IJCRT.ORG ISSN : 2320-2882

INTERNATIONAL JOURNAL OF CREATIVE RESEARCH THOUGHTS (IJCRT)

An International Open Access, Peer-reviewed, Refereed Journal

Role Of Forest In Carbon Sequestration With Reference To Kamta Beat Of Chitrakoot Forest Range

Alok Kumar[1], Ravindra Singh[2], Sadhana Chaurasia

[1]Research Scholar, Dept. of Biological Sciences MGCGV Chitrakoot

[2]Head, Dept. of Biological Sciences MGCGV Chitrakoot.

[3]Associate Professor Dept. of Energy and Environment

MGCGV Chitrakoot.

Satna (Madhya Pradesh) 485334

ABSTRACT

Industrialization and population growth enhance earth greenhouse effect which is a critical environment problem. Carbon dioxide is the most significant contributor to the human influence on the green house effect and trees act as sink for CO_2 by fixing carbon during photosynthesis and storing surplus carbon as biomass which after through time as tree grow, die & decay. Carbon sequestration is a natural method for the removal of carbon from atmosphere by storing it in the biosphere. As more photosynthesis occurs more co_2 is converted in to biomass reducing Co_2 in the atmosphere and sequestering it in plant tissue above and below ground resulting with growth of different parts. The continued and indiscriminate exploitation of forest resulted in an imminent environment crisis. The release of Co_2 cannot be stopped easily. The only solution for Co_2 mitigation is reforestation and conservation of existing species and diversity keeping in this view an attempt has been made to study the carbon sequestration by P1 comportment of Kamta beat forest of Chitrakoot. The study area was divided in to open and dense forest. Total 8 tree species were observed. In open forest total no. of trees was found 182 and in dense forest no. of trees was found 246. In this study carbon sequestration by open forest was 3793.94 kg/year & by dense forest 7730.95 kg/year. The total carbon sequestration was observed 11524.89 kg/year in study area.

