Letter No. 1877 /OMC/F&E/2023
3rd February, 2023

To

The Divisional Forest Officer,
Keonjhar Forest Division.

Sub.: Proposal for non-forestry use of 1243.27 ha of forest land for mining of Iron and Manganese Ore in Dubna-Sakradihi Mines in favour of M/s Odisha Mining Corporation Ltd in District Keonjhar (Odisha) - reg.

Ref: (i) Memo No. 1878 dt 01.02.2023 by Conservator of Forests (Nodal).
(ii) Memo No.1058/Mining-98/2021 dt 03.02.2023 by DFO, Keonjhar.

Sir

The compliance to the following observations raised by Conservator of Forest (Nodal) vide memo under reference (i) and subsequent instruction by DFO, Keonjhar to provide the compliance report of the said observation vide letter under reference (ii) pertaining to Dubna-Sakradih Iron and Manganese ore mines of OMC Ltd in Keonjhar district of Odisha for diversion of 1243.27 ha of forest land is given as under:

Ohservation.1: The mining lease area depicted at Point No.1 differs to granted mining lease.

In compliance, it is submitted that the mining lease area depicted at Point No.1 of Table No.7 (p-32) of the Final Report by TFRI, Jabalpur is 1332.019 ha as per the proceedings by the State Government dt 18.02.2006 wherein Dubna Manganese ML over 1135.419 ha (executed on dt 08.09.1971 for a period of 20 years) have been amalgamated with that of overlapping Sakradih ML for iron ore over 564.55 ha (executed on dt 28.12.1959 for a period of 30 years). Hence, there is no difference in the area mentioned at point No.1 with that of the area granted by the State Government in their proceedings dt 18.02.2006. The total ML area comprises 1243.27 ha of forest land and 88.749 ha of non-forest land.

Observation.2: ***The calculation provided from Point No.1 to 8 in this compliance is not as per the model proposed.***

In compliance, it is submitted that OMC shall undertake plantation in forest as well as in non-forest land as per the plantation programmee recommended by TFRI, Jabalpur in their final Report dt 03.02.2023. During first five years, 332.5604 ha shall be utilized for mining and no plantation shall be taken up. During 6th to 10th year, out of 500.00 ha, 197.75 ha (39.55% of 500 ha) shall be brought under short rotation forest species having less than 10 years rotation age like *Bamboo spp., Eucalyptus spp., Populus deltoids, Gmelina arborea and Leucaena leucocephala.* Out of 414.70 ha proposed for mining and ancillary activities beyond 10 th year of operation, 119.14 ha (28.73% of 414.70 ha) shall be brought under plantations of tree species having more than 10 years rotation age like *Gmelina arborea, Acacia auriculiformis, Leucaena leucocephala, Melia azedarach, Dalbergia sissoo and Dalbergia latifolia.*

The total safety zone and green belt over 26.17 ha shall be brought under plantations of tree species like *Tectona grandis, Azardirachta indica, Haldina cordifolia, Madhuca longifolia* from

the very first year of operation. Plantation over 58.5888 ha of private land shall not be carried out. Thus the total area of 343.06 ha (197.75 + 119.14 + 26.17) shall be brought under plantation within the ML area of 1332.019 ha which comes within 25.75%.

Necessary changes required at page-1, 2, 32, 34 and 35 of the FINAL REPORT have been made in the revised final report submitted by TFRI, Jabalpur on dt 03.02.2023. The copy of the report is enclosed herewith as **Annexure-I** for reference.

It is therefore requested to consider the above compliance and recommend to higher quarter for grant of Stage-II Forest Clearance.

Yours falthfully,

Encls. as above.

(Dr Suman Krishna Sit)
General Manager (Geology)
Authorized signatory

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UNDERTAKING

I Dr. Suman Krishna Sit, General Manager (Geo), Authorized Signatory, M/s Odisha Mining Corporation Ltd. do hereby undertake to carryout plantation in forest as well as in non-forest land as per the plantation programme recommended by TFRI, Jabalpur in their final Report dt 03.02.2023 pertaining to Dubna-Sakradihi Iron & Mn Ore Mines of OMC Ltd.

(Dr. Suman Krishna Slt)
General Manager (Geo)
Authorized Signatory

8/2/2023

Gmail Dillip Kumar Pattanaik <dkpattanaik60@gmail.com>

Submission of Revised Final Report of Dubna-Sakradihi (Odisha)

2 messages

avinash jain <jainavl@yahoo.com> Fri, Feb 3, 2023 at 3:02 PM
Reply-To: avinash jain <jainavi@yahoo.com>
To: Dillip Kumar Pattanaik <dkpattanaik60@gmail.com>
Cc: Dheeraj Gupta <guptadk11@gmail.com>, Nidhi Mehta <mhta.nidhi@gmail.com>

Sir,

Please find attached revised final report of the consultancy project for your kind perusal and necessary action.

