ISSN: 0975-8585

Research Journal of Pharmaceutical, Biological and Chemical Sciences

A Preliminary Study on Carbon Sequestration Potential of Few Road Side Plant Species of Pursurah Area of Hooghly district, West Bengal (India).

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ABSTRACT

The present study reveals the carbon sequestration potential of ten plant species selected from those growing in the road side of Pursurah block of Hooghly district, were assessed by non- destructive method. Carbon sequestration is a mechanism for removal of carbon from the atmosphere fallen victim to increasing levels of atmospheric carbon dioxide (CO_2) and other "greenhouse" gases. All the selected species, although not dominating in the study site, were found to have good carbon storage potential. The highest value of carbon sequestration was seen in case of *Ficus religiosa* L. (86.67 g) and the lowest in *Melia azedarach* L. (2.5g).

Keywords: Pursurah block, Hooghly District, Carbon Sequestration.

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ISSN: 0975-8585

INTRODUCTION

Climate change may also stimulate forest growth by enhancing availability of mineral nitrogen and through the CO_2 fertilization effect, which may partly compensate release of soil carbon in response to warming. Carbon sequestration describes long-term storage of carbon dioxide or other forms of carbon to either mitigate or defer global warming and avoid dangerous climate change. It has been proposed as a way to slow the atmospheric and marine accumulation of greenhouse gases, which are released by burning fossil fuels. Carbon dioxide (CO_2) is naturally captured from the atmosphere through biological, chemical, and physical processes [8]. Artificial processes have been devised to produce similar effects, including large-scale, artificial capture and sequestration of industrially produced CO_2 using subsurface saline aquifers, reservoirs, ocean water, aging oil fields, or other carbon sinks.

Carbon sequestration is the route through the use of agro-forestry technologies for soil conservation, which could enhance Carbon storage in trees and soils. Agro-forestry systems with perennial crops may be important carbon sinks, while vigorously managed agro-forestry systems with annual crops are more similar to conventional agriculture [4].

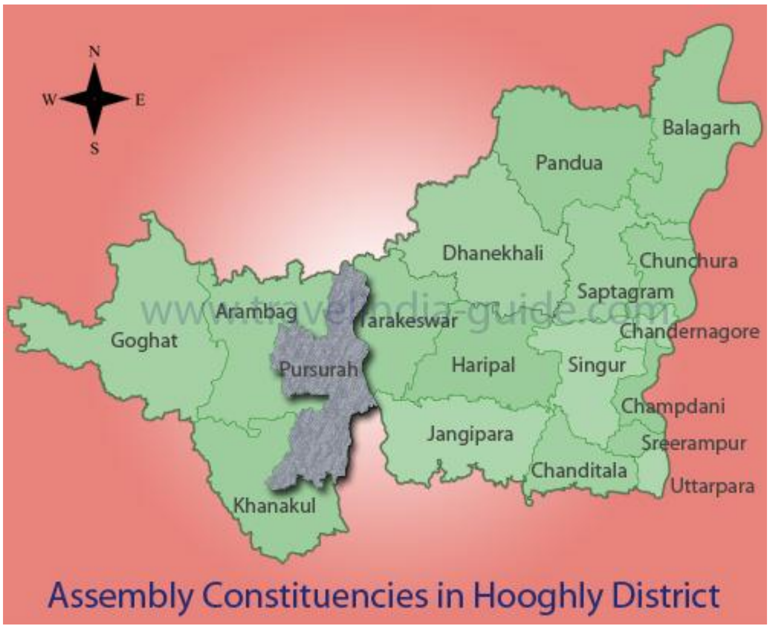
The carbon sequestration capacity of plant species depends upon its age, height, girth, size, biomass accumulation rates, canopy diameter wood density [1, 2].

The present work undertaken to measure the carbon sequestration of ten plant species grow in the Pursurah block of Hooghly district.

MATERIALS AND METHODS

Study Area

The study area i.e Pursurah in Hooghly district of West Bengal, India [Fig.1 and Fig. 2] having the latitudes 22.8385 °N and longitudes 87.783292 °E with the total area of 96.92 km^2. It is about 7 kilometers away from Tarakeswar. Pursurah block is bounded by Raina II Block, in Bardhaman district, in the north, Dhaniakhali, Tarakeshwar and Jangipara Blocks in the east, and Udaynarayanpur Block, in Howrah district, and Khanakul I and Khanakul II Blocks in the south and Arambagh Block in the west.



[Source: http://www.travelindia-guide.com/assembly-elections/west-bengal/images/hooghly/Pursurah.jpg]

Figure 1: Pursurah in Hooghly district of West Bengal, India

ISSN: 0975-8585

Figure 2: Map of study site located in Hooghly district of West Bengal, India

As many as ten species were selected. Non destructive allometric method was employed to estimate carbon stock in each plant species. The biomass of tree was estimated on the basis of different indicator parameters (e.g. tree DBH, height). The following parameters were measured for estimating biomass pool.

