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RESEARCH ARTICLE

Carbon Sequestration Studies at Nagpur Municipal Corporation's Water Treatment Plant at Pench I & II by Existing Greenbelt

[1]Joshi M. P., [2]Grignon Melanie, [3]Devarkar V. D. & [4]Pande Rucha

[1]Director, Surya Envirotech, Hanuman Nagar, Nagpur
[2]Director Communications, Veolia Water Private Limited, India
[3]Department of Botany, SCS College, Omerga Dist. Osmanabad
[4]Manager (PR), Orange City Works Private Limited, Nagpur

Corresponding Author: milindjoshi70@gmail.com

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ABSTRACT

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. Present study deals with the absorption of the atmospheric carbon in the study area selected by selecting planting methods that return biomass to the soil and enhance the conditions in which the carbon within the plants will be reduced to its elemental nature and stored in a stable state through Green belts. It is calculated that, Carbon Absorption by Green Belt Carbon absorption rate is approximated 49.27 kg per mature plant per year as per international standards. As per CPCB (2000) Guidelines, the trees to be planted are 1250 plants per acre, 1250 trees will absorb 1250 X 49.27 = 61587.50 kg of carbon per year per Acer. Project Site (Pench I & II - 1.16 acre) has sequestered 18724 kg of carbon per Acre.

Keywords: Carbon sequestration, Pench project, Nagpur Municipal Corporation.

INTRODUCTION

Climate change has become a global issue. Almost all countries have paid attention towards alarming environmental concerns. Green plants act as a natural sink for carbon, which is one of the greenhouse gases. Carbon dioxide is naturally captured from the atmosphere through biological, chemical, or physical processes. Bio-sequestration or carbon sequestration through biological processes affects the global carbon cycle. The process of removal of carbon from the atmosphere and storing it in tree's parts is known as carbon sequestration. Kanth *et al* (1960) has given good account on green belt plant species selection for wind erosion, wind breaks and shelter – belts and Hu *et. al.* (2016) mentioned the root rather than leaf litter input drives soil carbon sequestration after afforestation on a marginal cropland in his article. This is done by selecting planting methods that return biomass to the soil and enhance the conditions in which the carbon within the plants will be reduced to its elemental nature and stored in a stable state through Green belts. Greenbelt sequestration practices may have positive effects on soil, air, and water quality, be beneficial to fauna. On degraded lands, an increase of 1 ton of soil carbon pool may increase crop yield by 20 to 40 kilograms per hectare of grasses, 10 to 20 kg/ ha. Biological carbon sequestration involves removal of carbon from atmosphere by using plants and its storage in plants in the form of biomass.

Carbon sequestration is the process involved in carbon capture and the long-term storage of atmospheric Carbon Dioxide (CO_2). 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. Chavan & Rasal (2012) has well explained the carbon sequestration potential and status of *Peltophorunp terocarpum* (DC.) K. Heyne in his research article. Carbon dioxide is naturally captured from the atmosphere through biological, chemical, or physical processes. Jha K K (2015) has studied the carbon sequestration rate in Teak plantation in tropical moist deciduous forest in India. Artificial processes have been devised to produce similar effects, including large-scale, artificial capture and sequestration of industrially produced CO_2 using carbon sinks. Bio-sequestration or carbon sequestration through biological processes affects the global carbon cycle.

STUDY AREA

Project Pench I & II at Nagpur Municipal Corporation's Water Treatment Plant, is located at Nagpur Maharashtra (Figure 1.). Nagpur has tropical savannah climate (Köppen climate classification) with dry conditions prevailing for most of the year. It receives about 163 mm of rainfall in June. The amount of rainfall is increased in July to 294 mm. Gradual decrease of rainfall has been observed from July to August (278 mm) and September (160 mm). The highest recorded daily rainfall was 304 mm on 14 July 1994. Summers are extremely hot, lasting from March to June, with May being the hottest month. Winter lasts from November to January, during which temperatures drop below 10 °C (50 °F). The highest recorded temperature in the city was 48 °C on May 19, 2015, while the lowest was 3.9 °C.

