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Original Research Article

Assessment of Biomass and Carbon Stocks in *Delonixregia* species in Vindhyas Series

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A B S T R A C T

It was observed that highest biomass in sites no.7 the *Delonixregia* tree was containing highest aboveground biomass, belowground biomass and total standing biomass (6.02tha^{-1}, 1.57tha^{-1} and 7.59tha^{-1}) and total carbon was observed 3.79 tha^{-1}. The carbon sequestration by the *Delonixregia* in this site was 13.9 tCO_2 and lowest biomass in site no. 1. In this site was observed above ground biomass, below ground biomass and total standing biomass (0.72 tha^{-1}, 0.19 tha^{-1} and 0.91 tha^{-1}) and total carbon was observed 0.45 tha^{-1} the carbon sequestration by the *Delonixregia* in this site was 1.65tCO_2. The *Delonixregia* tree containing total aboveground biomass, belowground biomass and total standing biomass in 4957 trees all nine sites was observed in (30.25tha^{-1}, 7.86tha^{-1} and 38.11tha^{-1}) and total carbon in all nine sites was observed 19.06 tha^{-1} the carbon sequestration by the *Delonixregia* in all nine sites was 69.95 tCO_2.

Keywords

Biomass Estimation, Allometric Equation, Tree Height, Wood Density, Carbon Stocks

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 localities 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 (Tam *et al.*,1995; Saintilan 1997; clough *et al.,* 1997; Ross *et al.*,2001 Liao *et al.*,2004; comely and McGuinness 2005; Cue and Ninomiya 2007; Komiyama *et al.,*

Experimental site

Vindhya range

Highest point Peak (Sadbhawna Shikhar / Kalumar Peak) Elevation 752 m (2,467 ft) Coordinates 23°28′0″N 79°44′25″E Coordinates: 23°28′0″N 79°44′25″E

Different sources vary on the average elevation of the Vindhyas, depending on their definition of the range. MC Chaturvedi mentions the average elevation as 300 m.Pradeep Sharma states that the "general elevation" of the Vindhyas is 300–650 m, with the range rarely going over 700 m during its 1200 km extent.

Climate and weather

Mirzapur falls in a belt of semi-arid to sub-humid climate. The normal period for the onset of monsoon in this region is the third week of June and it lasts up to the end of September or sometimes extends to the first week of October.

Winter showers are often experienced in between the month of December to mid of February. However, March to May is generally dry. On an average, out of the total annual rainfall major fraction (75 %) is received from June to September. The winter months are cool whereas summers are hot and dry. The coldest and hottest months are January and May, respectively.

The temperature begins to rise from the month of February and reaches its maximum in May.

Rainfall (mm)

Total rainfall received during the tree growth period was 1049.34 mm. The maximum rainfall of 446.32 mm was recorded in February 2018 and minimum rainfall of 3.40 mm was recorded in February 2019

Temperature (°C)

The monthly mean maximum and minimum temperature, during the period of experiment, ranges from 19.94^0C to 36.75^0C and 10.51^0C to 27.34^0C, respectively.

The maximum temperature 36.75^0C was recorded in the month of June, whereas the minimum temperature 10.51^0C was observed in the month of December.

Relative humidity (%)

The monthly maximum relative humidity of 90.20 to 94.68% in and monthly minimum relative humidity 55.36 to 72.81% in during the period of experimentation.

Materials and Methods

Above Ground Biomass (g) = volume of biomass (cm^3)***** wood density (g/ cm^3)

AGB (Above ground biomass) includes the all living biomass above the soil.

AGB are calculates by multiplying volume to the green wood density of the tree species.

AGB= V **x** D

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**x**0.26

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

Total biomass= AGB+BGB

Carbon Estimation

Generally, for any plant species 50% of its biomass is considered as carbon (Pearson *et al.,* 2005).

Carbon Storage = Biomass x 50% or Biomass / 2

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 observe in trees, hence average volume was estimated by using above formula.

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

Carbon storage = Biomass x 50%

Carbon sequestration (CO_2e)

The elemental carbon removed from the atmosphere (CO_2) was then calculated as per procedure followed by Dury *et al.,* (2002).

$CO_2e = C_b \times 3.67$

Carbon sequestration in *Delonixregia*

Delonixregia is an ornamental tree due to its red flowers known as flame of forest with commonly and mostly planted in household or company compounds.

The total tree count in vindhyas series area accounts 10365, which are highest in rest of the number of individual tree species in Vindhyas series.

The standing biomass stalks and carbon sequestered in *Delonixregia* trees in are shown in Table.

There are 4957 trees in all nine sites in the Vindhyas series with maximum number of *Delonixregia* in sites 7 accounting to 987 trees followed by 948 in sites 8 and minimum number (118) insites1.