Keywords: - Carbon Sequestration, carbon emission, carbon sink, biomass, Forest

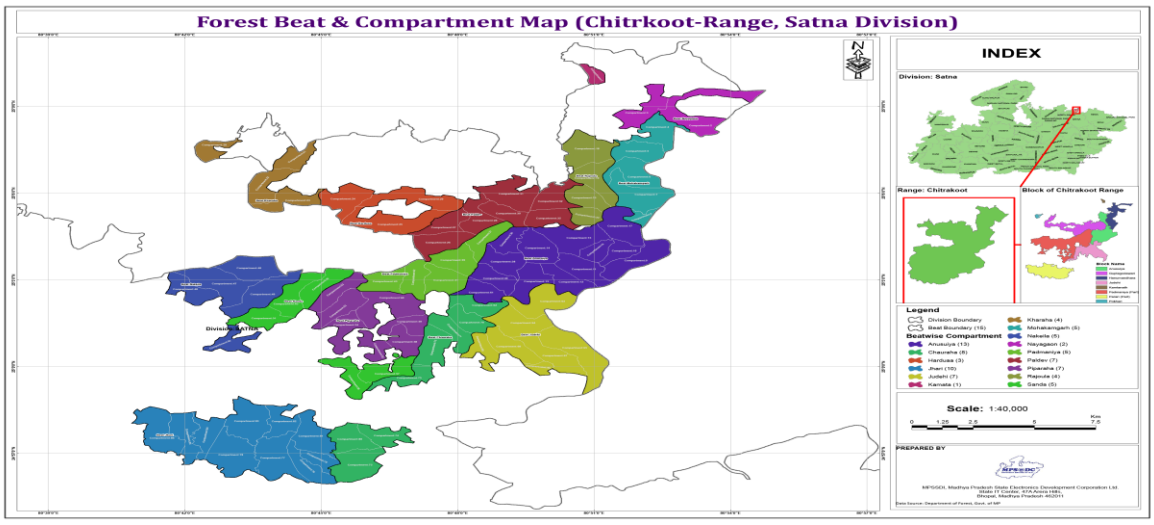
INTRODUCTION-

All cellular life forms primarily consist of carbon, which is used by trees to produce their trunk, roots, stems, branches, and leaves. Through photosynthesis, trees remove carbon from the atmosphere (Francesco Ferrini *et al*., 2011).The greenhouse effect's side consequence, climate change, has become a serious environmental problem for ecosystems, natural resources, economy, society, and politics on a global and national scale. The greenhouse effect is undoubtedly a result of modern human activities that are continually expanding in the fields of energy, agriculture, and forestry. Global biogeochemical cycles have fluctuated due to industrialization, which has also changed the landscape and increased biota mobility. Because forests account for a larger portion of the carbon exchange between the atmosphere and terrestrial biosphere than any other ecosystem type, they play a significant role in the global carbon cycle (Dixon *et al*., 1994). The burning of terrestrial plants by fossil fuels is causing an increase in atmospheric carbon dioxide. Since carbon is easily transferred between the biosphere, atmosphere, and oceans, regulating the biosphere's carbon stock should allow for control over the atmospheric carbon concentration. Without interfering with other benefits the biosphere offers, society can manage the biosphere in ways that lower the amount of the greenhouse gas carbon dioxide in the atmosphere.

STUDY AREA –

Kamta Beat is located in Chitrakoot forest range, Satna in Madhya Pradesh. Satna district has 7502 km^2 geographical area with 2037 km^2 forested area. Chitrakoot lies between $80^0$44'- $80^0$54' E latitude and $25^0$12'- $25^0$19'N longitude on the border of Madhya Pradesh and Utter Pradesh in Satna and Chitrakoot District respectively. The vegetation of Kamta Beat is tropical dry deciduous type (Champion and Seth 1968).It is Vindhyan range of forest, functioning like lungs to help maintain the equilibrium to its environment .The potential role of forest in carbon sequestration was evaluated with respect to environment. The period of March to June is dry and hot and constitutes the summer season. The period of July to October is moist and hot and constitutes the rainy season. The period of November to February is moist and cold and constitutes the winter season. The topography of Chitrakoot consists of series hill range with isolated peaks. The general topography is hilly, precipitous and undulating, cut off by numerous rivers and rivulets.

Fig: 1. Map showing study area



MATERIAL AND METHODS

In this study, measurement of the carbon sequestered by trees has been carried out and this was based on the amount of biomass of herbs, shrubs and trees in this Beat. In Kamta Beat different quadrates were laid. The work is done by quadrates of 35m x 35 m (1225 m^2), which would divided into 8 tracks and these subdivided into 2 + 5 subunits of 5m x 5 m (25 m^2) and 1m x 1 m (1 m^2). Within each plot, 30 subunits would draw, being three subunits by track from 8 total tracks in each unit of 35m x 35 m, where tree, shrubs & herbaceous vegetation surveys respectively and environmental parameters would made. Number of quadrates varies depending upon the area of the site (Misra 1968). Quadrates of 35 m×35 m were taken at this site and at the same time measurement of (CBH) in centimeter (cm) and height (ft) for different trees were taken (Yadav and Devi 2006). Based on these values biomass and carbon sequestration were calculate according to (Clark *et al*., 1986). Results obtained, and represented in to kilogram per tree per year. Conversion and comparisons were done of total carbon sequestered by different plant species. Selection of sample plot was done randomly and the sample plot covered maximum area of Kamta beat.

Calculation: Estimation of amount of carbon dioxide in trees was done by the following method-

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 Co_2 sequestered in the tree per year.

1. Total (green) weight (W1) of the tree:

W_1= 0.25D2H (If D11) (Clark *et al*., 1986)

W_1= 0.15D2H (If D>11) (Clark *et al*., 1986)

2. Dry Weight (W2) of the Tree:

W_2= W1×72.5% (Dewald *et al*., 2005)

3. **Weight of Carbon (C1) present**:

C_1= W2×50% (Birdsey, 1992)

4. Determine the weight of CO_2 sequestered in the tree:

$CO_2 = C_1 \times 3.6663$

5. Determine the weight of CO_2 sequestered in the tree per year

Divided the weight of CO_2 sequestered in the tree by the age of the Tree.