Thanks and Regards

Sincerely

Dr. Avinash Jain

Scientist-F and Head,
Forest Ecology & Climate Change Division
Tropical Forest Research Institute
(Indian Council of Forestry Research & Education)
P.O. RFRC, Mandla Road, Jabalpur - 482 021 (M.P.)
Mobile - +91 9826563036
Work - 0761 2840008
Email - jainavi@yahoo.com
jaina@icfre.org

2 attachments

Dubna Final report.doc
15143K

Dubna Final Report.pdf
7686K

Dillip Kumar Pattanaik <dkpattanaik60@gmail.com> Fri, Feb 3, 2023 at 4:10 PM
To: avinash jain <jainavi@yahoo.com>

Thank you.
[Quoted text hidden]

2022

Final Report

RAISING SHORT ROTATION FORESTRY CROPS FOR INTERMITTENT PERIODS AT DUBNA-SAKRADIHI IRON AND MANGANESE ORE MINES IN KEONJHAR DISTRICT OF ODISHA

Forest Ecology and Climate Change Division

Tropical Forest Research Institnte

Indian Conncil of Forestry Research & Edncation

(An autonomous Council under the Ministry of Environment Forests and Climate Change, Govt. of India)

P.O. - RFRC, Mandla Road, Jabalpur – 482021 (M.P.)

Final Report

RAISING SHORT ROTATION FORESTRY CROPS FOR INTERMITTENT PERIODS AT DUBNA-SAKRADIHI IRON AND MANGANESE ORE MINES IN KEONJHAR DISTRICT OF ODISHA

PRINCIPAL INVESTIGATOR

Dr. Avinash Jain, Principal Investigator
Scientist F & Head, Forest Ecology and Climate Change Division

VEGETATION SURVEY

Dr. Nidhi Mehta
Jyoti Desai
Amrutha Balakrishnan
Sooraj Swain
Ashish Tiwari

SOIL SURVEY

Dr. Jangam Deepika
Shweta Yadav
Sooraj Swain

MAP PREPARATION, SITE AND SPECIES SELECTION

Dheeraj Gupta
M. Rajkumar
Ajin Sekhar

Forest Ecology and Climate Change Division
Tropical Forest Research Institute
Indian Council of Forestry Research & Education
(An autonomous Council under the Ministry of Environment Forests and Climate Change, Govt. of India)
P.O. - RFRC, Mandla Road, Jabalpur – 482021 (M.P.)

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Executive Summary

1. A total of 1332.019 ha land has been provided to Odisha Mining Corporation Limited in Keonjhar district of Odisha.

2. Out of the total, 261.919 ha land has been verified broken prior to 25.10.1980, which includes 258.599 ha forest land and 3.320 ha non-forest land. The broken up area contains a substantial amount of mineral reserve, which will be further extracted after getting forest clearance.

3. In the first 5 years, OMCL has proposed to utilize 326.9818 ha land for mining and ancillary activities, which includes 261.919 ha already broken area. Moreover, 5.5786 ha land will be kept for public purpose like cremation ground, market place, roads, pond and grazing purpose. The land for public purpose has been excluded from the diversion proposal and shall be used by villagers. Hence, a total of 332.5604 ha land will not be available for raising plantations.

4. Around 500 ha land will be taken up for mining activities between 6 and 10 years, 39.55% of which means 197.75 ha land can be brought under short rotation forest species having less than 10 years rotation age like *Bamboo spp., Eucalyptus spp., Populus deltoids, Gmelina arborea* and *Leucaena leucocephala*. The National Forest Policy of India (1988) describes the goal of achieving more than 33% of the geographical area of the country under forest and tree cover. Moreover, according to India State of Forest Report (2021), the natural forest in Odisha state is 33.50% of the geographical area of the state. Hence, it was decided to bring more than 33% area under green cover in the present case.

5. The remaining 414.7028 ha land will be taken up for mining activities after 10 years, 28.73% of which means 119.14 ha land can be brought under plantations of tree species having more than 10 years rotation age like *Gmelina arborea, Acacia auriculiformis, Leucaena leucocephala, Melia azedarach, Dalbergia sissoo* and *Dalbergia latifolia.*

6. An area of 26.17 ha designated for safety zone and green belt will never be used for extracting minerals hence the whole area can be utilized for raising plantation of long rotation tree species like *Tectona grandis, Azadirachta indica, Haldina cordifolia* and *Madhuca longifolia.*

7. As a whole, plantations can be raised on 343.06 ha land, which is 25.75% of total lease area of 1332.019 ha. All the plantations can be raised in either first or second year of getting clearance for augmentation and continuous flow of ecological goods and services.

8. Plantations of all the species can be raised with 2m x 2m spacing, except Eucalyptus and Poplar which can be planted with 1m x 1m spacing.

1. Introdnction

The Indian state of Odisha is the leading mineral producing state with the highest and over half of the iron ore production of the country (Jaganmohan, 2021). The state also tops the total reserves/resources with 44% shares and as the third largest producer of the mineral manganese. Mining of the minerals involves drilling, blasting, vehicles movement on haul roads, collection, transportation, handling, screening, sizing and segregation, storage and various other activities. All these activities invariably affect the existing environmental, ecological structure and health (MoEFCC, 2010). Mining is currently responsible for 4 to 7 percent of greenhouse-gas (GHG) emissions globally (Delevingne et al., 2020). India's Intended Nationally Determined Contribution to UNFCCC pledges to reduce the greenhouse gas (GHG) emission intensity of its GDP by 33 to 35 per cent by 2030 from 2005 level. In accord to the commitments, industries are committed to mitigate challenges of global warming caused by emission of CO_2 by various anthropogenic activities.

