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ESTIMATION OF STANDING BIOMASS AND CARBON SEQUESTRATION STUDIES AT BIOLOGICALLY RECLAIMED OVERBURDEN DUMPS OF GOUTHAM KHANI OCP

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ABSTRACT

Coal is the most abundant fossil fuel of India, it contributes about 61% of Indian electricity needs. Coal is produced in India by two different mining methods viz., Underground method and Opencast method. 92% of Coal Production in India is through Opencast Mining activity only. During opencast mining, Surface materials covering the valuable deposit considered as Over Burden(OB). The overlying soil is removed and the fragmented rock is heaped in the form of overburden dumps. These dumps are covered with top soil and biologically reclaimed.

Reclaimed overburden dumps of Gouthamkhani OCP is selected for the study and the CO_2 sequestration in reclaimed mine sites is calculated by estimating carbon stock of standing biomass (above ground and below ground), The above ground biomass (AGB) carbon stock consists of all living vegetation above the soil, inclusive of stems, stumps, branches, bark, seeds and foliage, while the below ground biomass (BGB) carbon stock consists of the biomass contained within live roots. Data is collected from 55 sample plots distributed over the entire study area, each sample plot covers an area of 0.1 Ha. Girth at breast height, Height and Crown size of trees recorded for each plot to arrive the total Carbon pool.

The above study established that the total carbon pool in study area is 38,026 Tonnes, for the accumulation of above, 1,39,557 Tonnes of Corbon dioxide is sequestrated by reclaimed plants of OB dumps and during the process 1,04,573 Tonnes of O_2 is liberated.

Key Words:

Biological Reclamation, Carbon Pool, Carbon Sequestration, Eco-restoration, Over Burden and Carbon stock

1. Introduction :

India is an emerging and developing country, Continuous electric supply plays key role in countries development.70% of Indian electricity production throw thermal power, coal alone contributes 62% of Indian electricity production. Surface mining and underground mining are the two basic methods adopted for coal production in India. Overlying sand and non economic rock material is considered as overburden. Opencast mining operation involves huge quantities of overburden removal and heaping the removed rock material in the form of

Overburden Dumps (*Gosh, 2002*). Mine spoil poses adverse conditions for soil microbe and plant growth due to its low organic matter and unfavorable soil chemistry, poor structure and high isolation from vegetation (*Singh et al., 1996*). For biological reclamation, unproductive mine spoils are handled in phased manner to make them suitable for plant growth viz., rebuilding of soil structure, management of soil pH by adding lime, increasing soil fertility by adding saw dust & plant residues, introducing soil microbes and restoring nutrient cycles etc.

Re-vegetation is one of the widely used techniques for controlling erosion and stabilization of dump slope (*Akers and Muter, 1974; and Singh et al., 1996*), and thereby maintaining ecological equilibrium in the area (*Jorgensen, 1994*). Eco restoration activity on mine spoils and mine surroundings helps in Carbon (C) sequestration which results in reduction of the greenhouse gases, improves the visual aesthetics, and helps in preventing sound pollution and dust pollution.

Carbon sequestration is defined as ‘‘the process of increasing the carbon content of a C pool other than the atmosphere’’ (*IPCC, 2000*). Terrestrial carbon sequestration is the process of transferring of atmospheric CO_2 through the photosynthesis process into biomass such as trees, shrubs, herbs and other vegetative matter. C sequestration through reclaimed coal mine soils have received considerable attention in recent past. The C sequestration in reclaimed mine sites is calculated by estimating C-stock of biomass (above ground and below ground), litter and reclaimed mine soils. The above ground biomass (AGB) C-stock consists of all living vegetation above the soil, inclusive of stems, stumps, branches, bark, seeds and foliage, while the below ground biomass (BGB) C-stock consists of the biomass contained within live roots. The greatest fraction of total biomass of forests is represented by trees. **Location of the study area:**Carbon sequestration study was carried out in a ecologically restored coalmine overburden dumps of Goutham Khani OCP project, operated by The Singareni Collieries Company Limited (SCCL), Kothagudem coal belt of Godavari Valley Coal Field (GVCF), located 10km away from the District head quarters Kothagudem of Badradri Kothagudem District, Telangana state and its geographical coordinates with Latitude 17°26’22” N to 17°28’15” N and Longitude 80°37’30” E to 80°40’05” E. Study area average MSL is 140m with minor variations. Maximum height of OB dump is 90m with 30m deck interval. The mine is operated with shovel dumper combination. The temperature varies between 22.5 to 49.6°C and the wind speed is 5 to 6 m/s from south to south-west direction, with a relative humidity of minimum 42% and maximum 85%. The average annual rainfall is 1150mm. Total Project area including infrastructure is 902 Ha, with the production capacity of 3 Mt/y. The study was carried out for an area of 452 Ha covered by reclaimed OB dumps.