When -

W= Above - ground weight of the tree in pounds
D= Diameter of the trunk in Inches
H= Height of the tree in feet

LITTER-

The forest department presents forest related data from time to time, in which the biomass of litter and dry wood is also included. In this study, to extract the biomass of Kamta Beat, the percentage has been extracted using the total biomass (litter and dry wood) of Kamta Beat of Chitrakoot Forest range.

HERBS-

For herbaceous biomass, total 3 quadrates of lm x l m were studied in the present sampled inventory. In each quadrate, herbaceous material was harvested, and collected in polythene bags. After taking fresh weight in the field, samples were dried into the laboratory and taking dry weight after oven drying the samples at 80^{o} C for 48 hours and the weight showed as biomass. At the same time in each quadrate. Below ground biomass (BGB) was calculated by using simple default value of 25 % of the aboveground biomass (IPCC,2006).Total biomass was measured as sum of above and below ground biomass (Sheikh *et al*.,2011).Carbon was considered as 50% of its biomass (Pearson *et al*.2005).

RESULT AND DISCUSSION

There is an increasing tendency among the environmentalists to view holistically the ever decreasing tree cover and subsequent fall in carbon sinks. This decline in carbon sink has resulted in concomitant increase in carbon emission and a subsequent rise in global temperatures. Study was carried out in open and dense forest Kamta beat by quadrate method. Carbon sequestration was estimated in the present study. The results obtain are discussed below:-

Carbon sequestered by Kamta beat Chitrakoot forest range – The total 6 tree species were found in dense forest. Common name, Botanical name, Number of Tree, Age of tree, DBH, Height, Green weight, dry weight and total sequestered CO_2 is given in table- 1. A total no. of 428 individuals trees were sampled and evaluated from an area of 0.702 km^2 using quadrates. Detail of individuals tree species i.e. no. of trees per individual , average age, DBH, mean height, green weight and carbon sequestration is given in table 1 and 2 for dense and open forest. The total average biomass in dense forest was found 1673.43 lbs. The annual total CO_2 sequestration was found 7730.95 kg/year .Among the tree studied, *Anogeissus pendula* was most prevalent species in dense forest. Maximum CO_2 sequestration of *Sterculia urens* is 43.70 (kg)/tree/years followed by *Holoptelea integrifolia* 42.81CO_2 kg /tree/year. The total CO_2 sequestration in dense forest was observed 7730.95 kg/year (table: - 1). The total average biomass in open forest was observed 1044.33 lbs. The annual sequestered CO_2 was found 3793.94 kg/year which was approximately 49.07 % of dense forest. *Anogeissus pendula* was the most abundant species observed in open forest. Maximum CO_2 sequestration was observed 33.92 kg/tree/year by *Diospyros melanoxylon*, followed by *Schleichera oleosa* (24.65 kg/tree/year). (Table: - 2). 4 tree species were observed in open forest and 6 species in dense forest area. It was found that only 2 plant species (*Anogeissus pendula*, *Diospyros melanoxylon*) were same in the both area, while the other 6 plant species were different, therefore total no. of 8 tree species were reported in both areas. (Table - 1&2).Integrated CO2 sequestration is given in table 3 and total annual sequestration of CO2 in Kamta beat was observed 11524.89 CO_2 kg/ year. The fresh biomass, dry biomass and moisture content of herbaceous plant in study area is given in table -4. The Co_2 sequestrated by herbaceous plant was observed 3.01 kg/ year and by litter 828.77 Kg/year. Carbon dioxide sequestered by tree, herbs and litter is given in (table 5). Total CO_2 sequestration was found 12356.66 Kg/ year in Kamta beat of forest range Chitrakoot Satna Madhya Pradesh.