Results and Discussion

The standing biomass stalks in *Delonixregia* trees in are show in Table. It was observed that in sites no. 7 the *Delonixregia* tree containing highest above ground biomass, belowground biomass and total standing biomass (6.02tha^{-1}, 1.57tha^{-1} and 7. tha^{-1}) followed in sites no. 6(5.29tha^{-1},1.50 tha^{-1} and 7.29 tha^{-1}), sites no. 9 (4.36 tha^{-1}, 1.13 tha^{-1} and 5.49 tha^{-1}), sites no. 5(3.87tha^{-1}, 1.01tha^{-1} and 4.88tha^{-1}),sites no. 3(2.92 tha^{-1}, 0.76tha^{-1} and 3.68 tha^{-1}), sites no. 4 (2.29 tha^{-1}, 0.60 tha^{-1} and 2.89 tha^{-1}), sites no. 8 (2.28tha^{-1}, 0.59 tha^{1} and 2.87 tha^{-1}), sites no. 2 (2.0 tha^{-1}, 0.52 tha^{-1} and 2.51 tha^{-1}) and lowest at sites no. 1 (0.72 tha^{-1}, 0.19 tha^{-1} and 0.91 tha^{-1}) respectively.

The standing aboveground biomass and belowground biomass of *Delonixregia* were 30.25tha^{-1} and 07.86tha^{-1} respectively, while total standing biomass of *Delonixregia* in 2847 hectares area was 38.11tha^{-1} (Fig. 1 and 2).

Table.1 Carbon sequestration in *Delonixregia*

Sites	Area in ha	Tree count	AGB. tha^{-1}	BGB tha^{-1}	TGB $ttha^{-1}$	AGC tha^{-1}	BGC tha^{-1}	TCtha^{-1}	tCO_2
1	221	118	0.72	0.19	0.91	0.36	0.09	0.45	1.65
2	223	327	2.00	0.52	2.51	1.00	0.26	1.26	4.62
3	356	479	2.92	0.76	3.68	1.46	0.38	1.84	6.75
4	528	376	2.29	0.60	2.89	1.15	0.30	1.45	5.32
5	244	635	3.87	1.01	4.88	1.94	0.50	2.44	8.95
6	175	948	5.79	1.50	7.29	2.89	0.75	3.64	13.36
7	501	987	6.02	1.57	7.59	3.01	0.78	3.79	13.9
8	232	373	2.28	0.59	2.87	1.14	0.30	1.43	5.25
9	369	714	4.36	1.13	5.49	2.18	0.57	2.74	10
	2847	4957	30.25	7.86	38.11	15.12	3.93	19.06	69.95