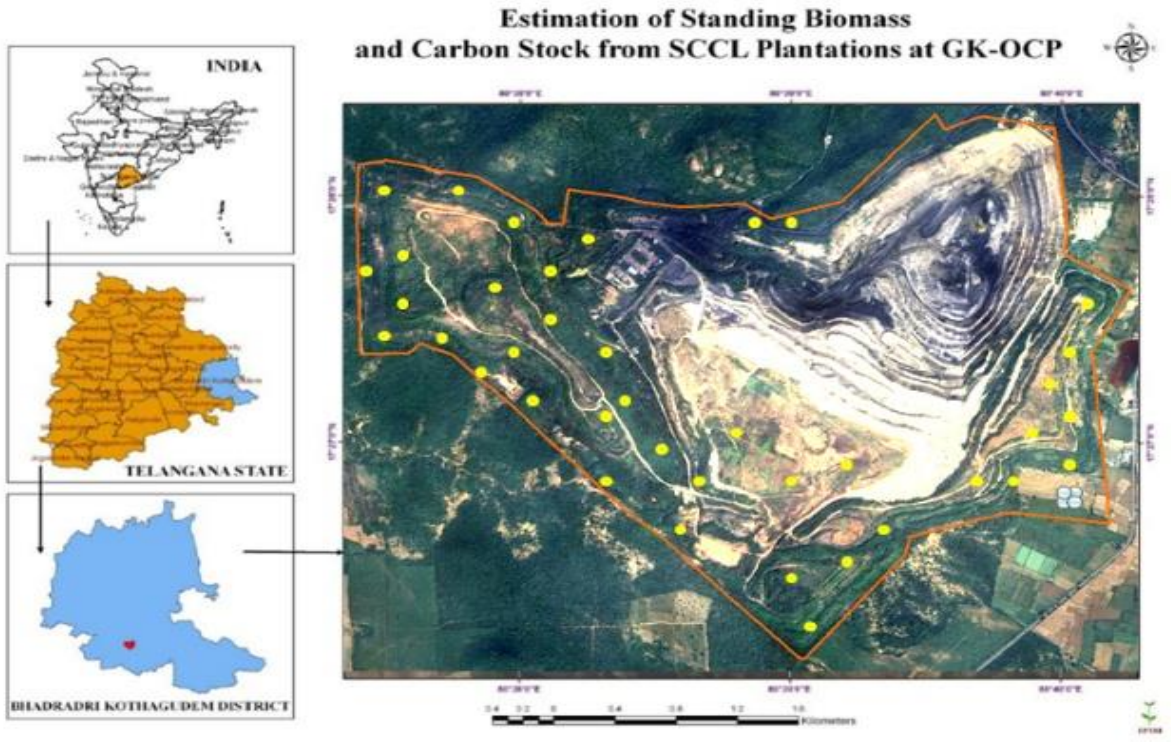

Fig 1: Location Map and Image (Google) Showing the study area

2. Methodology:

The primary data was collected from the study area in 55 randomly distributed sample plots of 0.1 ha each. The location of sample plots is shown in the map with yellow dots. Thus a total of 5.5 hectare area was sampled covering 1.22% of the total 452 hectare study area. A total of 55 sample plots of 31.62 x 31.62m size were identified based on Normalized Difference Vegetation Index (NDVI) values. A comprehensive format design of Vegetation Carbon Pool (VCP) Assessment by National Carbon Project, Indian Institute of Remote Sensing (IIRS) (*Singh and Dadhwal, 2008)* was adopted for data collection.

