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Study Of Flora And Soil Quality Of Selected Chromite Mining OB Dumps In Sukinda, Odisha, India.

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Abstract

The nature plays a very significant role in the maintenance of ecological order of the ecosystem.
The forests, occupy unique position because of its renewable nature. Forests also preside protection to other resources and crops. The species diversity in a plant community increases with the decrease in anthropogenic disturbances. As a result of mining and coal combustion significant areas of land are degraded and acting ecosystems are replayed by undesirable waste materials in the form of dumps, tailing dams and ash dams. The dumping of mine tailings and other rejected materials (referred to as overburden, OB) generated from opencast metal mines is considered as a major contributor to the ecological and environnemental degradation. Plant communities are often subjected to disturbances and these conditions may facilitate co-existence and maintain high diversity**.** To understand the influence of disturbances on vegetation, their spatial and temporal dimension, frequency of occurrence and magnitude has to be considered**.** Relatively more biological rich area was observed where the disturbance is low. The Indian Bureau of mines (2000) has recommended ecorestoration of dump as a part of natural succession process and it should be started with sowing of seeds of legumes, grasses, herbs and shrubs in the inter-spacing of tree plantation.

Key Words: ecosystem, community, overburden, opencast mine, spatial and temporal dimension

INTRODUCTION

The dumping of mine tailings and other reject materials (referred to as overburden, OB) generated from opencast metal mines is considered as a major contributor to the ecological and environnemental dégradation (Chaoji 2002; Ghose 2004; Deka Boruah *et al 2008).* Hoyel (1973) reported that, organic mater raised water holding capacity, cation exchange capacity and served as reservoir of nutrients. A comprehensive and up to date knowledge of flora is essential for the study of plant resources of any areas and their utility and in turn is prerequisite for protection and proper management of biodiversity **(**Reddy *et al*. 2006). The success of any biological reclamation depends on: climatic conditions, nature of spoils, types of plant species, nature of dumps, proximity to seed banks and types of amendments used (Maiti, 2006b). **Fig.1** shows the location of the study sites and **Table 1** depicts the detail ideas of the study sites.