Fig.1

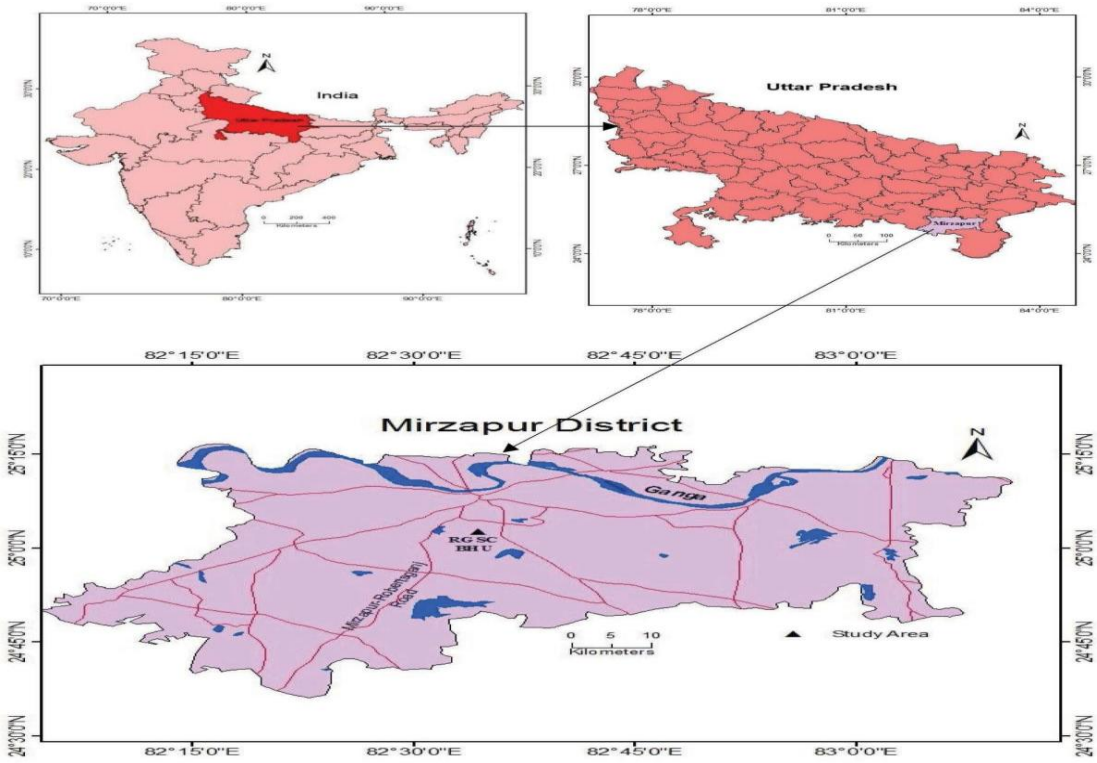
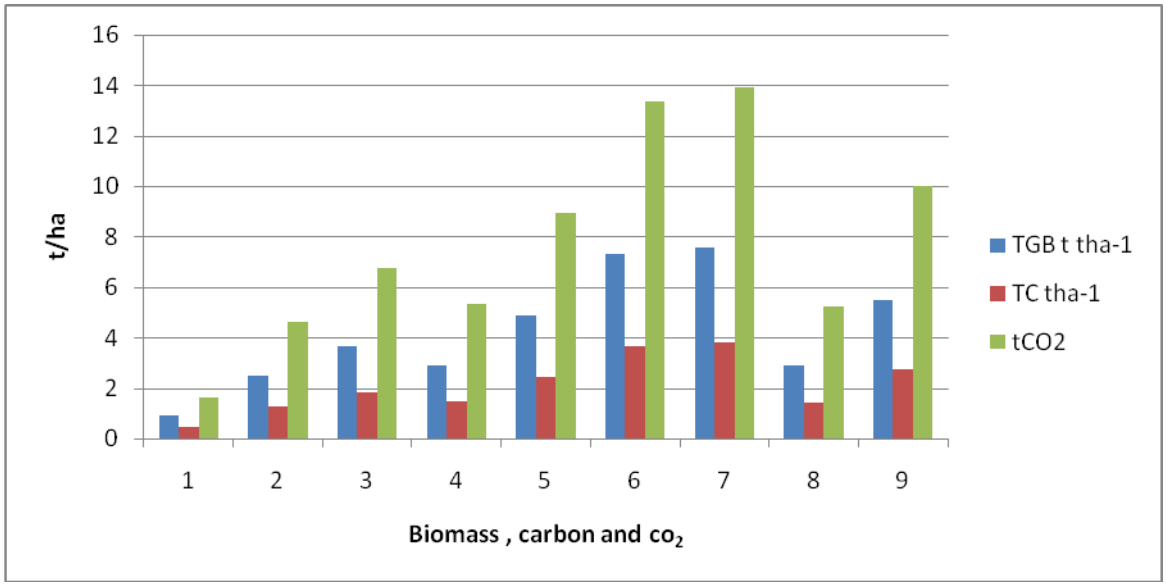


Fig.2 Carbon sequestration in *Delonixregia*



The *Delonixregia* tree containing highest carbon stalk in sites no.7 above ground, below ground and total carbon sequestered (3.01tha^{-1}, 0.78tha^{-1} and 3.79 tha^{-1}) followed in sites no. 6 (2.89 tha^{-1}, 0.75 tha^{-1} and 3.64 tha^{-1}), sites no. 9 (2.18 tha^{-1}, 0.57 tha^{-1} and 2.74 tha^{-1}), sites no. 5 (1.94 tha^{-1}, 0.50 tha^{-1} and 2.44 tha^{-1}), sites no. 3 (1.46tha^{-1},0.38tha^{-1} and 1.84tha^{-1}), sites no. 4 (1.15tha^{-1},0.30 tha^{-1} and 1.45 tha^{-1}), sites no. 8 (1.14tha^{-1}, 0.30tha^{1} and 1.43 tha^{-1}), sites no. 2 (1.0tha^{-1}, 0.26 tha^{-1} and 1.26 tha^{-1}) and lowest at sites no. 1 (0.36 tha^{-1}, 0.09 tha^{-1} and 0.45 tha^{-1}) respectively.

The sequestered carbon stalk in aboveground and belowground standing biomass of *Delonixregia* were 15.12 tha^{-1} and 3.93tha^{-1} respectively, while total standing biomass of *Delonixregia* in 2847 hectares area was 19.06tha^{-1}. The average carbon sequestration and carbon dioxide of *Delonixregia* intake is 19.06tha^{-1} and 63.96 tCO_2 in.

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