Enumeration of trees was done in each plot by measuring the Girth at Breast Height (GBH) (1.3m GBH) and the height & approximate crown size of the tree (Photo-a). One ultimate branch of 5cm girth (thumb size) was selected having twigs, leaves, flowers or fruits. The fresh weight (Photo-b) was recorded by using Electronic Balance at field site. Branch samples for each species were collected for different girth classes. The data for each species was classified based on GBH classes: ≥10-30cm, ≥31-60cm, ≥61-90cm, ≥91- 120cm, ≥121-150cm, ≥151-180cm, ≥181-210cm etc. The Twigs (material collected at field) was dried for a period of 30 days, and the dry weight (Photo-c) was recorded.

Photo: a) GBH Measurement; b) Recording Wet Weight; c) Recording Dry Weight after 30 days.

We have also documented the species available in the plots. All the plant taxa present in the sample plots were recorded and photographed during the field survey. The estimation of volume, biomass and carbon stocks of trees in the study area were calculated for all 55 sample plots spreading all over the OB dumps and covering different age groups and plant densities.

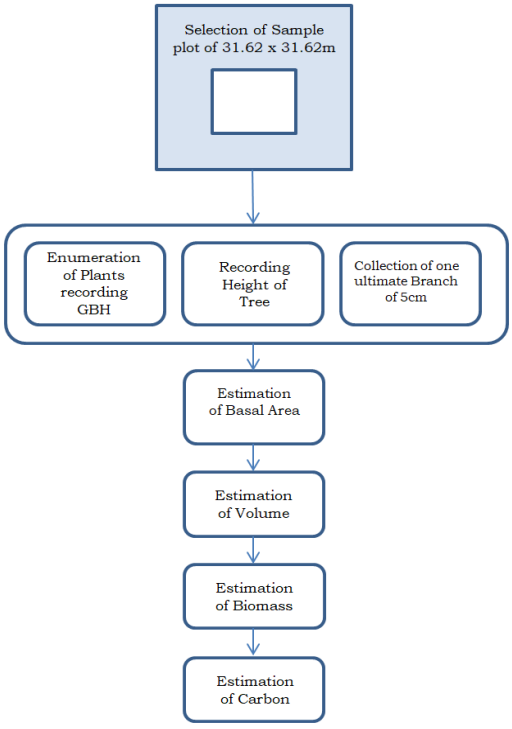

*Fig 2:*Flow Chart of field Methodology

3. Results:

The above studies have established the presence of 18 families *(Table-1 and Fig-3)* consisting of 40 genera and 52 species with a total strength of 5618 tree individuals (<30 GBH 3732 individuals and >30 GBH 1886 individuals) in the sample plots of 5.5Ha. The mean stem density is 102 stems ha^{-1}. The dominant tree species are *Eucalyptus globules* (1051 individuals) followed by *Leucaena leucocephala* (923), *Pongamia pinnata* (678), *Pithecellobium dulce* (463), *Simarouba amara* (445), *Senna siamea* (401), *Albizia procera* (225), *Peltophorum pterocarpum* (194), *Phyllanthus emblica* (144), *Acacia auriculiformis* (142), *Hardwickia binata* (141), *Prosopis juliflora* (110) and *Gliricidia Sepium* (100) which shares 89.3% of the total population of the sampled inventory. However, different sampling plots (0.1 ha) showed diversity as per the species as well as total number of individuals are concerned, this ranges from 41 to 227 individuals in different plots.