Forest cover is an important natural resource due to its rich species diversity and vast array of environmental services (Boyle et al., 2016) yet, ecological and economical contribution of plantations cannot be ignored. Evidently, with less than 5% of the world's total forest area, plantations account for nearly 35% of the wood products (Zhang and Stanturf, 2008). Industrial afforestation and plantations of trees serves no less to provide various invaluable tangible and intangible goods and services including timber, non-timber forest products, soil erosion control, aesthetics, carbon sequestration and climate change mitigation etc.

More importantly, afforestation using short-rotation forestry crops delivers multi-functional benefits addressing the economical (material requirements, income/employment generation, industrial growth, etc.), environmental (rehabilitates degraded lands, conserve soil, enhances soil fertility & biodiversity captures atmospheric carbon and mitigates effects of climate change etc.) and social (empower local people, discourages rural migration etc.) issues (Chauhan et al., 2017). Christersson L. and Verma K., 2006 defines short-rotation forestry as the silvicultural practice under which high-density, sustainable plantations of fast-growing tree species (having a rotation period of less than 30 years) produce woody biomass on agricultural land or on fertile but degraded forest land. Such plantation consists of high variety, pest resistant tree species that are well maintained through timely irrigation, weeding and fertilizers understanding their ecological

and economical impacts. Also, these are fenced to avoid unwanted incidences of grazing, browsing and human interferences. Plantations are harvested when the yearly growth rate no longer exceeds the mean annual increment. Short-rotation forestry is surely a way to go ahead for open-casted mineral mines like that of iron and manganese.

This consultancy project is regarding seeking prior approval of the Central Government on "Proposal for non-forestry use of 1243.27 ha of forest land for mining of Iron and Manganese Ore in Dubna-Sakradihi Mines in favor of M/S Odisha Mining Corporation Limited in Keonjhar district of Odisha" under Section 2 of the Forest (Conservation) Act, 1980. Ministry of Environment, Forests and Climate Change, Government of India has sought additional information and the proposal has been examined by the Forest Advisory Committee constituted by the Central Government under Section-3 of the aforesaid Act.

Tropical Forest Research Institute (TFRI), Jabalpur (M.P.), one of the institutes of Indian Council of Forestry Research and Education (ICFRE) under Ministry of Environment, Forests and Climate Change, Government of India has been bestowed with the responsibility to execute this project on "Raising short rotation forestry crops for intermittent periods at Dubna-Sakradihi Iron and Manganese Ore Mines in Keonjhar district of Odisha".

2. Stndy area and selection of sites

The study has been conducted at Dubna-Sakradihi iron and manganese ore mines located in Keonjhar district of Odisha. The climate of the district is characterized by hot summer, high humidity and well distributed monsoons. Summer generally commences in the month of March and temperature rises rapidly attaining the maximum in the month of May. The temperature varies between 38°C to 7°C and average annual rainfall is around 1534.5 mm in the region.

The forest of Keonjhar can be classified into two major forest type (according to the revised Champion and Seth classification) - a) Group C: Northern Tropical Moist Deciduous Forest and b) Group 5B: Northern Tropical Dry Deciduous Forest. Several variations occur due to edaphic and biotic factors within the above two main groups, as a result the forests are further sub groups as under: a) 3C/c2e Moist Peninsular Valley Sal, b) 5B/C 1C Dry Peninsular Sal Forests c) 5B/C2 Northern Dry Mixed Deciduous Forests. Besides, the above three main sub-groups Dry Sal Forests and E4 Lateritic Semi Evergreen Forests and DSI Dry Deciduous Scrub Forest are also reported in small extent in the district. The main species are *Shorea robusta, Anogeissus latifolio, Terminalia crenulata, Madhuca latifolia, Diospyros melanoxylon, Lannea coromandilica* etc.

Seleetion of sites

Random sampling was adopted after surveying and detailed discussion with the officers of the mining area. A total of 12 quadrats were laid to enumerate the number of species and collect soil samples from the study area. GPS location of each site/quadrat were recorded (Table 1) and plotted on the map of the study area (Figure 1).

Table 1: GPS location of seleeted sites for vegetation survey and soil sample collection from Dubna-Sakradihi Irou aud Maugauese Mine Area

Site/ Quadrat No.	GPS Location		Site/ Quadrat No.	GPS Location	
	Latitnde	Lougitude		Latitude	Lougitude
1	22.86269°N	85.40374°E	7	21.86188°N	85.38207°E
2	21.86174°N	85.39800°E	8	21.86278°N	85.38435°E
3	22.18159°N	85.39238°E	9	21.83142°N	85.38829°E
4	21.84741°N	85.39711°E	10	21.84565°N	85.38024°E
5	21.83332°N	85.38487°E	11	21.85249°N	85.38429°E
6	21.86000°N	85.39957°E	12	21.82980°N	85.40505°E