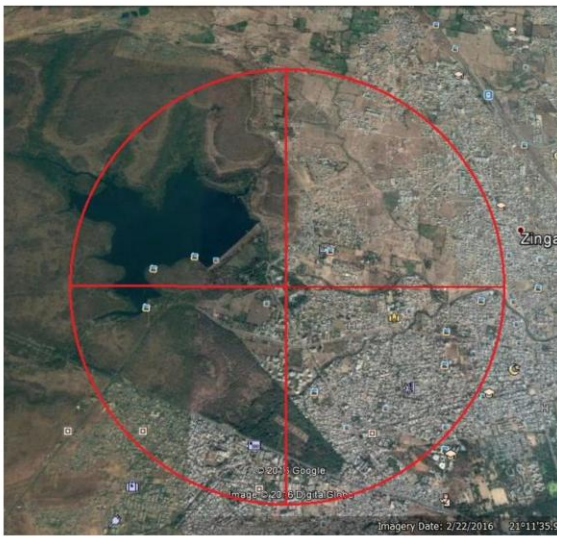

Figure 1: Study Area (Satellite View)

Pench Project: Phase-I

In this scheme 113.5 MLD water is drawn from Pench right bank canal by gravity to the Mahadulla pumping station. The raw water is pumped to the B.P.T. of capacity 5.7 lakhs liters through 1606 mm dia M.S. Rising Main of length 5624 m. from B.P.T. water is taken to the Gorewada balancing tank through 700 mm dia duplicate C.I. gravity mains each of length 400 m. from Gorewada Tank it is drawn to the conventional treatment plant of capacity 113.5 MLD through 1200 mm dia M.S. gravity main. The filtered and chlorinated water from the treatment plant is pumped to Seminary Hills G.S.R. of capacity 20.43 ML and Gittikhadan G.S.R. of capacity 5.94 ML. Sitabuldi G.S.R. is fed from Seminary Hills G.S.R. through 700 mm dia M.S. Feeder Main of length 4000 m.

Pench Project: Phase-II

Under Pench Phase - II a baby canal from Pench right bank canal to Mahadulla pumping station was constructed to draw additional 136 MLD of water. The raw water is pumped to the existing B.P.T. of capacity 5.70 lakh ltrs. through 1626 mm dia M.S. Rising Main of length 5.60 km from B.P.T. water is conveyed to Gorewada tank through

1500 mm dia P.S.C. 8 Kg.cm2 gravity main of length 400 m. from Gorewada Tank water is taken to conventional water treatment plant of capacity 145 MLD through 1100 mm and 1000 mm dia P.S.C. 4 Kg/Sq.cm. gravity mains of length 650 m and 325 m respectively. Pure water is pumped to Seminary Hills G.S.R. of capacity 20.43 ML through 1321mm dia M.S. Rising Main of length 3760 m. In this scheme two E.S.R.s at Jaripatka and Sharda Rolling Mill each of capacity 22.7 lakhs liters are constructed.

METHODOLOGY

Taxonomical observations and identification of plant species is done with the help of standard, regional and online floras and resources viz. Almeida, (1996-2003); Bahadur (1993); Bhogaonkar & Devarkar, (1999); Flowers of India (2013); Hooker J. D. (1872-1897) and Singh & Karthikeyan, (2000). Estimation of carbon sequestration was done by using tree inventory data. Ravindranath & Ostwald (2008) method was used for calculating total carbon sequestered by all trees. This method was used as it is a non-destructive and is designed for tropical plant species. The estimation was done by using two parameters i.e. Height and Girth of a tree. Carbon sequestration calculation wad done using following steps-

Measurement of Height And Girth: Height and girth of each tree species is measured during tree inventory at Pench I & II project, Nagpur.

Calculation of Above Ground Biomass: This calculation is done by using data of height and girth of each species. In this step above ground biomass is determined by calculating volume of a tree and multiplying it by its wood density. (Wood density of a tree is specific for each species).

Calculation of Below Ground Biomass: Below ground biomass is nothing but the mass of a root system of any tree. It is assumed that for any tropical tree, the below ground biomass is 26% of its above ground biomass. Hence it is calculated by using the above ground biomass values.

Calculation of Total Dry Biomass: Total dry biomass is calculated by adding values of above and below ground biomasses.