Table-1

Systematic enumeration of GK OCP Plantation			
S.No.	**Family**	**Species**	**Genera**
1	Leguminosae	22	16
2	Simaroubaceae	2	2
3	Rutaceae	2	2
4	Meliaceae	1	1
5	Ebenaceae	1	1
6	Sapindaceae	1	1
7	Myrtaceae	2	2
8	Moraceae	5	1
9	Combretaceae	4	2
10	Lamiaceae	2	2
11	Apocynaceae	1	1
12	Ulmaceae	1	1
13	Sapotaceae	2	2
14	Anacardiaceae	1	1
15	Rubiaceae	2	2
16	Phyllanthaceae	1	1
17	Celastraceae	1	1
18	Rhamnaceae	1	1
		52	**40**

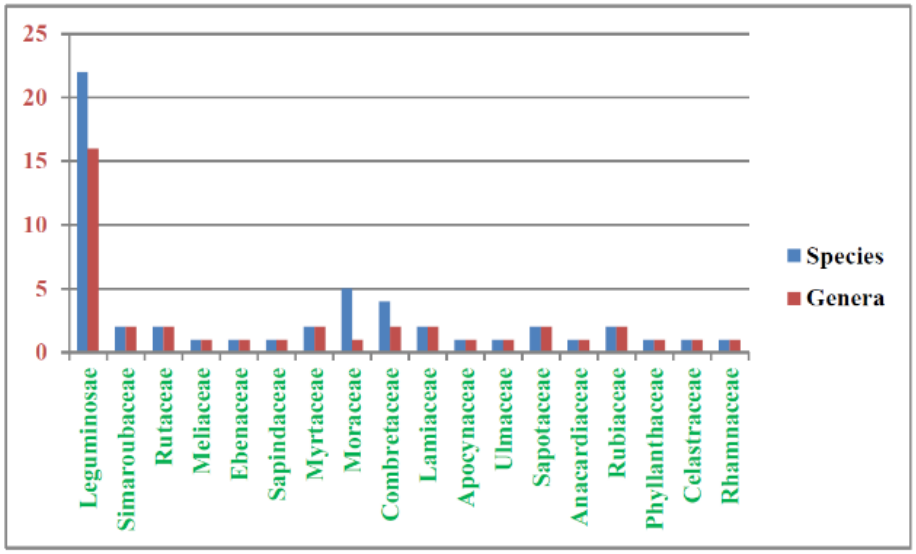

Figure-3: Systematic enumeration of GK OCP Plantation

4. Carbon (C) pool estimation:

4.1 Biomass of trees with ≥10-30 cm GBH

4.1.1 Basal Area (BA):

Basal area of each tree was calculated by using following standard formulas

dbh (cm) = gbh(cm) / π

dbh (m) = dbh(cm) / 100

Radius(r) = dbh(m) / 2

Basal Area (m^2 ha^{-1}) = πr^2

The basal area of individual plants are in ranges between 0.008-22.3 m^2 ha^{-1} in the sampled plots **(Table-2).** The top ten dominant tree species basal areas are viz., *Eucalyptus globulus* (22. m^2 ha^{-1}), *Leucaena leucocephala* (19.2 m^2 ha^{-1}), *Pongamia pinnata* (14.5 m^2 ha^{-1}), *Simarouba amara* (11.7 m^2 ha^{-1}), *Pithecellobium dulce* (10.2 m^2 ha^{-1}), *Hardwikia binata* (3.9 m^2 ha^{-1}), *Albizia procera* (3.8 m^2 ha^{-1}), *Phyllanthus emblica* (3.5 m^2 ha^{-1}) and *Gliricidium sepium* (3.1 m^2 ha^{-1}). The top ten dominant tree species shared 83.04% of the total basal area.