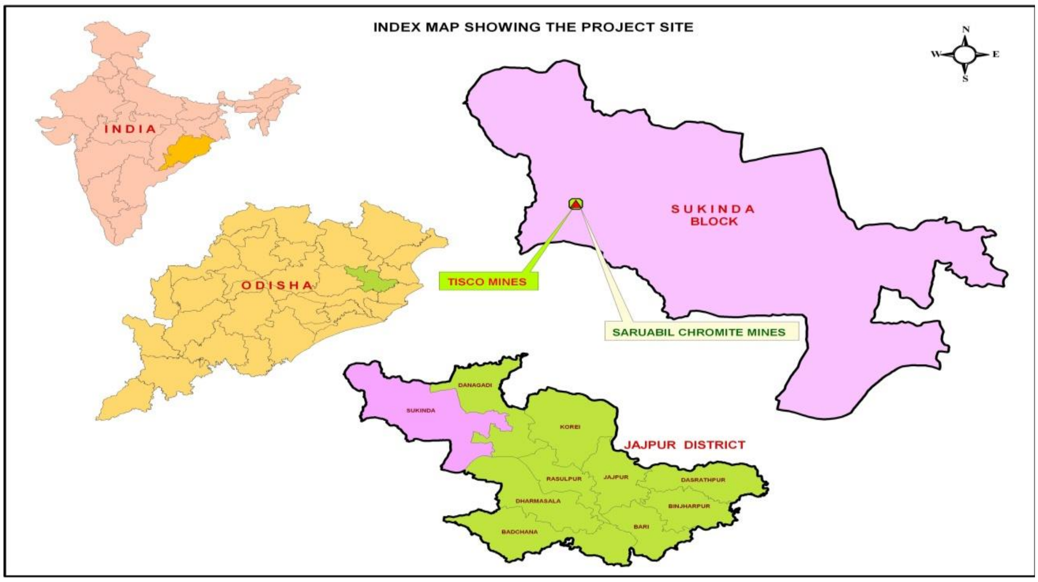

Fig 1: - Map of the Study site

The study site is located in Sukinda valley of Jajpur district in Odisha. This area is connected with the nearest railway station of Jajpur- Keonjhar road in Howrah-Madras main rail-line and by an all weather road of 55km connecting National High way (NH5). Sukinda valley is at a distance of 130 km from the state capital Bhubaneswar and is a Tehsil with its Head Quarter at Sukindagarh town (38 KM towards west from District head quarter) bounded by Korei , Byasanagar Tehsil in East , Danagadi Tehsil in north , Rasulpur Tehsil in south . Nearby towns are Byasanagar, Bhuban, Anandapur and Jajapur. Jajpur district with a total area of 2899 sqkms consists of ten blocks rich with most fertile lands on the bank of river Baitarini which produce a large quantity of cash crops every year. Eight sites were selected for study, out of which 6 were from OB (Over Burden) dumps and two were reclaimed mining sites. All the study sites are in Sukinda chromite mining region and belong to two mining companies Viz. Tata steel mines and Saruabil mines. The phytosociological study was carried out during December 2009 to August, 2011 by laying quadrats of 10mx10m for the tree and 1mx1m for the herb species as per the procedure given in Misra (1968).

Table 1: The study sites, location and plantation age of re- claimed sites in Sukinda Chromite mining area.

Site	Site No	Name of site	Site Location	Plantation Age
1	D1	OB-II dump	Tata Steel	1Yr
2	D2	Kakudia dump	Tata Steel	2Yrs
3	D3	Magazine dump	Saruabil	3Yrs
4	D4	OB-X dump	Tata Steel	4Yrs
5	D5	Reclaimed-13	Tata Steel	13Yrs
6	D6	Main Road Side dump	Saruabil	14Yrs
7	D7	Reclaimed-15	Tata Steel	15Yrs
8	D8	Artificial Reservoir side	Saruabil	18Yrs