Carbon Footprint and Carbon Count:

Carbon count and trees required are calculated by consumption of CO_2 on the basis of,
1. Electricity consumption
2. Office vehicles
3. Tanker (diesel)
4. Vehicles (petrol)
5. Liquid Petroleum Gas (LPG)

Use (Kwh/year) X EF (kg CO_2 E/kwh) = Emission (kg CO_2/ year) Where, EF = Emission factor.
Amount of CO_2 release by fuel or usages are given below;
- 1 lit of petrol produce 2.22 kg of CO_2
- 1 lit of diesel produce 2.63 kg of CO_2
- 1 kg of LPG produce 1.56 kg of CO_2
- 1000 KWH electricity produce 912.39 kg CO_2

Combustion formulae:
Petrol:
$2C_8H_{18} + 25O_2 \rightarrow 16CO_2 + 18H_2O + 2631$ cal. (0.7197 KG/L)
Diesel:
$4C_{12}H_{23} + 71O_2 \rightarrow 48CO_2 + 46H_2O$ + energy (0.832 KG/L)
LPG:
$C_3H_8 + 5O_2 \rightarrow 3CO_2 + 4H_2O + 53$ cal. (0.52 KG/L)

Calculations for carbon count CO_2 Released by Electricity Consumption

PENCH-I
Consumption in average = 976500 KWH/year.
1 KWH of electricity production releases 975 gm. of CO_2
Therefore, 976500 X 975 = 952087500 gm. of CO_2/ year
i.e. 9520875 kg. CO_2/year
One mature tree absorbs- 49.27 kg CO_2/year. Therefore, No. of trees required to absorb the CO_2 released by electricity used is, 9520875/49.27 = 1, 93, 238.78 trees

PENCH-II
Consumption in average = 1037990 KWH/year.
1 KWH of electricity production releases 975 gm. of CO_2
Therefore, 1037990 X 975 = 1012040250 gm. of CO_2/ year
i.e. 1012040 kg. CO_2/year
One mature tree absorbs- 49.27 kg CO_2/year
Therefore, No. of trees required to absorb the CO_2 released by electricity used is, 1012040/49.27 = 20540.6 trees

Calculation of Carbon Sequestered: For any tree total carbon sequestered till date is 50% of its total dry biomass. Hence carbon sequestration for individual tree species is calculated using total dry biomass value. Liski *et. el.* (2014) has produced as model to study indirect emission of forest bio-energy, other relevant information about trees in the campus of Pench I & II project like Tree trunk girth, tree height, tree age, living status, canopy organization, leaf area covered, etc. along with the following information is also collected during the field survey and incorporated in the field data diary:

1. Secondary data analysis for of plants listed in the proposed Greenbelt area for its biodiversity status as per IUCN (International union for conservation of nature) for each species.

2. Quantitative listing of herbs, shrubs and trees in the proposed area of the greenbelt and the area not under construction for Veolia plant.
3. Diversity, Density, and Frequency of the species observed in the proposed greenbelt area.
4. Medicinal and Economic importance of plant species present in the proposed greenbelt area.
5. Carbon sequestration studies and values by each tree.

OBSERVATIONS & RESULTS

Vegetation Study and Tree Inventory

As per the CPCB guidelines (2000) the plant are falls under Western Plateau and hills in South zone, where average rainfall is about 1040 mm, climate is semi-arid to dry sub humid, soil is medium to shallow black. Forest observations and structure is mentioned by Bahadur (1993). Environmental impact studies are also important to define the stress on the ecology of the particular area (Devarkar *et.al*, 2018; Joshi *et.al*, 2019).

There are about 2048 plant species growing in the Pench I & II project plant areas. As per the site and plant layout, scientific Greenbelt is not developed on any of the sites. But natural vegetation and Office and around areas planted with some garden varieties for aesthetication of the area. Most of the area is dominated by grasses and weeds. Along with them, *Sesbania sesban* there are few other species were also noted such as *Tectona grandis* (Teak, Sagwan), *Dalbergia sisoo* (Shisham), *Azadirachta indica* (KaduNimb), *Bauhinia racemosa* (Kanchan), *Lantana camara* (Ghaneri), *Zizyphus jujuba* (Bor), *Cassia fistula* (Bahava), *Cryptostegia grandiflora* (Sarpvel), *Albizzia lebbeck* (Shirish), *Pithecellobium dulce* (Vilayati Chinch), *Mangifera indica* (Aamba), *Tinospora cordifolia* (Gulvel), *Calotropis procera* (Ruchaki) and grasses. The plantation is purposely watered on most of the non-construction areas of the sites. But road side plantation and garden, lawn is found well-watered.