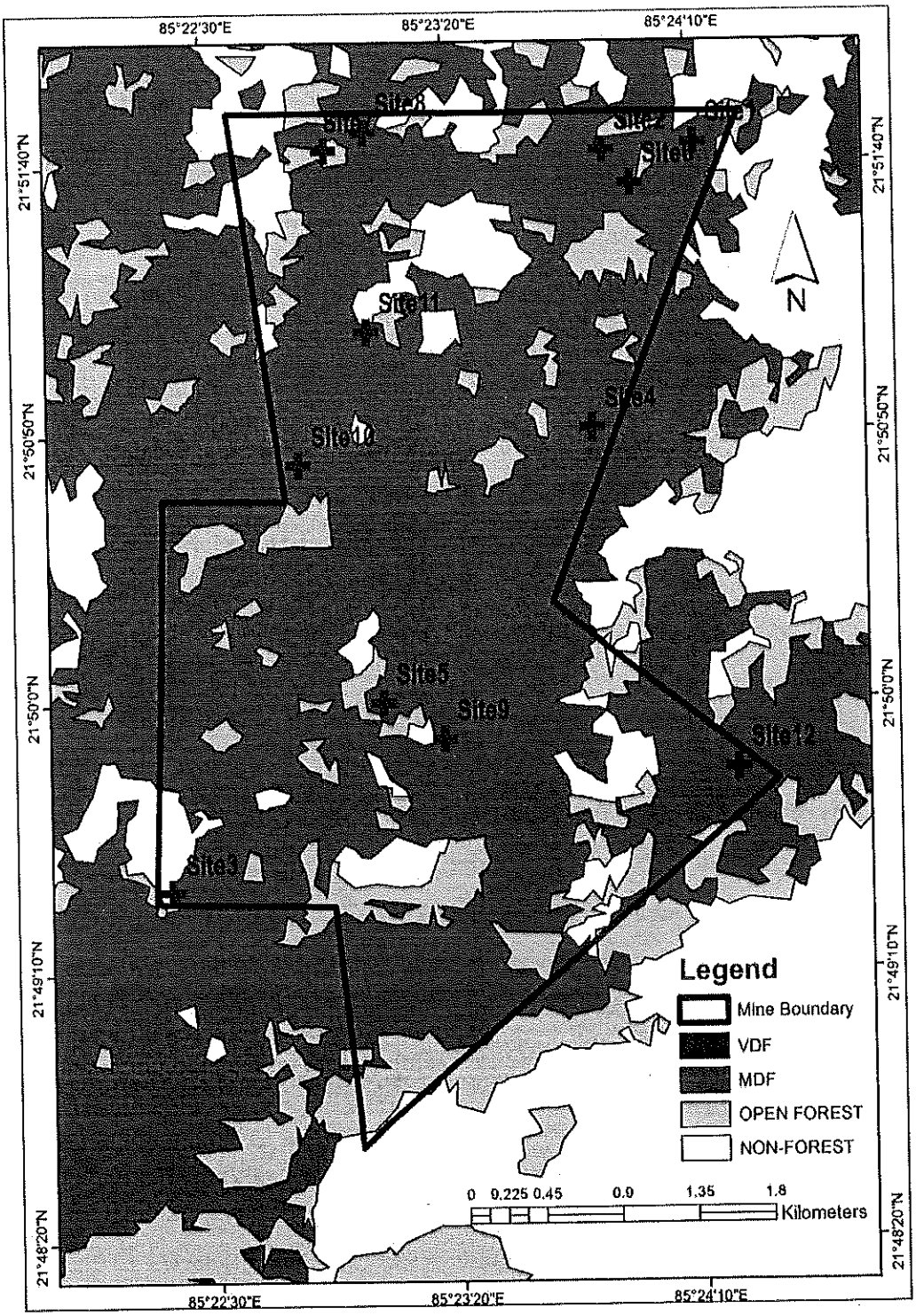


Figure 1: Map depicting 12 sites/quadrats for vegetation diversity and phyto-sociological assessment at Dubna-Sakradihi iron and manganese ore mine area in Keonjhar, Odisha.

3. Assessment of vegetation diversity

Assessment of floral diversity of an area presents the qualitative and quantitative spectrum of vegetation of the area. The type of vegetation met within a given locality depends on climate, soil and past treatments. The ground flora diversity and grass production under plantation are reported to vary with species (Singh et al., 1986) depending on species type, age of plants, density, soil type, climatic and geographic factors etc. Good soil conditions and site support luxuriant under growth of vegetation (Rajvanshi et al., 1983). Proper under growth in a forest is essential for maintenance of nutrient status, ecological balance and wildlife habitat of the forest ecosystem.

Hence, vegetation survey, phyto-sociological assessment and soil analysis of Dubna-Sakradihi Iron and Manganese Ore Mine Area in Keonjhar District of Odisha was conducted to study biodiversity at species level in the natural forests and plantations in and around mining area. Identification of indigenous species performing exceptionally in terms of growth in the local climate and result of the edaphic factors including soil will assist in selection of best suited species for plantation as forestry crop in the area.

Vegetation diversity and its distribution evaluation

A thorough survey and discussion was conducted prior to selection of sites for vegetation survey at the Dubna Sakradhi mine area in order to cover all the major density and types of forests at the study area. Vegetation study was conducted using quadrat method in the 12 quadrats (Figure 1) of 0.1 ha i.e., 250m X 4m each were laid at various locations to enumerate the number of species of the study area. GPS location of each site/quadrat was also reeoded and plotted on the map of the study area. Growth parameters (girth and height) of all tree species present inside the quadrates were recorded.