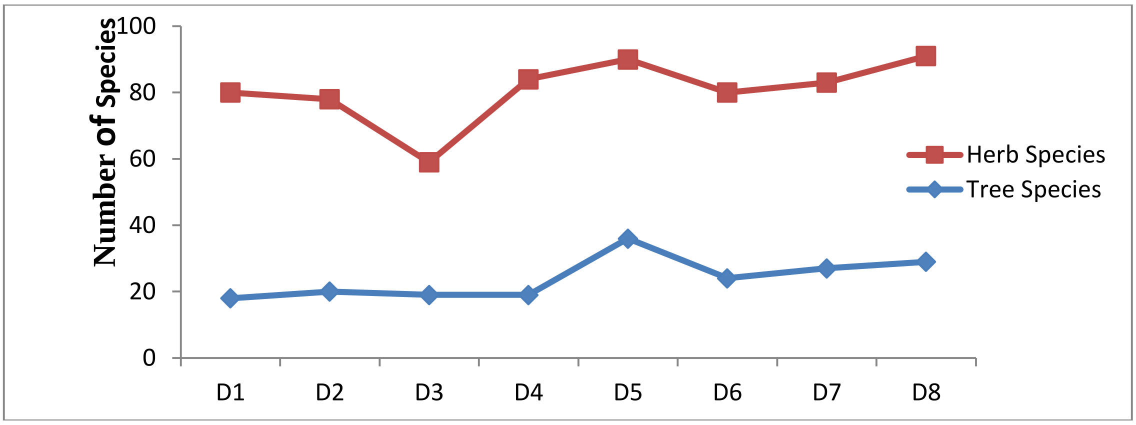

Figure:1 Total number of species (Tree and herb) recorded at study sites

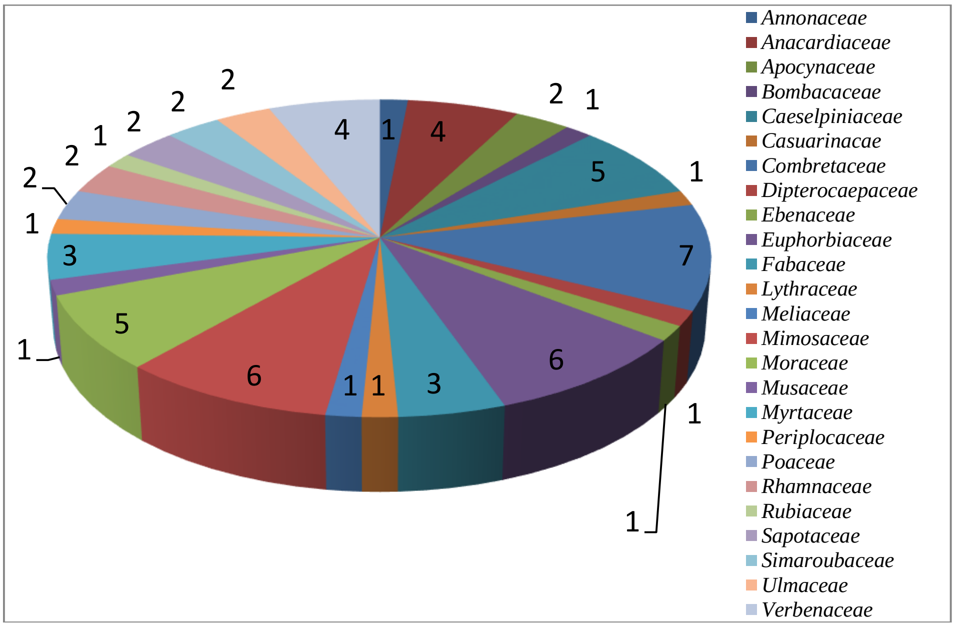

Fig. 2 Tree species and their families recorded at study sites

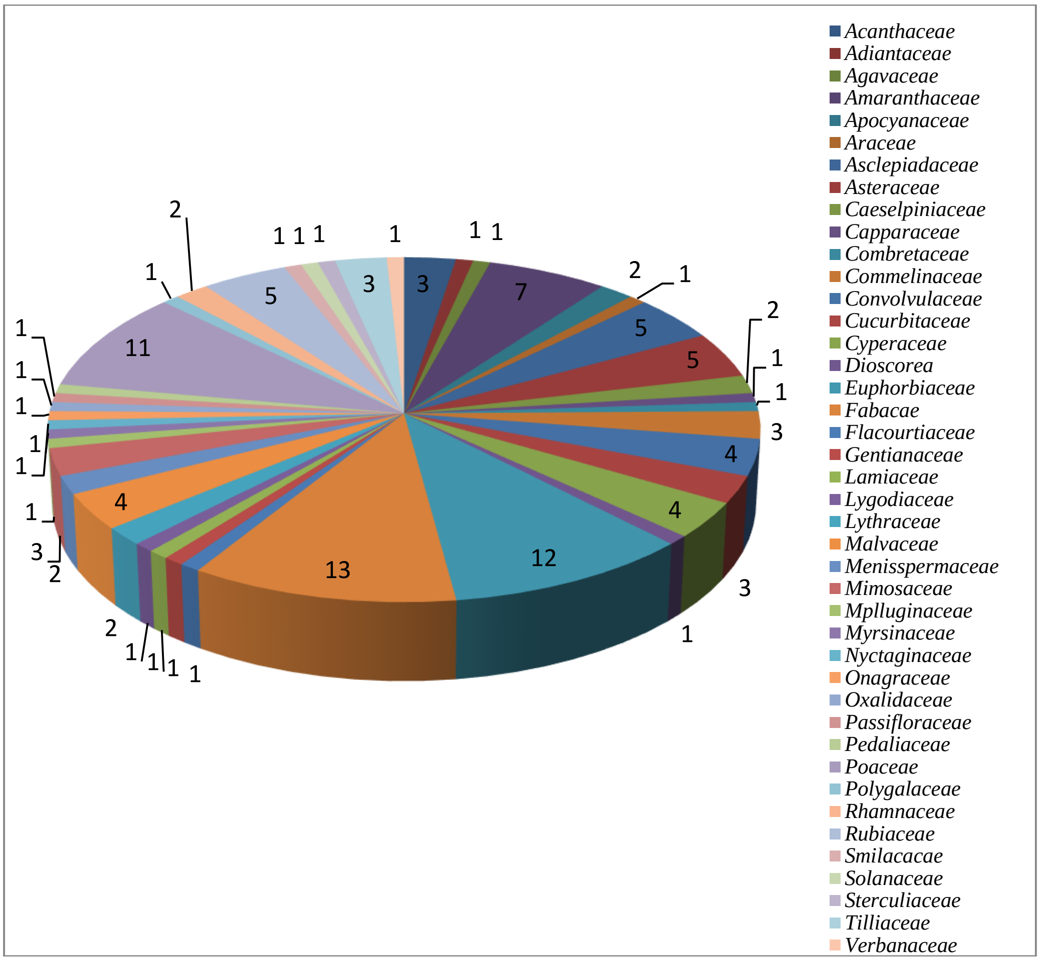

Fig 3. Herb species and their families recorded at study sites