As per taxonomic classification Pench I & II has total 59 species of 58 genera belongs to 30 families, were observed on project site. As per IUCN reports and publications only one species falls under Vulnerable category ie *Santalum album* from Santalaceae family. Other species those have mention as Least Concern or Data Deficient are *Asteracantha longifolia* (Acanthaceae), *Alternanthera sessilis* (Amaranthaceae), *Mangifera indica* (Anacardiaceae), *Rhynchosia minima* (Fabaceae), *Pongamia pinnata* (Fabaceae), *Ficus carica* (Moraceae), *Typha latifolia* (Typhaceae) and *Potamogeton natans* (Potamogetonaceae) have mention in the Red Data Book / Red List.

Existing green cover and open space assessment studies revealed that Pench I & II project sites have good species diversity with dominance of Graminaceaous species. Top 15 species are *Andropogon pumilus*, *Setaria intermedia*, *Peristophe bicalyculata*, *Cynodon dactylon*, *Alternanthera sessilis*, *Achyranthus aspera*, *Asteracantha longifolia*, *Hyptis suveolens*, *Mucuna pruriens*, *Tephrosia purpurea*, *Euphorbia geniculate*, *Rhynchosia minima* and *Duranta repens.*

Carbon Sequestration Through Existing Greenbelt

Carbon sequestered by existing Greenbelt was calculated by using Ravindranath and Ostwald (2008) method. During site visit it was observed that, there are many species of trees. For these species, standard average of wood density was used to determine above ground biomass. It was noted that trees in existing Greenbelt dominance of grasses, weeds and other trees are of dissimilar age group. It shows good mix of old and new plant species. Hence total dry biomass of these plant species is relatively good. Hence total carbon sequestered by existing Greenbelt is 18724 kg. (Refer Table 1 & Table 2 for details). The species in the existing green cover are the verge of maturity or matured and hence the carbon sequestration for future years will be change negligibly.

Carbon Absorption by Green Belt Carbon absorption rate is approximated 49.27 kg per mature plant per year as per international standards. As per CPCB Guidelines, the trees to be planted are 1250 plants per acre, 1250 trees will absorb 1250 X 49.27 = 61587.50 kg of carbon per year per Acer. Project Site (Pench I&II - 1.16 acre) has this much of land as greenbelt. Pench I & II (1.16 acre Greenbelt) No. of trees 1444. Therefore, by planting 1444 trees the carbon absorption will be 61587.50 x 1.16 Acre= 71441.5 kg carbon is get absorbed per year.

Present carbon emission in the plant area is very negligible during the process of water treatment for drinking purpose in the municipal corporation area of Nagpur city. But the overall projects (utilities) consuming large amount of electricity (Pench-I = 976500 Kwh/Year, Pench-Ii =1037990 Kwh/Year) which releases CO_2 in the process of Electricity generation process. Thus, it's a joint responsibility of electricity Production Company and User Company to increase the carbon absorption by adapting greenbelt development in the vicinity of 2000 mtrs. Veolia, Nagpur covers approximate area of 28 acres. Observations and Identification of plant species was done by experts in the field of botany especially plant taxonomy. Total numbers of trees enumerated at all sites are about 8878 that makes 10.7 acres of area under green.

CONCLUSION

Carbon sequestration rate is approximated 49.27 kg per mature plant per year as per international standards. As per CPCB (2000) Guidelines, the trees to be planted are 1250 plants per acre, 1250 trees will absorb 1250 X 49.27 = 61587.50 kg of carbon per year per Acre. Project Site (Pench I&II) has this 1.16 acre of land as greenbelt. It means, Pench I & II: (1.16 acre Green Belt) No. of trees 2048. But as all the plants are not fully grown carbon absorption is calculated as 18724 kg carbon is get absorbed per year (Table 1 &2).

Present carbon emission in the plant area is very negligible during the process of water treatment for drinking purpose in the municipal corporation area of Nagpur city. But the overall projects (utilities) consuming large amount of electricity (Pench-I = 976500 Kwh/Year, Pench-Ii =1037990 Kwh/Year, which releases CO_2 in the process of Electricity generation process. Thus, it's a joint responsibility of electricity Production Company and User Company to increase the carbon absorption by adapting greenbelt development in the vicinity of 2000 mtrs. Veolia, Nagpur covers approximate area of 28 acres. Observations and Identification of plant species was done by experts in the field of botany especially plant taxonomy. Total numbers of trees enumerated at all sites are about 2048 that makes 1.16 acres of area under green.