4.1.2 Volume (V)

Volume of each tree of ≥10cm diameter and above was estimated using the selected volumetric equation developed and compiled by FSI (1996). The volume of individual plants in the study area ranges between 0.025-47m^3 ha^{-1} in the sampled plots **(Table-2)**. The top ten dominant species are *Eucalyptus globulus* (46.7 m^3 ha^{-1}), *Pongamia pinnata* (41.25 m^3 ha^{-1}), *Leucaena leucocephala* (36.8 m^3 ha^{-1}), *Simarouba amara* (18.9 m^3 ha^{-1}), *Senna siamea* (17.3 m^3 ha^{-1}), *Acacia auriculiformis* (9.2 m^3 ha^{-1}), *Albizia procera* (7.2 m^3 ha^{-1}), *Hardwickia binata* (7.1 m^3 ha^{-1}) and *Prosopis juliflora* (5.5 m^3 ha^{-1}. The top ten dominant tree species shared 84.69% of the total volume.

4.1.3 Biomass

The estimated volume was converted into biomass by multiplying with specific gravity (Limaye and Sen 1956; Rajput *et al.*, 1996). Biomass of all the trees was summed up to obtain total biomass (AGB). The AGB ranges of individual plants are in between 0.017-28 Mg ha^{-1} in the sampled plots **(Table-2)**. The top ten dominant species are *Eucalyptus globulus* (27.84 Mg ha^{-1}), *Pongamia pinnata* (26.39 Mg ha^{-1}), *Leucaena leucocephala* (23.14 Mg ha^{-1}), *Simarouba amara* (12.4 Mg ha^{-1}), *Pithecellobium dulce* (11.4 Mg ha^{-1}), *Senna siamea* (10.8 Mg ha^{-1}), *Acacia auriculiformis* (5.5 Mg ha^{-1}), *Albizia procera* (4.43 Mg ha^{-1}), *Hardwickia binata* (3.8 Mg ha^{-1})

In the present study, 20% of the above ground biomass was considered as root biomass (BGB) (Achard*et al.*, 2002; Houghton *et al.*, 2001; Jenkinson, 1990; Montagu *et al.*, 2002; Ramankutty*et al.*, 2007).

Table-2: GK OCP ≥10-30cm GBH Species Values

Plot No.	BA (m^2 ha^{-1})	Volume ($m3$ ha^{-1})	Biomass (Mg ha^{-1})	BGB	TB	Carbon Stock (Tonne)
1	2.239	8.001	4.717	0.943	5.660	2.66
2	1.86	5.883	3.713	0.743	4.456	2.094
3	4.004	7.519	4.651	0.93	5.582	2.623
4	1.847	1.381	0.884	0.177	1.060	0.498
5	2.32	3.67	2.323	0.465	2.787	1.31
6	3.32	17.208	9.205	1.841	11.046	5.192
7	1.977	2.771	1.692	0.338	2.031	0.955
8	0.745	1.998	1.227	0.245	1.472	0.692
9	0.717	1.068	0.664	0.133	0.797	0.375
10	1.746	0.485	0.344	0.069	0.413	0.194
11	2.711	4.533	2.82	0.564	3.384	1.59
12	1.664	1.588	1.076	0.215	1.291	0.607
13	0.882	1.559	1.045	0.209	1.254	0.589
14	1.748	2.489	1.672	0.334	2.007	0.943
15	1.229	5.392	3.12	0.624	3.745	1.76
16	1.399	2.796	1.727	0.345	2.072	0.974
17	2.557	3.239	2.02	0.404	2.424	1.139
18	2.42	4.826	3.105	0.621	3.726	1.751
19	4.457	6.226	3.962	0.792	4.754	2.234
20	4.911	8.114	5.261	1.052	6.313	2.967
21	2.042	4.532	2.322	0.464	2.787	1.31
22	1.243	1.7	1.022	0.204	1.227	0.577
23	2.69	3.114	1.917	0.383	2.301	1.081
24	1.235	1.452	0.919	0.184	1.103	0.518
25	4.207	8.426	5.132	1.026	6.158	2.894
26	0.808	2.21	1.423	0.285	1.707	0.802
27	1.405	3.496	2.37	0.474	2.844	1.337
28	2.009	3.845	2.714	0.543	3.256	1.531
29	2.614	7.732	4.706	0.941	5.647	2.654
30	4.045	7.37	4.508	0.902	5.410	2.543
31	2.266	5.377	3.677	0.735	4.412	2.074
32	3.527	1.886	1.324	0.265	1.589	0.747
33	3.411	1.308	0.884	0.177	1.061	0.499
34	3.227	6.867	4.166	0.833	4.999	2.349
35	0.139	0.077	0.052	0.01	0.062	0.029
36	2.73	6.296	3.813	0.763	4.576	2.151
37	1.048	5.465	3.312	0.662	3.975	1.868
38	0.672	1.815	1.276	0.255	1.531	0.719
39	0.99	3.947	2.621	0.524	3.145	1.478
40	2.321	6.166	3.925	0.785	4.710	2.214
41	2.428	6.638	4.234	0.847	5.080	2.388
42	1.871	3.245	2.129	0.426	2.555	1.201
43	1.456	4.662	2.872	0.574	3.446	1.62
44	2.5	8.693	5.655	1.131	6.786	3.189
45	3.813	8.406	5.083	1.017	6.099	2.867
46	1.444	4.822	2.891	0.578	3.469	1.63
47	1.496	4.387	2.822	0.564	3.387	1.592
48	1.158	3.511	2.18	0.436	2.616	1.229
49	3.095	7.215	4.684	0.937	5.621	2.642
50	2.877	4.132	2.667	0.533	3.201	1.504
51	3.096	1.245	0.841	0.168	1.010	0.475
52	2.464	6.692	4.21	0.842	5.052	2.375
53	1.598	2.427	1.578	0.316	1.893	0.89
54	1.752	4.1	2.715	0.543	3.258	1.531
55	0.386	0.799	0.485	0.097	0.582	0.274
Total	**118.815**	**244.803**	**152.354**	**30.471**	**182.825**	**85.928**