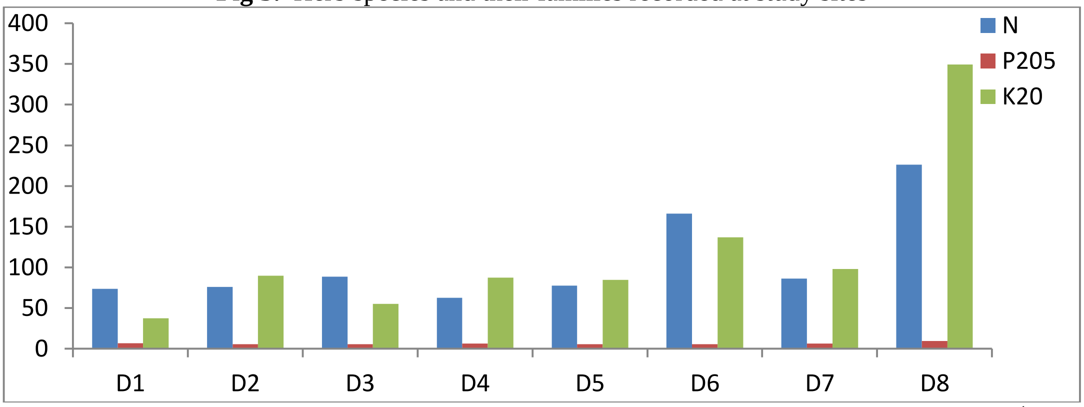

Fig 4. Nitrogen, phosphorous and potassium content in soil of different study sites (Kg ha $^{-1}$)

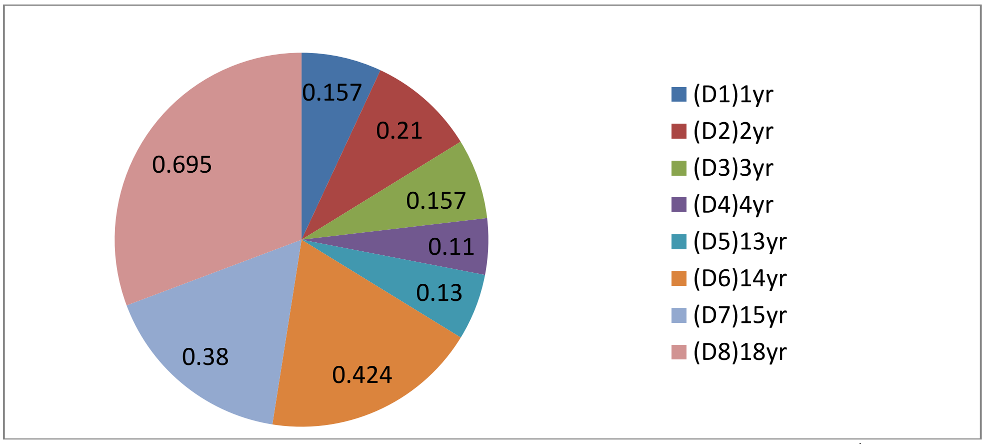

Fig 5. Organic Carbon content in soil of different study sites (Kg ha $^{-1}$)