The enumeration from the survey revealed a total of 2342 trees along with its saplings with average height and DBH of 5.41 m and 10.30 cm, respectively in the selected 12 quadrats of the study area (Table 2).

Maximum DBH was recorded for the tree *Ficus benjamina* (95.54cm) whereas the tree of *Ficus racemosa* (16m) was recorded to be the tallest followed by *Shorea robusta* and *Terminalia tomentosa* trees showing a height of 14m. *Syzigium cumini* (2m), *Bridelia retusa* (2m) and

Bauhinia roxburghii (2.5m) were found to be the smallest among the enumerated trees.The most diverse was quadrat 5 containing 28 different species, while quadrat 2 had only 02 species. Also, *Diospyros melanoxylon* and *Shorea robusta* occurred in maximum number of quadrats i.e., 10 out of 12 followed by *Lagerstroemia parviflora* and *Terminalia bellirica* which oecurred in 09 quadrats (Table 2).

Table 2: List of recorded trees, saplings and their growth parameters during vegetation survey at Dnbua-Sakradihi iron and manganese ore mine area, Odisha.

Site/ Quadrat No.	Form	Name of Species	Nnmber of Individnals	Growth Parameters	
				DBH (em)	Height (m)
I	Tree	*Buchanania lanzan*	4	12.74	3.50
	Tree	*Dalbergia paniculata*	2	11.15	3.50
	Tree	*Diospyros melanoxylon*	4	11.94	4.75
	Tree	*Lagerstroemia parviflora*	4	15.45	5.50
	Tree	*Madhuca longifolia*	6	38.43	7.17
	Tree	*Meynalaxiflora*	2	12.10	6.50
	Tree	*Semecarpus anacardium*	6	15.71	5.50
	Tree	*Syzigium cumini*	2	17.52	5.50
	Tree	*Terminalia bellirica*	18	18.26	6.17
	Tree	*Terminalia tomentosa*	2	12.74	4.50
	Tree	*Ziziphus xyloporus*	2	11.78	6.50
	Sapling	*Bridelia retusa*	6	7.64	5.50
	Sapling	*Buchanania lanzan*	8	6.21	4.63
	Sapling	*Croton persimilis*	2	5.41	4.50
	Sapling	*Diospyros melanoxylon*	2	9.55	5.00
	Sapling	*Madhuca longifolia*	2	9.24	3.50
	Sapling	*Olax scandens (climber)*	2	3.18	5.50
	Sapling	*Syzigium cumini*	2	6.37	5.00
2	Tree	*Shorea robusta*	36	18.40	8.41
	Tree	*Syzigium cumini*	2	35.67	6.00
	Sapling	*Shorea robusta*	22	8.60	5.92
3	Tree	*Albizia odoratissima*	2	32.17	13.00
	Tree	*Dalbergia paniculata*	2	27.07	10.00
	Tree	*Ficus exasperata*	2	10.83	8.00
	Tree	*Ficus racemosa*	2	82.17	16.00
	Tree	*Hiptage benghalensis*	2	15.92	6.00
	Tree	*Mangifera indica*	4	18.47	8.00
	Tree	*Shorea robusta*	98	13.24	11.54
	Tree	*Terminalia bellirica*	2	52.55	11.00

Site/ Qnadrat No.	Form	Name of Species	Number of Individnals	Growth Parameters	
				DBH (cm)	Height (m)
	Sapling	*Buchanania lanzan*	4	5.10	3.75
	Sapling	*Diospyros melanoxylon*	88	5.75	3.73
	Sapling	*Lagerstroemia parviflora*	6	7.64	6.00
	Sapling	*Shorea robusta*	6	8.60	10.67
4	Tree	*Dalbergia paniculata*	2	11.15	4.00
	Tree	*Syzigium cumini*	2	19.75	8.00
	Tree	*Terminalia bellirica*	4	11.46	4.75
	Sapling	*Aegle marmelos*	42	3.42	2.69
	Sapling	*Diospyros melanoxylon*	40	4.58	3.06
	Sapling	*Semecarpus anacardium*	6	3.50	4.00
	Sapling	*Shorea robusta*	356	4.13	3.48
	Sapling	*Terminalia bellirica*	6	6.58	4.17
5	Tree	*Aegle marmelos*	2	17.20	9.00
	Tree	*Albizia odoratissima*	4	21.18	7.50
	Tree	*Bauhinia roxburghii*	10	20.19	5.40
	Tree	*Bridelia retusa*	6	19.53	7.83
	Tree	*Callicarpa arborea*	2	23.57	9.00
	Tree	*Casearia graveolens*	2	12.10	3.00
	Tree	*Cassia fistula*	2	16.56	6.50
	Tree	*Croton persimilis*	8	16.72	4.80
	Tree	*Dalbergia lanceolaria*	2	15.92	9.00
	Tree	*Diospyros melanoxylon*	6	13.38	5.67
	Tree	*Diospyros montana*	4	18.95	4.50
	Tree	*Erythrina indica*	2	12.10	4.00
	Tree	*Ficus religiosa*	2	49.68	11.00
	Tree	*Haldina cordifolia*	4	25.00	5.50
	Tree	*Holarrhena pubescens*	8	13.46	3.25
	Tree	*Madhuca longifolia*	2	74.84	8.00
	Tree	*Nyctanthus arbor-tristis*	2	15.92	3.00
	Tree	*Semecarpus anacardium*	2	12.10	3.00
	Tree	*Shorea robusta*	2	15.29	3.00
	Tree	*Syzigium cumini*	8	20.22	4.38
	Tree	*Terminalia bellirica*	10	19.17	5.90
	Tree	*Terminalia tomentosa*	8	18.15	10.13
	Sapling	*Alstonia scholaris*	2	5.73	3.80
	Sapling	*Bridelia retusa*	4	4.14	3.00
	Sapling	*Casearia graveolens*	10	4.90	3.12