4.2 Biomass of trees with ≥30 cm GBH

4.2.1 Basal Area (BA)

The basal area of individual plants ranges between 0.076-81 m^2 ha^{-1} in the sampled plots **(Table-3)**. The top ten dominant tree species are *Eucalyptus globulus* (81.38 m^2 ha^{-1}), *Leucaena leucocephala* (43.79 m^2 ha^{-1}), *Peltophorum pterocarpum* (39.19 m^2 ha^{-1}), *Senna siamea* (30.9 m^2 ha^{-1}), *Pithecellobium dilce* (21.9 m^2 ha^{-1}),

Pongamia pinnata (18.06 m^2 ha^{-1}), *Azadirachta indica* (16.8 m^2 ha^{-1}), *Simarouba amara* (16.1m^2 ha^{-1}), *Albizia procera* (13.4m^2 ha^{-1}) and *Mangifera indica* (8.5 m^2 ha^{-1}). The top ten dominant tree species shared 85.77% of the total basal area **(Table-3)**.

4.2.2 Volume (V):

The volume of individual plants ranges between 0.033-312 m^3 ha^{-1} in the sampled plots **(Table-3).** The top ten dominant species are *Eucalyptus globulus* (312.1 m^3 ha^{-1}), *Mangifera indica* (294.13 m^3 ha^{-1}), *Azadirachta indica* (293.7 m^3 ha^{-1}), *Peltophorum pterocarpum* (121.2 m^3 ha^{-1}), *Pithecellobium dulce* (68.6 m^3 ha^{-1}), *Leucaena leucocephala* (30.9 m^3 ha^{-1}), *Syzygium cumini* (20.7 m^3 ha^{-1}), *Albizia procera* (17.2 m^3 ha^{-1}), *Ficus religiosa* (13.6 m^3 ha^{-1}) and *Pongamia pinnata* (12.48 m^3 ha^{-1}). The top ten dominant tree species shared 94.92% of the total volume **(Table-3).**