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REFERENCES

Almeida, M. R. (1996-2003) Flora of Maharashtra Volume I to IV. Oriental Press, Mumbai. First Edition.

Anonymous. (1948). The Wealth of India - Raw Material I. A-B (Industrial Products) Delhi. II- C-1951, III-D-E-1953, IV-F-G. 1956, V H-K-1959.V Supplement 1962, (Council of Scientific & Industrial Research.)

Bahadur S. (1993). General Descriptions and Conditions of the Forests. Two Decades of Project Tiger, Melghat (1973 - 1993) 25-34. Publicity and Information officer, Pune.

Bhogaonkar & Devarkar. (1999). Additions to the Flora of Melghat (Some rare and Uncommon Plants). Technical Bulletin No. VII. The Directorate Project Tiger Melghat, Amravati. (Maharashtra, India.)

Central Pollution Control Board (2000). Guidelines for developing green belts. Ministry of Environment, Forest and Climate Change, New Delhi

Chavan, B and G. Rasal (2012) Carbon Sequestration potential and status of Peltophorunp terocarpum (DC.) K. Heyne Science Research Reporter 2(1):51-55

Devarkar, V. D., Nichat, V. V., & Joshi, M. P. (2018). Baseline Impact Assessment Studies on Flora & Fauna around Goa Industrial Development Corporation (GIDC), Goa Zone. *Plantae Scientia*, *1*(01), 9-17. https://doi.org/10.32439/ps.v1i01.9-17

Flowers of India (2013). Retrived August 12, 2013, from Flowers of India: http://www.flowersofindia.net/
Gamble J. S. 1919. Flora of Presidency of Madras. Vol I - II Kew - Britain. Global Invasive Species Database. (2013). Retrived Audits 14, 2013, from Global Invasive Species Database: http://www.issg.org/database/welcome/

Hooker J. D. (1872-1897). The Flora of British India. Vol. I - VII. London.

Kanth D. C. et al (1960). Wind Erosion, Wind – Breaks and Shelter – Belts; Farm Information Unit, Ministry of Food & Agriculture, New Delhi, Second edition.

Hu YL, Zeng DH, Ma XQ, Chang SX. (2016). Root rather than leaf litter input drives soil carbon sequestration after afforestation on a marginal cropland. Forest Ecology and Management.362: 38-45. https://doi.org/10.1016/j.foreco.2015.11.048

Jha K K (2015). Carbon storage and sequestration rate assessment and allometric model development in young teak plantation of tropical moist deciduous forest, India. Journal of Forestry Research 26(3):589-604. https://doi.org/10.1007/s11676-015-0053-9

Joshi, M. P., Barde, P., Mungantiwar, P., Bhole, A. ., & Devarkar, V. (2019). Environmental Impact Assessment Studies of Ground Water in Solapur Thermal Power Plant Area (Maharashtra), India. *Plantae Scientia*, *2*(4), 48-52. https://doi.org/10.32439/ps.v2i4.48-52

Liski J, Kaasalainen S, Raumonen P, Akujarvi A, Krooks A, Repo A, Kaasalainen M (2014). Indirect emission of forest bioenergy: detailed modelling of stump root systems, GCB Bioenergy 6(6): 777-784. https://doi.org/10.1111/gcbb.12091

Ravinranath, N. H. and M. Ostwald (2008) Advances in global change research Carbon inventory methods- Handbook for greenhouse gas inventory, Carbon mitigation and round wood production projects. Springer science.

Singh N. P. & S. Karthikeyan. (2000). Flora of Maharashtra State-Dicotyledones - Vol.1. Botanical Survey of India. Calcutta. India.

The Biological Diversity Act, (2002); No. 18 of 2003; Ministry of Law And Justice (Legislative Department)

Tiwari, A. K. and Singh, J. S. (1987). Analysis of forest land use and vegetation in a part of Central Himalaya using aerial photographs. Enviro Conserv., 14: 233-244. https://doi.org/10.1017/S0376892900016441