Table:-1 CO_2 Sequestration by different Plant species in Kamta Beat Dense forest of Chitrakoot forest Range

S. no.	Com-mon Name	Botanical Name	Total No. of Tree	Average Age of tree (y.)	Average DBH (Inch)	Average Height of Tree (ft)	Average Green weight of Tree with Root (lbs)	Average Dry weight of Tree with root (lbs)	Sequestered C (lbs)	Sequestered Co_2/ tree /year (Kg)	Total Sequestered Co_2(kg)/year
1.	करधई	*Anogeissus pendula*	236	25.51	8.10	67.40	1327.62	962.52	481.26	31.37	7404.16
2.	कुटज	*Holarrhena antidysenterica*	2	40.00	12.53	72.50	2047.55	1484.48	742.24	30.86	61.72
3.	कुल्लू	*Sterculia urens*	2	29.00	9.08	85.00	2102.38	1524.23	762.11	43.70	87.41
4.	तेंदू	*Diospyros melanoxylon*	4	30.50	9.55	49.50	1354.36	981.91	490.95	26.77	107.08
5.	महुआ	*Madhuka indica*	1	30.41	13.15	45.00	1401.31	1015.95	507.98	27.78	27.78
6.	चिल्ला	*Holoptelea integrifolia*	1	25.45	10.02	60.00	1807.57	1310.49	655.24	42.81	42.81
		Total	**246**	**30.14**	**10.40**	**63.23**	**1673.47**	**1213.26**	**3639.79**	**203.29**	**7730.95**

Table:-2. CO_2 Sequestration by different Plant species in Kamta Beat Open forest of Chitrakoot forest Range

S. no.	Com-mon Name	Botanical Name	Total No. of Tree	Average Age of tree (y.)	Average DBH (Inch)	Average Height of Tree	Average Green wait of Tree with Root (lbs)	Average Dry weight of Tree with root (lbs)	Sequestered C (lbs)	Sequestered Co_2/ tree /year (Kg)	Total Sequestered Co_2(kg)/year
1.	करधई	*Anogeissus pendula*	170	26.74	8.37	42.43	891.75	646.52	323.26	20.10	3417.70
2.	कोशम	*Schleichera oleosa*	1	24.00	7.51	58.00	981.36	711.49	355.74	24.65	24.65
3.	तेंदू	*Diospyros melanoxylon*	10	33.64	10.53	56.90	1892.74	1372.23	686.12	33.92	339.18
4.	गूलर	*Ficus racemosa*	1	20.00	6.26	35.00	411.47	298.32	149.16	12.40	12.40
		Total	**182**	**26.10**	**8.17**	**48.08**	**1044.33**	**757.14**	**1514.28**	**91.08**	**3793.94**

Table: -3. Integrated CO_2 sequestration in Kamta Beat

S. no.	Common Name	Botanical Name	Total No. of Tree	Average DBH (Inch)	Sequestered C (lbs)	Sequestered CO_2/ tree /year (Kg)	Total Sequestered Co_2(kg)/year
1.	करधई	*Anogeissus pendula*	406	8.24	804.52	51.48	10821.86
2.	तेंदू	*Diospyros melanoxylon*	14	10.04	1177.07	60.69	446.26
3.	कुटज	*Holarrhena antidysenterica*	2	12.53	742.24	30.86	61.72
4.	कुल्लू	*Sterculia urens*	2	9.08	762.11	43.70	87.41
5.	महुआ	*Madhuka indica*	1	13.15	507.98	27.78	27.78
6.	चिल्ला	*Holoptelea integrifolia*	1	10.02	655.24	42.81	42.81
7.	कोशम	*Schleichera oleosa*	1	7.51	355.74	24.65	24.65
8.	गूलर	*Ficus racemosa*	1	6.26	149.16	12.40	12.40
		Total	**428**	**9.60**	**5154.07**	**294.37**	**11524.89**

Table:-4 Above ground Herbaceous Biomass (1m x 1 m)