4.2.3 Biomass

The biomass of individual plants ranges between 0.026-211 Mg ha^{-1} in the sampled plots **(Table-3)**. The top ten dominant species are *Eucalyptus globulus* (210.99 Mg ha^{-1}), *Azadirachta indica* (203.53 Mgha^{-1}), *Mangifera indica* (170.89 Mg ha^{-1}), *Peltophorum pterocarpum* (73.83 Mg ha^{-1}), *Pithecellobium dulce* (41.7 Mg ha^{-1}), *Leucaena leucocephala* (18.57 Mg ha^{-1}), *Syzygium cumini* (13.41 Mg ha^{-1}), *Albizia procera* (9.2 Mg ha^{-1}), *Pongamia pinnata* (7.6 Mg ha^{-1}) and *Acacia chundra* (7.5 Mg ha^{-1}). The top ten dominant tree species shared 94.64% of the total Biomass **(Table-3)**.

5. Total Biomass (TB):

The total biomass of each plot was calculated by the addition of total above-ground biomass (AGB) and below ground biomass (BGB). Further the mean and standard deviation was calculated and extrapolated for the whole study area. The sum of total AGB and BGB of ≥10-30cm ranges between 0.062-11.05 Mg ha^{-1} in the sampled plots with a mean value of 3.324 Mg ha^{-1}. It accounts for 182.825 Mg in the study area (**Table-2)**. The sum of the total AGB and BGB of ≥31cm ranges between 0.35-567 Mg ha^{-1} in the sampled plots with a mean value of 17.5 Mg ha^{-1}. It accounts for 962 Mg in the study area (**Table-3)**. The total biomass in study area (all the individuals) is 1144.825 Mg.

6. Carbon Pool:

The carbon pool of individual plants ranges between 0.03-5.2 Mg ha^{-1} in the sample plots with a mean value of 1.5 Mg ha^{-1} of ≥10-30 cm GBH trees the total carbon pool in the study area is 85.928(A) Mg (**Table-2)**.

The carbon pool of individual plants ranges between 0.13-223.24 Mg ha^{-1} in the sample plots with a mean value of 6.85 Mg ha^{-1} of ≥31 cm GBH trees. The total carbon pool in the study area is 376.783 (B) Mg (**Table-3)**. The below ground biomass was estimated by adding 20% value to above ground biomass. The total carbon pool in the sample plot area (all the individuals A+B) is 462.711 Mg.

Table-3: GK OCP >30 GBH Species Values

Plot No.	BA (m^2 ha^{-1})	Volume (m3 ha^{-1})	Biomass (Mg ha^{-1})	BGB	TB	Carbon Stock (Tonne)
1	0.731	1.003	0.62	0.124	0.744	0.291
2	1.17	0.922	0.589	0.118	0.707	0.277
3	7.377	4.904	3.206	0.641	3.848	1.507
4	2.351	1.332	0.841	0.168	1.009	0.395
5	8.549	2.558	1.668	0.334	2.002	0.784
6	6.97	7.534	4.041	0.808	4.849	1.899
7	13.941	15.867	10.194	2.039	12.232	4.791
8	3.665	3.05	2.235	0.447	2.681	1.05
9	5.382	3.943	2.603	0.521	3.123	1.223
10	3.236	1.247	1.023	0.205	1.228	0.481
11	0.829	1.493	0.911	0.182	1.094	0.428
12	2.17	0.718	0.502	0.1	0.602	0.236
13	1.515	0.711	0.445	0.089	0.535	0.209
14	0.642	0.342	0.311	0.062	0.373	0.146
15	6.699	18.236	11.191	2.238	13.429	5.26
16	11.871	32.704	22.009	4.402	26.411	10.344
17	7.776	3.941	2.688	0.538	3.226	1.263
18	13.506	26.312	17.637	3.527	21.165	8.29
19	13.742	4.922	3.136	0.627	3.763	1.474
20	14.027	8.16	5.036	1.007	6.043	2.367