Table 1: Carbon sequestration in the study area

Plants at Gorewada (Pench I & II) ProjectSite

Sr. No.	Botanical Name	Family	Plant Count	Carbon Sequestration/ Year in Kg.	Total Carbon Sequestered / Year in Kg
1	Hyptis suveolens	Acanthaceae	60	1.7	102
2	Ruellia tuberosa	Acanthaceae	23	1.8	41.4
3	Asteracantha longifolia	Acanthaceae	41	1.3	53.3
4	Peristophe bicalyculata	Acanthaceae	54	1.2	64.8
5	Achyranthus aspera	Amaranthaceae	75	1.2	90
6	Alternanthera sessilis	Amaranthaceae	80	1.1	88
7	Mangifera indica	Anacardiaceae	2	80.48	160.96
8	Anona squamosa	Annonaceae	5	36.11	180.55
9	Anona reticulata	Annonaceae	2	36.22	72.44
10	Thevetia peruviana	Apocyanaceae	11	17.55	193.05
11	Barleria prionities	Apocyanaceae	35	5.2	182
12	Phonix sylvestris	Arecaceae	4	32.25	129
13	Borassus flabelifer	Arecaceae	10	33.54	335.4
14	Pergularia daemia	Asclepiadaceae	10	3.2	32
15	Spathodia campanulata	Bignoniaceae	4	84.65	338.6
16	Tamarindus indicus	Caesalpiniaceae	10	60.15	601.5
17	Bauhinia racemosa	Caesalpiniaceae	4	72.4	289.6
18	Terminalia catapa	Combrataceae	8	87.65	701.2
19	Ipomoea hederifolia	Convolvulaceae	25	1.32	33
20	Coccinia indica	Cucurbitaceae	23	2.36	54.28
21	Bryonopsis laciniosa	Cucurbitaceous	24	3.45	82.8
22	Thuja arvensis	Cupressaceae	30	30.14	904.2
23	Phylantus emblica	Euphorbiaceae	4	38.69	154.76
24	Tephrosia purpurea	Fabaceae	40	2.36	94.4
25	Butea monosperma	Fabaceae	10	64.53	645.3
26	Clitoria ternatea	Fabaceae	25	2.54	63.5
27	Mucuna pruriens	Fabaceae	41	4.8	196.8
28	Rhynchosia minima	Fabaceae	78	1.3	101.4

Table 2: Carbon sequestration in the study area

Sr. No.	Botanical Name	Family	Plant Count	Carbon Sequestration/ Year in Kg.	Total Carbon Sequestered / Year in Kg
29	Pongamia pinnata	Fabaceae	12	52.3	627.6
30	Gulphimia glauca	Malpighiaceae	10	7.6	76
31	Abutilon indicum	Malvaceae	25	2.8	70
32	Hibiscus rosa-sinensis	Malvaceae	32	22.3	713.6
33	Azadirachta indica	Meliaceae	12	35.4	424.8
34	Tinospora cordifolia	Menispermaceae	35	39.25	1373.75
35	Acacia arabica	Mimosaceae	20	50.63	1012.6
36	Prosopis juliflora	Mimosaceae	10	35.2	352
37	Pithecellobium dulce	Mimosaceae	8	48.5	388
38	Ficus carica	Moraceae	12	80.15	961.8
39	Ficus benghalensis	Moraceae	2	100.5	201
40	Ficus religiosa	Moraceae	2	95.6	191.2
41	Eugenia jambolana	Myrtaceae	4	85.2	340.8
42	Callistemon lanceolatus	Myrtaceae	12	32.1	385.2
43	Psidium gujava	Myrtaceae	2	35.28	70.56
44	Nelumbo nucifera	Nymphaeaceae	150	2.9	435
45	Cynodon dactylon	Poaceae	400	1.2	480
46	Andropogon pumilus	Poaceae	425	1.3	552.5
47	Setaria intermedia	Poaceae	300	1.5	450
48	Dendrocalamus strictus	Poaceae	30	4.8	144
49	Potamogeton natans	Potamogetonaceae	40	2.4	96
50	Anthocephalus cadamba	Rubiaceae	3	100.65	301.95
51	Ixora parviflora	Rubiaceae	30	22.1	663
52	Citrus limon	Rutaceae	2	38.45	76.9
53	Aegle marmelos	Rutaceae	4	69.2	276.8
54	Sapindus laurifolius	Sapindaceae	2	80.58	161.16
55	Mimusops elengi	Sapotaceae	4	78.56	314.24
56	Ailanthus excelsa	Simaroubaceae	3	105.2	315.6
57	Datura stramonium	Solanaceae	10	9.54	95.4
58	Tectona grandis	Verbenaceae	10	86.65	866.5
59	Lantana camara	Verbenaceae	30	10.66	319.8
		Total	**2048**		**18724**