S.No.	Fresh weight (g.)	Dry Weight (g)	Loss of moisture (g)	Difference of fresh and dry weight in %	Moisture content in %
1	670.00	118.00	552.00	17.61	82.38
2	730.00	150.00	580.00	20.54	79.45
3	509.00	200.00	309.00	39.29	60.70
Total	**1909.00**	**468.00**	**1441.00**	**Average- 25.81**	**Average-74.17**

Calculation of Herbaceous Belowground Biomass:-

Above ground Biomass = 468 g. ($3m^2$)
= 468/3
AGB = 156g.
BGB = AGB x 0.25
= **39 g. (Belowground Biomass)**
Total Biomass (Herbs) = AGB+BGB
= 156+39
= 195 g.
Carbon Storage = Biomass x 0.50
= 195 x 0.50
Carbon = 97.5 g. /m^2
CO_2 = 97.5 x 3.6663

CO_2 = 357.5 g/m^2

Total monthly sequestered CO_2 of Kamta beat = 357.5 x 0.702

(Where, 0.702 Km^2 is total beat area)

= 250.96 g.

= 250.96 x 12

=3011.60 g /year

Total Annual sequestered CO_2 of Kamta beat = 3.01 kg /year

Calculation of CO_2 Sequestration by Litter:-

Total forested area of Satna = 226674.63 ha.

Total Biomass of dry wood and litter = 0.282 ton/ha.

Total forested area of Chitrakoot forest Range = 18920 ha

The total area of Study area (Kamta Beat) = 70.2 ha.

Total Biomass of Kamta Beat = 70.2x 0.282ton/ha.

= 19.7964 ton

Total Biomass (litter) of Kamta Beat = 19796.4 kg.

Amount of Carbon = 19796.4x0.47 kg

=9304.308 kg/ha

Amount of CO_2 = 9304.308 x 3.6663 kg

=34112.38 kg

Average age of forest of Kamta Beat = 41.16 year

Sequestered CO_2 per year =34112.38/41.16

= **828.77 kg/year**

Table: -5 Total CO_2 Sequestered kg/year in Kamta forest Beat

S.No.	Classified plants/ source	Sequestered CO_2 /(kg) / year
1.	Tree	11524.88
2.	Herbs	3.01
3.	Litter	828.77
4.	**Total**	**12356.66**