Site/ Qnadrat No.	Form	Name of Species	Nnmber of Individnals	Growth Parameters	
				DBH (em)	Height (m)
	Sapling	*Croton persimilis*	26	6.15	3.49
	Sapling	*Cryptolepis buchanani*	2	4.78	4.00
	Sapling	*Diospyros melanoxylon*	14	4.78	3.50
	Sapling	*Erythrina indica*	2	5.73	3.50
	Sapling	*Gmelina arborea*	2	8.92	3.50
	Sapling	*Holarrhena pubescens*	32	4.42	2.84
	Sapling	*Lagerstroemia parviflora*	2	7.01	3.20
	Sapling	*Phyllanthus emblica*	2	1.53	4.00
	Sapling	*Semecarpus anacardium*	10	5.60	3.85
	Sapling	*Shorea robusta*	4	6.37	3.35
	Sapling	*Terminalia tomentosa*	2	9.55	10.20
	Sapling	*Woodfordia fruticosa*	6	4.25	3.67
6	Tree	*Cassia fistula*	2	12.10	5.00
	Tree	*Cassine glauca*	2	23.89	5.00
	Tree	*Croton persimilis*	2	12.10	3.80
	Tree	*Diospyros montana*	2	30.25	8.00
	Tree	*Ficus benjamina*	2	95.54	10.00
	Tree	*Haldina cordifolia*	10	20.38	8.30
	Tree	*Holarrhena pubescens*	2	11.15	3.50
	Tree	*Mitragyna parviflora*	8	14.65	5.13
	Tree	*Schleichera oleosa*	2	70.06	10.00
	Tree	*Semecarpus anacardium*	2	19.75	10.00
	Tree	*Terminalia bellirica*	2	21.66	5.00
	Tree	*Terminalia tomentosa*	12	38.00	10.83
	Sapling	*Aegle marmelos*	2	7.96	3.50
	Sapling	*Bridelia retusa*	6	3.61	4.83
	Sapling	*Cipadessa baccifera*	2	3.82	3.00
	Sapling	*Croton persimilis*	2	9.55	5.00
	Sapling	*Dalbergia lanceolaria*	2	9.55	4.00
	Sapling	*Haldina cordifolia*	2	8.92	6.50
	Sapling	*Holarrhena pubescens*	6	9.13	4.00
	Sapling	*Nyctanthus arbor-tristis*	4	7.96	5.10
	Sapling	*Psidium guajava*	2	5.73	3.00
7	Tree	*Albizia odoratissima*	7	26.39	9.14
	Tree	*Anogeissus latifolia*	2	13.38	9.00
	Tree	*Buchanania lanzan*	2	10.51	7.00
	Tree	*Careya arborea*	2	10.19	4.00

Site/ Qnadrat No.	Form	Name of Species	Nnmber of Individnals	Growth Parameters	
				DBH (em)	Height (m)
	Tree	*Diospyros melanoxylon*	2	12.74	5.50
	Tree	*Diospyros montana*	4	19.75	8.25
	Tree	*Haldina cordifolia*	28	16.22	5.75
	Tree	*Lannea coromandelica*	2	19.11	8.00
	Tree	*Madhuca indica*	2	41.40	10.00
	Tree	*Madhuca longifolia*	7	18.38	7.06
	Tree	*Shore arobusta*	8	12.26	6.88
	Sapling	*Albizia odoratissima*	2	7.64	5.30
	Sapling	*Anogeissus latifolia*	24	4.25	4.49
	Sapling	*Bridelia retusa*	4	7.33	5.10
	Sapling	*Buchanania lanzan*	2	7.01	4.00
	Sapling	*Casearia graveolens*	4	5.42	3.25
	Sapling	*Croton persimilis*	10	7.26	4.79
	Sapling	*Diospyros melanoxylon*	58	4.36	3.51
	Sapling	*Diospyros montana*	4	8.28	5.33
	Sapling	*Haldina cordifolia*	4	6.53	4.90
	Sapling	*Holarrhena pubescens*	4	5.73	3.50
	Sapling	*Lagerstroemia parviflora*	10	3.44	3.30
	Sapling	*Miliusa tomentosa*	4	6.85	4.25
	Sapling	*Shorea robusta*	34	5.54	3.34
8	Tree	*Anogeissus latifolia*	2	12.10	4.50
	Tree	*Buchanania lanzan*	2	14.33	4.50
	Tree	*Callicarpa arborea*	2	10.51	6.00
	Tree	*Casearia graveolens*	6	13.16	5.33
	Tree	*Cipadessa baccifera*	2	12.10	6.00
	Tree	*Croton persimilis*	2	11.15	3.50
	Tree	*Diospyros melanoxylon*	2	12.10	4.50
	Tree	*Diospyros montana*	2	11.46	4.00
	Tree	*Haldina cordifolia*	6	18.05	4.67
	Tree	*Lagerstroemia parviflora*	2	12.10	5.50
	Tree	*Madhuca indica*	6	15.71	5.00
	Tree	*Shorea robusta*	38	20.06	9.32
	Tree	*Syzigium cumini*	2	47.13	7.50
	Tree	*Terminalia tomentosa*	4	24.52	8.25
	Tree	*Ziziphus xyloporus*	2	15.92	7.00
	Sapling	*Anogeissus latifolia*	4	4.62	4.00
	Sapling	*Buchanania lanzan*	6	4.46	2.67
	Sapling	*Casearia graveolens*	4	7.49	3.25