Plot No.	BA (m^2 ha^{-1})	Volume (m3 ha^{-1})	Biomass (Mg ha^{-1})	BGB	TB	Carbon Stock (Tonne)
21	41.6	738.023	474.99	94.998	569.988	223.245
22	1.878	1.076	0.647	0.129	0.776	0.304
23	4.585	4.462	2.885	0.577	3.462	1.356
24	10.158	15.865	10.593	2.119	12.712	4.979
25	3.952	2.521	1.542	0.308	1.85	0.725
26	1.251	2.632	1.751	0.35	2.101	0.823
27	1.807	2.014	1.32	0.264	1.583	0.62
28	2.116	4.368	1.979	0.396	2.375	0.93
29	4.041	7.057	4.314	0.863	5.177	2.027
30	8.954	4.457	2.707	0.541	3.248	1.272
31	3.97	3.154	2.063	0.413	2.476	0.97
32	2.14	0.401	0.288	0.058	0.346	0.135
33	1.951	0.783	0.528	0.106	0.634	0.248
34	4.957	8.413	5.289	1.058	6.346	2.486
35	17.039	78.923	53.352	10.67	64.022	25.075
36	1.155	0.842	0.502	0.1	0.603	0.236
37	1.492	3.649	2.201	0.44	2.641	1.034
38	0.683	0.704	0.429	0.086	0.515	0.202
39	1.137	2.036	1.292	0.258	1.551	0.607
40	1.394	0.878	0.652	0.13	0.782	0.306
41	9.536	13.812	8.642	1.728	10.371	4.062
42	0.635	1.33	0.821	0.164	0.986	0.386
43	5.047	9.986	6.188	1.238	7.426	2.908
44	4.83	13.052	8.036	1.607	9.643	3.777
45	1.952	1.415	0.875	0.175	1.049	0.411
46	2.014	1.958	1.29	0.258	1.548	0.606
47	3.917	8.003	4.764	0.953	5.717	2.239
48	3.337	7.275	4.342	0.868	5.211	2.041
49	8.062	13.456	8.301	1.66	9.961	3.901
50	8.527	20.264	13.556	2.711	16.267	6.371
51	8.489	6.534	4.417	0.883	5.301	2.076
52	6.097	5.297	3.195	0.639	3.834	1.502
53	2.11	2.288	1.437	0.287	1.724	0.675
54	2.238	1.184	0.777	0.155	0.933	0.365
55	29.705	123.827	74.816	14.963	89.779	35.164
Total	**338.903**	**1251.839**	**801.667**	**160.333**	**962**	**376.783**

CONCLUSION:

Reclamation process is an integral part of mining operation aimed to stabilize mine degraded sites which resulted carbon sequestration. C stock in reclaimed mine soil is dependent on the nature & type of soil, vegetation, age and geo-climatic conditions.

The study area is dominated by *Eucalyptus globulus, Leucaena leucocephala, Pongamia pinnata, Albizia saman, Azadirachta indica, Bambusa bambos, Ficus benghalensis, Ficus religiosa, Hardwickia binata, Limonia acidissima, Peltophorum pterocarpum, Phyllanthus emblica, Psidium guajava, Senna siamea, Simarouba amara, Tectona grandis* etc., A total of 52 species was documented. These species were classified into two girth classes *i.e.* ≥10-30 cm GBH and ≥31 cm GBH. Total standing crop biomass was estimated based on volume and specific gravity. Total carbon accumulation was estimated using carbon factor 0.47. A total of **462.711** Mg (tonnes) of C-stock was found accumulated in the sampling plots (i.e. 5.5 ha) while a total of **38,026.43** Mg (Tonnes) C-stock was found accumulated in the study area (452 ha).

As one ton of carbon equals to 3.67 Mg (Tonnes) of carbon dioxide, hence, in the study area 38,026.43 tons of carbon stock accumulated is equals to 1,39,557 Mg (Tonnes) of carbon dioxide is sequestrated and oxygen liberated during this process is 1,04,573 Mg (Tonnes).

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