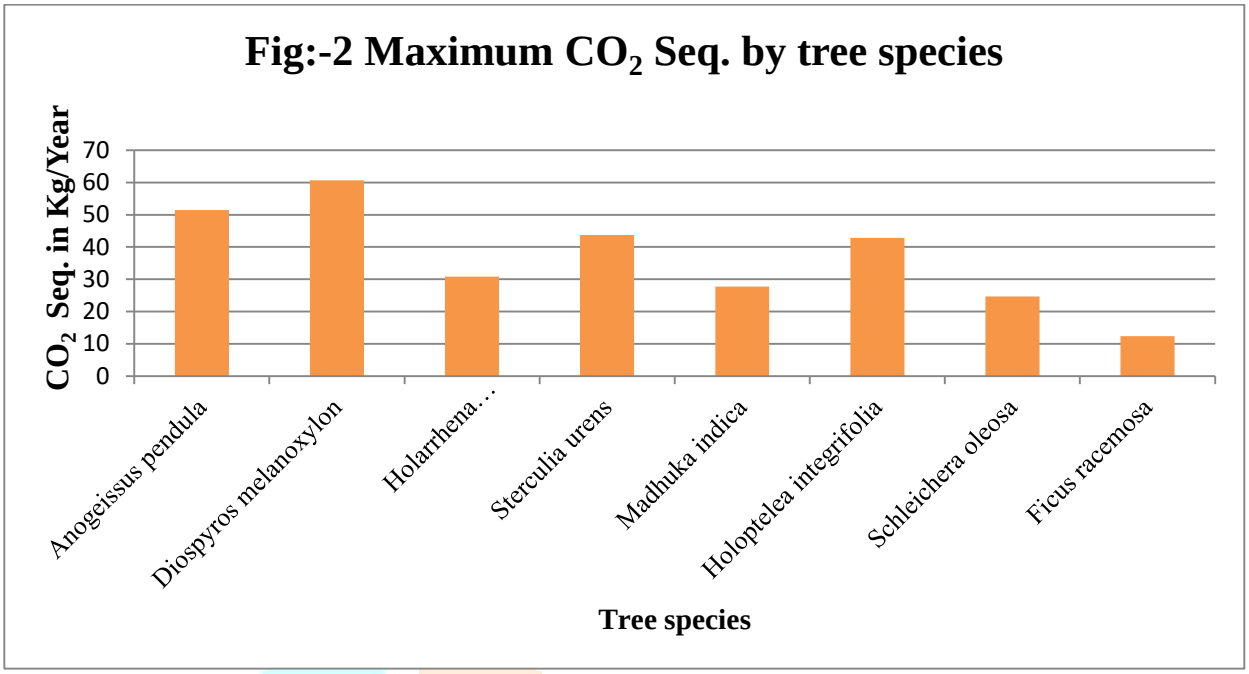


Fig:-2 Maximum CO_2 Seq. by tree species
CO_2 Seq. in Kg/Year
70
60
50
40
30
20
10
0
Anogeissus pendula
Diospyros melanoxylon
Holarrhena…
Sterculia urens
Madhuka indica
Holoptelea integrifolia
Schleichera oleosa
Ficus racemosa
Tree species

