayanadurga forest area of Tumkur city is presented in Table number 2. The sum of carbon (t/tree) in the trees studied is summarized in Table No. 2. The sum of carbon Carbon in *Acacia nilotica* is 2808.68. It is followed by *Albizia lebbeck* is 1694.73, *Azardirachta indica* is 2178.03, *Butea monosperma* is 2596.19, *Bauhinia raemosa* is 1916.14, *Cassia fistula* is 1355.2, *Dalbergia sisso* is 1173.9, *Delonix regia* is 779.2, *Eucalyptus citriodora* is 777.9, *Eucalyptus globules* is 681.2, *Ficus bengalensis* is 571.6, *Ficus religiosa* is 533.1, *Hyophorbe amercaulismort* is 435.5, *Leucaena latisiliqua* is 417.5, *Mangifera indica* is 222.3 and remaining all tree having less than 200 t/tree.

SI . No	Scientific name	Sum of carbon
1.	*Acacia nilotica*	2808.68
2.	*Albizia lebbeck*	1694.73
3.	*Azardirachta indica*	2178.03
4.	*Bauhinia raemosa*	1916.14
5.	*Butea monosperma*	2596.19
6.	*Cassia fistula*	1355.2
7.	*Dalbergia sisso*	1173.9
8.	*Delonix regia*	779.2
9.	*Eucalyptus citriodora*	777.9
10.	*Eucalyptus globulus*	681.2
11.	*Ficus bengalensis*	571.6
12.	*Ficus religiosa*	533.1
13.	*Hyophorbe amercaulismort*	435.5
14.	*Leucaena latisiliqua*	417.5
15.	*Mangifera indica*	222.2
16.	*Peltaforum pterocarpum*	171.6
17.	*Pithecellobium dulce*	161.6
18.	*Polyalthia longifolia*	109.6
19.	*Pongamia pinnata*	108.42
20.	*Tamarindus indica*	102.4
Grand total		18794.69

Table 2: Total number of carbon storage in tree species.

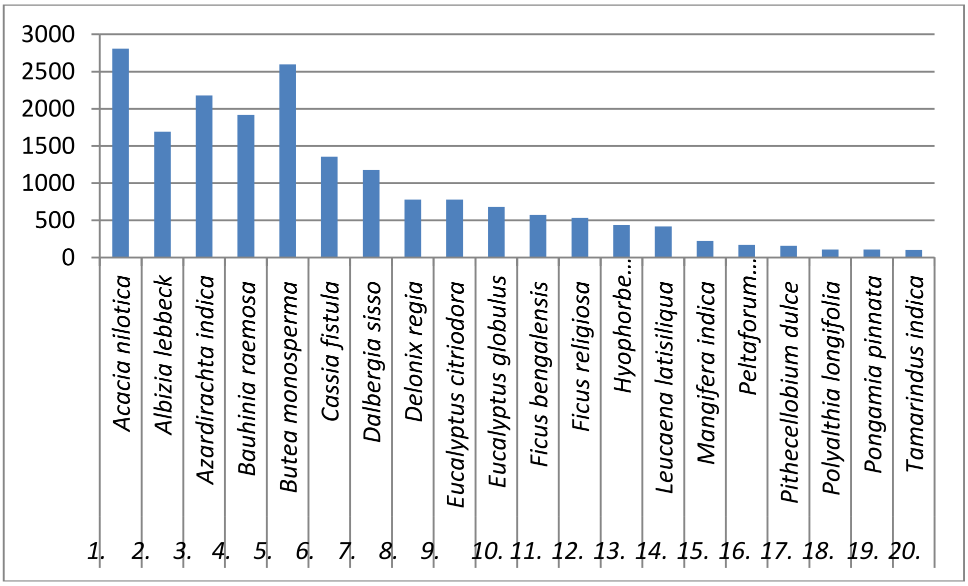

Fig 1: In the Pivot Chart analysis, it was the denoted that in *Acacia*, *Albezia*, *Azadirachta*, *Bahuhinia* and *Butea* has noticeably higher 'Carbon found in it.

4. Critical discussion

This study documents field data collected from Devarayana Durga forest, observing over 252 species in the surrounding area. Carbon sequestration is the process of capturing and storing carbon dioxide from the atmosphere or industrial processes to reduce climate change. It occurs through natural and artificial processes, removing CO2 from the atmosphere and storing it in reservoirs like soil, plants, oceans, and geological formations. Carbon sequestration occurs naturally through photosynthesis, where plants absorb and store CO2 from the atmosphere, and organic matter formation in soils. This process is crucial as CO2 is a primary greenhouse gas contributing to global climate change. It is released into the atmosphere through natural processes like respiration, volcanic activity, and human activities like burning fossil fuels, deforestation, and land use changes.

Carbon sequestration is crucial as rising atmospheric CO2 levels cause global temperatures to rise, causing severe weather events like heat waves, droughts, wildfires, storms, flooding, and changes in precipitation patterns. However, carbon sequestration can also mitigate climate change effects by reducing the amount of carbon dioxide in the atmosphere, slowing global warming and resulting in positive environmental effects. This process can help mitigate the negative impacts of climate change.

5. Conclusion

The Devarayanadurga was prominent hill peak (1,169m) of Tumkur District, According to a recent report by the World Resources Institute, produces over 70% of global CO2 emissions due to it is very near to city, economic activity and energy consumption. Factors such as population, transportation, and industrial activity contribute to its carbon dioxide emissions. Despite occupying only 2% of the Earth's surface, urban areas contribute significantly to global emissions.

Devarayanadurga hill is a wonderful place with various species due to the fieldwork that may be done there. We found 252 species at Devarayanadurga forest cover using available data. The forest area has the most *Acacia nilotica* plants in the region, according to the statistics. Experiment detected 7 species. The second number is a *Albizia lebbeck* species with 5 variants on campus. *Azardirachta indica* is third on the 3-species list. *Bauhinia*, *Butea*, *Cassia fistula*, *Dalbergia sisso* and *Eucalyptus* are low-abundance species in the forest area. *Pongamia* and Tamarindus Tree are low-frequency species on Forest. Trees are effective carbon sequestration tools, absorbing and storing significant amounts of carbon over their lifetimes. Fast-growing tree species can sequester carbon quickly, reducing 8.7 metric tons of CO2 from the surrounding environment. Trees and other plants absorb carbon dioxide (CO2) from the air and store it in their tissues through photosynthesis. Planting trees and protecting forests can lower CO2 levels, improve soil health, reduce erosion, and promote biodiversity. Conservation practices like tillage, cover cropping, and reforestation also store carbon. The use of public transportation, electric vehicles, and active transportation like walking or cycling can also reduce emissions.

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