Measurement of DBH (Diameter at breast height):

DBH can be estimated by measuring tree Girth at Breast Height (GBH), approximately 1.3 meter from the ground [4]. The GBHs of trees were measured directly by measuring tape. Tree diameter (D) was calculated by dividing 3.14 to the marked girth of tree i.e. GBH/3.14

Measurement of tree height:

By using Theodolite instrument tree height was measured at DBH. Then height (H) of the tree is calculated by the following formula [10]. $H = h + b \tan\phi$. Here, h is height of horizontal plane of Theodolite. b is the distance in feet between tree and observer. ϕ is the angle between eye view at breast height and top of the tree.

Measurement of above ground biomass:

AGB include all living biomass above the soil. The aboveground biomass (AGB) has been calculated by multiplying volume of biomass and wood density. Tree bio-volume (TBV) value established by multiplying of diameter and height of tree species to factor 0.4[3].

$$\text{Tree Bio-volume } (T_{BV}) = 0.4 \times (D)^2 \times H$$
$$\text{AGB (kg)} = \text{Tree bio volume } T_{BV} \text{ (m3)} \times \text{wood density (kg/m3)}$$

Where; D = (GBH/π), diameter (meter) calculated from GBH, assuming the trunk to be cylindrical [5], H = Height (meter).

Wood density is used from Global wood density database [5, 9]. The standard average density of 0.6 gm/cm is applied wherever the density value is not available for tree species [5].

Measurement of below ground biomass:

The belowground biomass (BGB) includes all biomass of roots .The belowground biomass has been calculated by multiplying the above ground biomass (AGB) by 0.26 factors as the root: shoot ratio [3, 5].
Belowground biomass (BGB) kg/tree = aboveground biomass (AGB) kg/tree × 0.26

ISSN: 0975-8585

Total biomass:

Total biomass is the sum of the above and below ground biomass. [7]

Total Biomass (TB) = Above Ground Biomass + Below Ground Biomass

Carbon Estimation:

Generally, for any plant species 50% of its biomass is considered as carbon [6] i.e. Carbon Storage = Biomass × 50% or Biomass/2

RESULTS AND DISCUSSION:

TABLE 1: List of Physiological Details of Selected Tree Species in study area

Name of the plant	Plant replica no.	GBH(in meter)	Diameter in meter	Height in meter	T_{bv}(meter^3)	AGB in kg	BGB(kg)	TB(kg)	Carbon storage(Gram)	carbon sequestration potential
Acacia auriculiformis Benth.	1	0.79	0.25	14	0.35	0.021	0.005	0.026	13	11.83
	2	0.70	0.22	13.7	0.27	0.016	0.004	0.020	10	
	3	0.51	0.16	12.1	0.12	0.007	0.018	0.025	12.5	
Alstonia scholaris (L.) R. Br.	1	1.19	0.38	14	0.81	0.049	0.013	0.062	31	51.17
	2	1.93	0.62	15.2	2.34	0.140	0.036	0.176	88	
	3	1.50	0.48	15.9	1.47	0.088	0.023	0.111	55.5	
Anthocephalus cadamba (Roxb.) Miq.	1	1.06	0.34	15.3	0.71	0.043	0.011	0.154	77	45.17
	2	0.89	0.28	14.6	0.46	0.028	0.007	0.035	17.5	
	3	1.27	0.40	16.9	1.08	0.065	0.017	0.082	41	
Dalbergia sissoo DC.	1	1.15	0.37	4	0.22	0.013	0.003	0.016	8	12.33
	2	1.20	0.38	3.8	0.22	0.013	0.003	0.016	8	
	3	1.52	0.49	5.7	0.55	0.033	0.009	0.042	21	
Eucalyptus grandis W. Hill	1	0.93	0.29	14.3	0.48	0.029	0.008	0.037	18.5	14.83
	2	0.70	0.22	13.6	0.26	0.016	0.004	0.020	10	
	3	0.84	0.27	14	0.41	0.025	0.007	0.032	16	
Ficus religiosa L.	1	1.96	0.62	16.3	2.51	0.151	0.039	0.190	95	86.67
	2	1.75	0.56	15.8	1.98	0.119	0.031	0.150	75	
	3	1.90	0.61	16.1	2.39	0.143	0.037	0.180	90	
Melia azedarach L.	1	0.46	0.15	7.7	0.07	0.004	0.001	0.005	2.5	2.5
	2	0.42	0.13	8.6	0.06	0.004	0.001	0.005	2.5	
	3	0.45	0.14	9	0.07	0.004	0.001	0.005	2.5	
Moringa oleifera Lam.	1	0.89	0.28	8.6	0.27	0.016	0.004	0.020	10	8.5
	2	0.81	0.26	8.5	0.23	0.014	0.004	0.018	9	
	3	0.71	0.23	8	0.17	0.010	0.003	0.013	6.5	
Tectona grandis L.f.	1	0.81	0.26	9	0.24	0.014	0.004	0.018	9	8.5
	2	0.66	0.21	7	0.12	0.007	0.002	0.009	4.5	
	3	0.89	0.28	10	0.31	0.019	0.005	0.024	12	
Terminalia arjuna (Roxb. ex DC.) Wight & Arn.	1	2.03	0.65	15.1	2.55	0.153	0.039	0.192	96	66.83
	2	1.27	0.40	12.3	0.79	0.047	0.012	0.059	29.5	
	3	1.83	0.58	14.8	1.99	0.119	0.031	0.150	75	