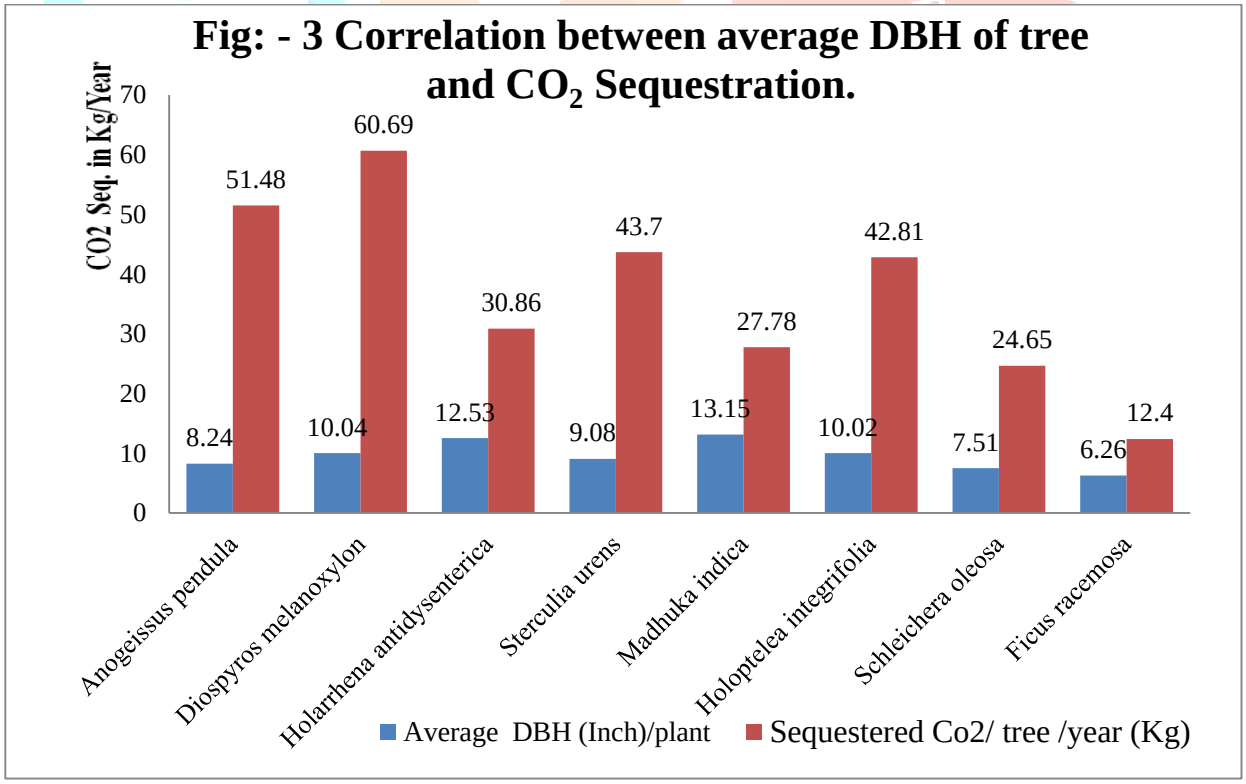


Fig: - 3 Correlation between average DBH of tree and CO_2 Sequestration.
CO2 Seq. in Kg/Year
70
60
50
40
30
20
10
0
51.48
60.69
30.86
43.7
27.78
42.81
24.65
12.4
8.24
10.04
12.53
9.08
13.15
10.02
7.51
6.26
Anogeissus pendula
Diospyros melanoxylon
Holarrhena antidysenterica
Sterculia urens
Madhuka indica
Holoptelea integrifolia
Schleichera oleosa
Ficus racemosa
Average DBH (Inch)/plant
Sequestered Co2/ tree /year (Kg)

CONCLUSION

The study area covered 0.702 Km^2 with 428 plants which belongs 8 species. Study concluded that the total CO_2 sequestration by tree, herbs and litter was 12356.66 Kg/year. The litter shows 828.77 kg/year out of total CO_2 sequestration. Maximum CO_2 sequestration observed by *Diospyros melanoxylon* (Fig.-2). Carbon sequestration monitor in the study area recommends that it is a valuable major to diminish alleviated atmospheric CO_2 concentration and hence contributes to the prevention of global warming. To avoid rise in temperature for benefits of society action must be taken to conserve the forest and to avoid illicit cutting.

.

REFFERENCE

1- (Champion HG and Seth SK (1968). A Revised survey of the forest type of India. **India, Delhi Manager of Publication.**

2- Bridsey, R.A. (1992). Carbon storage and accumulation in United State Forest Ecosystem. North Eastern Forest Experiment Station. **United State Department of Agriculture Forest Service.**

3- Clark A; Saucier, Joseph R.; McNab, W. Henry, (1986) Total-tree weight, stem weight, and volume tables for hardwood species in the southeast. Georgia Forest Research Paper GF-RP-60. **Georgia Forestry Commission,**44

4- Dewald S,.S. Josiah, B. Erdkamp, (2005) Heating with wood producing, harvesting and processing firewood. University of Nebraska-Lincoln Extension. **Institute of Agriculture and Natural Resources**.

5- Dixon, R.K., S. Brown, R. A. Houghton, A. M. Solomon, M.C Trexler and J.Wisniewski. (1994) Carbon pools and flux of global forest ecosystems. **Science,** 263: 185-190

6- Francesco Ferrini and Alessio Finni, (2011) Sustainable management techniques for trees in the urban areas. **Journal of Biodiversity and Ecological Sciences.** 1 (1):1-20.

7- IPCC (2006). Guidelines for National greenhouse Gas Inventories. The institute for global environmental strategies (IGES) for the IPCC, Kanagawa, Japan.4, 32-4.

8- Misra, R. (1968) Ecology Workbook, **Oxford & IBH Publishing Co, Calcutta, India**.

9- Pearson. TRH, Brown S and Ravindranath NH (2005). Integrating carbon benefits estimates into GEF Projects. **UNDP GEF Capacity development and adaptation group guideline:** 1-56.

10- Sheikh MA, Kumar M, Bussman RW and Todaria NP (2011). Forest carbon stocks and fluxes in physiographic zones of India. **Carbon Balance and Management**. 6 (15):1-10

11- Yadav, P.S and S.L. Devi,(2006) In Floristic diversity assessment and vegetation analysis of tropical semi evergreen forest of Manipur, north east India. **Tropical Ecology,** 47(1):89-95