Site/ Quadrat No.	Form	Name of Species	Number of Individuals	Growth Parameters	
				DBH (cm)	Height (m)
	Sapling	*Casearia sp.*	4	7.32	2.50
	Sapling	*Cassia fistula*	2	6.37	5.00
	Sapling	*Cipadessa baccifera*	6	5.84	3.33
	Sapling	*Diospyros melanoxylon*	78	4.11	2.70
	Sapling	*Gardenia sp.*	2	6.05	3.00
	Sapling	*Haldina cordifolia*	2	9.55	5.00
	Sapling	*Holarrhena pubescens*	12	6.16	3.42
	Sapling	*Lagerstroemia parviflora*	6	7.85	3.43
	Sapling	*Phyllanthus emblica*	2	7.32	6.00
	Sapling	*Shorea robusta*	8	4.06	4.25
	Sapling	*Syzigium cumini*	2	7.32	1.25
	Sapling	*Terminalia bellirica*	4	7.97	5.75
	Sapling	*Terminalia chebula*	2	6.37	5.00
	Sapling	*Terminalia tomentosa*	6	8.49	4.67
9	Tree	*Aegle marmelos*	6	11.89	6.33
	Tree	*Anogeissus latifolia*	10	22.42	9.20
	Tree	*Bombax ceiba*	2	22.61	12.00
	Tree	*Bridelia retusa*	2	46.50	12.00
	Tree	*Butea superba*	2	18.15	12.00
	Tree	*Cassia fistula*	2	14.33	6.00
	Tree	*Croton persimilis*	10	15.86	6.20
	Tree	*Diospyros melanoxylon*	8	11.15	7.25
	Tree	*Holarrhena pubescens*	4	11.62	5.75
	Tree	*Schleichera oleosa*	10	32.10	10.20
	Tree	*Shorea robusta*	44	17.31	8.58
	Tree	*Syzigium cumini*	6	18.68	8.83
	Tree	*Terminalia bellirica*	2	18.47	10.00
	Tree	*Terminalia tomentosa*	6	21.23	10.17
	Sapling	*Aegle marmelos*	24	6.02	4.17
	Sapling	*Anogeissus latifolia*	2	9.55	6.00
	Sapling	*Casearia graveolens*	2	6.37	3.00
	Sapling	*Cipadessa baccifera*	8	5.81	4.50
	Sapling	*Croton persimilis*	16	5.77	4.19
	Sapling	*Diospyros melanoxylon*	18	8.32	5.28
	Sapling	*Holarrhenapubescens*	8	7.00	4.88
	Sapling	*Lagerstroemia parviflora*	2	7.32	7.50
	Sapling	*Meyna laxiflora*	4	6.69	3.00