Result and Discussion

A total of 65 herb species were encountered at site D4 followed by 62 species at both site D1 and D8. 58 species were recorded at site D2, 56 species each at site D5, 6 and 7, and only 40 species at site D3 **(Figure 1).** Among the herb species *C.dactylon* was present on each aspect of every site. *M. pudica* was present on every aspect of all sites except south of D5 and D7. *P.foetida* and *R. quinqennalaris* were observed on only east and south aspects of D6 and south aspect of D8, respectively. However, species number of herb species is generally higher with increased number of tree species. Vegetationanalysis was carried out for planted tree species at different sites. Out of 65 tree species identified representing 25 families, 7 species were from the family Combretaceae, 6 species each from family Euphorbiaceae and Mimosaceae, 5 species each from family Anacardiaceae and Verbanaceae, 3 species each from family Myrtaceae and Fabaceae, 2 species each from family Apocyanaceae, Poaceae, Rhamnaceae, Sapotaceae. Simarubaceae, and Ulmaceae and one species each from Annonaceae, Bombacaeae, Casuarinacae, Diptencaepaceae, Ebenaceae, Lytheraceae, Meliaceae, Musaceae, Periplocaceae and Rubiaceae (Figure **2**). A total of 117 herbs were recorded across all the sites from 42 families . 13 species were from the family Fabaceae, 12 species from Euphorbiaceae, 11 species from Poaceae, 7 species from Amaranthaceae, 5 species each from families Asclepiadaceae, Asteraceae and Rubiaceae, 4 species each from families Convolvulaceae, Cyperaceae and Malvaceae, 3 species each from families Acanthaceae, Commelinaceae, Cucurbitaceae, Mimosaceae and Tilliaceae. 2 species each from families Rhamnaceae, Menisspermaceae, Lythraceae, Caeselpiniaceae and Apocyanaceae and one species each from families Adiantaceae, Agavaceae, Araceae, Capparaceae, Combretaceae, Dioscoreaceae ,Flacourtiaceae, Gentianaceae, Lamiaceae, Lygodiaceae, Plugonaceae, Myrsinaceae, Nyctaginaceae, Onagraceae, Oxalidaceae, Passifloraceae, Polygalaceae, Smilacacae, Solanaceae, Sterculiaceae, and Verbanaceae **(Figure 3).**

The importance of soil characteristics has been emphasized in restoration studies as soil is one of the primary agents in determining vegetation development. Quantitative, directional change in soil properties over time following disturbance indicates soil development route (Aarde et al. 1998).A comparative analysis of different available macronutrients like N, P and K at the different study sites is given in **Fig. 4**. As the dump age increased the N and K content also increased and the concentration was maximum at D8 with 18 years of age. However, slight deviation in the pattern is marked which may be due to some biological reasons.K content at D1 and N content at D4 was minimum. There was no major difference in P content of all the sites. In the tropical ecosystem, Nitrogen and Phosphorus are major limiting factors. However, forest tree planting tends to improve soil Nitrogen and Phosphorus, especially at degraded sites (Marcos et al. 2007, Rhodes et al. 1998). Inouye et al. (1987) reported that early stages of succession were characterized by low soil Nitrogen. Three major macronutrients, namely Nitrogen, Phosphorus and Potassium are generally found to be deficient in overburden dumps (Coppin and Bradshaw, 1982; Sheoran et al. 2008). Organic matter is the major source of nutrients. A level of Organic Carbon (O.C.) greater than 0.75% indicates good fertility (Ghosh et al. 1983). Most tropical legume tree species are able to nodulate with effective (able to fix Nitrogen from the atmosphere) Rhizobia (De Faria et al. 1984; 1987; 1999; De Faria, 1995; Sprent and Parson, 2000).

From the **Figure 5** it is observed that no definite pattern is marked in the O.C content with the age of the Dump site. However, O.C content was maximum at D8 site with 18 years of age and D4 site showed minimum O.C content. There is a direct relationship between soil Carbon and Organic matter. High levels of soil Organic Carbon have been reported under mixed plantation after the restoration of a degraded pasture site (Jimenez et al. 2007). Forest tree plantations are the primary sink for atmospheric carbon through the development of both above and below ground biomass (Sharrow and Ismail, 2004; Ceuvas et al. 1991).

Conclusion:

Every holder of a prospecting licence or a mining lease shall take all possible precautions for the protection of environment and control of pollution while conducting prospecting, mining beneficiation or metallurgical operations in the area. There has been rise in reclamation established well at the reclaimed sites will help native species of Sukinda Chromite region. Present study results indicate that.

Taking up plantation of local species with good ecological value will help maintaining the ecological balance and food chain. Only those herbs, shrubs and tree species may be selected initially which are not grazed. Generally, the pioneer species are resistant to grazing, climatic fluctuation and low nutrient and water availability. Apart from these species, the tree species like *Albizia lebbeck*, *Azadirachta indica, Tamarindus*, *Cassia*, *Acacia*, *Pongamia pinnata*, *Bambusa sps.*, *Dalbergia sissoo*, etc. may be the promising species for initial stabilization of soil as brought out by this study. However, opinion of local ecologists, wildlife and forestry experts may be useful before taking plantation

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