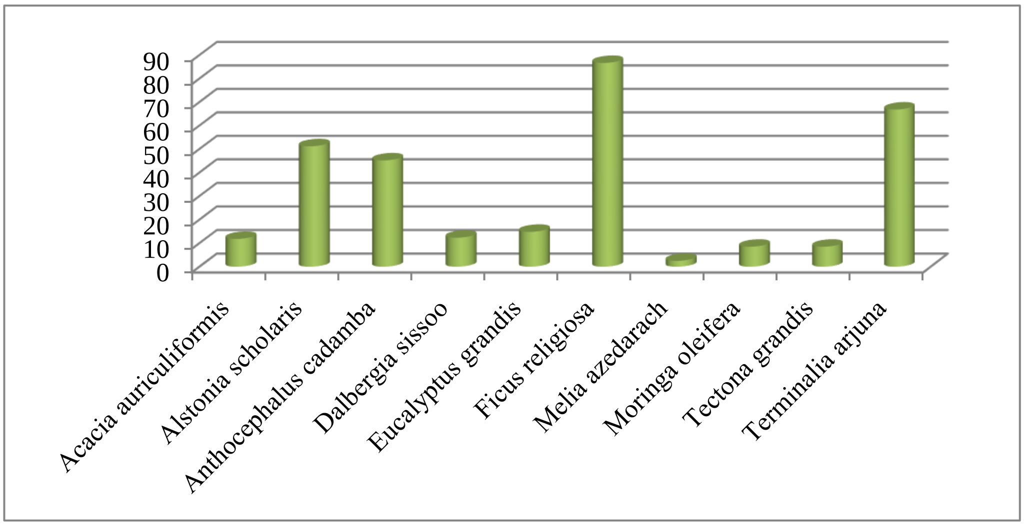


Fig 3: Graphical representation of Carbon sequestration potential of the different Plant

The data related to carbon sequestered by 10 different genera including 30 individuals plants were assessed from the Pursurah of Hooghly district. Table 1 indicates the GBH in cm and tree height in meters. The above ground Biomass (AGB) per tree, below ground biomass (BGB) per tree, the total biomass of individual species and the total carbon sequestrated in each genus has been summarized. Among the ten selected species, major carbon sequestrating species were *Ficus religiosa* (86.67), followed by *Terminalia arjuna* (66.83), *Alstonia scholaris* (51.17). The *Melia azedarach* has lowest carbon sequestration potential (2.5) and jointly the second lowest carbon sequestrating species were *Moringa oleifera* and *Tectona grandis* having carbon content 8.5.

CONCLUSION

From the present work it was observed that *Ficus religiosa*, species was found to be dominant that sequestered (86.67) of carbon followed by *Terminalia arjuna* (66.83) (Table 1 and Fig 3). The greenery of the Pursurah block has been optimizing the environment by constituting a green patch in the area of Hooghly district to sustain a wide diversity of flora which is indispensable for Pollution abatement to control or get rid of pollution from a given environment.

ACKNOWLEDGEMENTS

All authors are thankful to Department of Botany for their encouragement and facilities for provided present work. They are especially thankful to Department of Geography, University of Burdwan.

REFERENCES

[1] Das M. and A. Mukherjee Indian Journal of Scientific Research 2015; 10(1): 53-57
[2] Das M., M. Das and A. Mukherjee RJPBCS 2017; 8(2): 1901-1908. doi: http://www.rjpbcs.com/pdf/2017_8(2)/[208].pdf
[3] Hangarge L. M., D. K. Kulkarni, V. B. Gaikwad, D. M. Mahajan and Chaudhari Nisha. Annals of Biological Research, 2012; 7: 3426-3429.
[4] Montagnini, F. and P. Nair, Agroforestry Systems (2004) 61: 281. doi:10.1023/B:AGFO.0000029005.92691.79
[5] Pandya Ishan Y., H. Salvi, O. Chahar and N. Vaghela Indian J. Sci. Res. 2013; 4(1): 137-141.
[6] Pearson T.R.H., S. Brown, N. H. Ravindranath, Integrating carbon benefits estimates into GEF Projects, 2005; 1-56.
[7] **S**heikh Mehraj A, Kumar Munesh, Bussman Raine and Wand Todaria NP. Carbon Balance and Management. 2011; doi.:10 .1186/1750-0680- 6-15.
[8] Vashum K. T., S. Jayakumar, J Ecosyst Ecogr., 2012; 2(4): doi:10.4172/2157-7625.1000116

ISSN: 0975-8585

[9] Zanne A. E., G. Lopez-Gonzalez, D. A. Coomes, J. llic, S. Jansen, S. L. Lewis, R. B. Miller, N. G. Swenson, M. C. Wiemann and J. Chave Global wood density database. Towards a worldwide wood economics spectrum. Ecology Letters, 2009; 12(4): 351-366