Site/ Quadrat No.	Form	Name of Speeies	Number of Iudividuals	Growth Parameters	
				DBH (cm)	Height (m)
	Sapling	*Schleichera oleosa*	2	9.24	5.50
	Sapling	*Shorea robusta*	8	7.72	5.91
	Sapling	*Syzigium cumini*	4	6.69	3.25
I0	Tree	*Bridelia retusa*	6	20.06	9.00
	Tree	*Croton persimilis*	2	11.15	6.00
	Tree	*Diospyros melanoxylon*	14	14.38	5.73
	Tree	*Haldina cordifolia*	6	20.06	8.00
	Tree	*Madhuca longifolia*	14	32.21	8.64
	Tree	*Nyctanthus arbor-tristis*	8	18.15	7.50
	Tree	*Schleichera oleosa*	2	10.51	7.00
	Tree	*Semecarpus anacardium*	4	16.08	8.50
	Tree	*Shorearobusta*	36	16.15	8.22
	Tree	*Syzigiumcumini*	6	15.92	6.33
	Tree	*Terminalia bellirica*	4	18.47	8.50
	Tree	*Terminalia tomentosa*	2	22.93	4.50
	Sapling	*Aegle marmelos*	6	3.61	2.83
	Sapling	*Anogeissus latifolia*	4	6.53	6.25
	Sapling	*Bridelia retusa*	2	9.55	8.00
	Sapling	*Buchananialanzan*	2	6.37	2.00
	Sapling	*Casearia graveolens*	20	4.81	4.45
	Sapling	*Croton persimilis*	16	6.77	4.31
	Sapling	*Diospyros melanoxylon*	16	5.73	5.00
	Sapling	*Helecteresisora*	4	3.82	3.50
	Sapling	*Holarrhenapubescens*	2	5.73	1.50
	Sapling	*Lagerstroemia parviflora*	6	5.74	4.83
	Sapling	*Meynalaxiflora*	2	3.82	4.00
	Sapling	*Nyctanthusarbor-tristis*	2	6.37	4.50
	Sapling	*Olax scandens (climber)*	4	4.46	4.00
	Sapling	*Phyllanthus emblica*	2	3.18	3.50
	Sapling	*Shorearobusta*	14	7.74	7.43
	Sapling	*Syzigiumcumini*	2	6.05	5.00
I1	Tree	*Aegle marmelos*	6	10.51	6.83
	Tree	*Albizia odoratissima*	2	41.40	10.00
	Tree	*Anogeissus latifolia*	6	17.09	8.50
	Tree	*Croton persimilis*	8	13.85	6.38
	Tree	*Diospyros melanoxylon*	4	20.38	7.75
	Tree	*Lagerstroemia parviflora*	2	30.57	8.50
	Tree	*Phyllanthus emblica*	2	13.06	8.50

Site/ Quadrat No.	Form	Name of Species	Number of Individuals	Growth Parameters	
				DBH (cm)	Height (m)
	Tree	*Schleicheraoleosa*	2	16.24	7.50
	Tree	*Shorearobusta*	12	14.97	9.50
	Tree	*Tectona grandis*	38	17.50	8.08
	Tree	*Terminalia bellirica*	18	18.33	8.22
	Tree	*Terminalia tomentosa*	6	17.20	8.17
	Sapling	*Aegle marmelos*	6	7.54	6.50
	Sapling	*Anogeissus latifolia*	8	8.52	5.75
	Sapling	*Casearia graveolens*	4	7.96	5.75
	Sapling	*Croton persimilis*	14	8.32	6.64
	Sapling	*Diospyros melanoxylon*	2	8.28	4.00
	Sapling	*Haldina cordifolia*	2	6.37	8.50
	Sapling	*Schleicheraoleosa*	2	6.69	7.00
	Sapling	*Shorearobusta*	16	8.44	7.16
	Sapling	*Syzigiumcumini*	2	8.28	6.00
	Sapling	*Tectona grandis*	6	7.43	4.25
	Sapling	*Terminalia bellirica*	22	8.51	7.91
	Sapling	*Terminalia tomentosa*	4	7.33	7.50
12	Tree	*Anogeissus latifolia*	4	12.90	6.00
	Tree	*Bridelia retusa*	2	10.83	2.00
	Tree	*Buchananialanzan*	6	15.61	5.83
	Tree	*Cassine glauca*	2	25.48	6.00
	Tree	*Diospyros melanoxylon*	2	11.15	6.50
	Tree	*Diospyros montana*	2	12.10	4.00
	Tree	*Haldina cordifolia*	2	15.61	6.50
	Tree	*Madhuca longifolia*	2	10.19	4.00
	Tree	*Phyllanthus emblica*	2	11.15	3.50
	Tree	*Shorearobusta*	10	17.07	5.30
	Tree	*Ziziphus xyloporus*	4	18.31	5.75
	Sapling	*Albizia odoratissima*	2	4.78	4.00
	Sapling	*Anogeissus latifolia*	4	7.17	5.50
	Sapling	*Buchananialanzan*	4	8.13	4.75
	Sapling	*Casearia graveolens*	4	6.85	3.75
	Sapling	*Cassine glauca*	2	4.78	4.50
	Sapling	*Diospyros melanoxylon*	28	6.16	3.69
	Sapling	*Grewia tilifolia*	2	6.05	6.00
	Sapling	*Haldina cordifolia*	8	8.28	3.83
	Sapling	*Holarrhenapubescens*	2	7.96	3.50
	Sapling	*Lagerstroemia parviflora*	6	5.41	3.33

Site/ Quadrat No.	Forui	Name of Speeies	Number of Individuals	Growth Parameters	
				DBH (cui)	Height (m)
	Sapling	*Madhuca longifolia*	2	9.87	5.00
	Sapling	*Meynalaxiflora*	2	7.96	3.50
	Sapling	*Phyllanthus emblica*	4	8.12	4.75
	Sapling	*Shorearobusta*	30	5.90	3.63
	Sapling	*Terminalia tomentosa*	16	6.77	3.88
	Sapling	*Woodfordiafruticosa*	2	1.59	2.50
	Sapling	*Ziziphus xyloporus*	6	7.75	4.17
			2342	**10.30**	**5.41**

The assessment of the vegetation iii the quadrats revealed that, a total of 1476 saplings and 866 number of trees were reported wherein, the average DBH and height of the former was measured to be 5.48cm and 5.99m, respectively whereas that of the latter was 18.51cm and 7.81m, respectively (Figure 2).

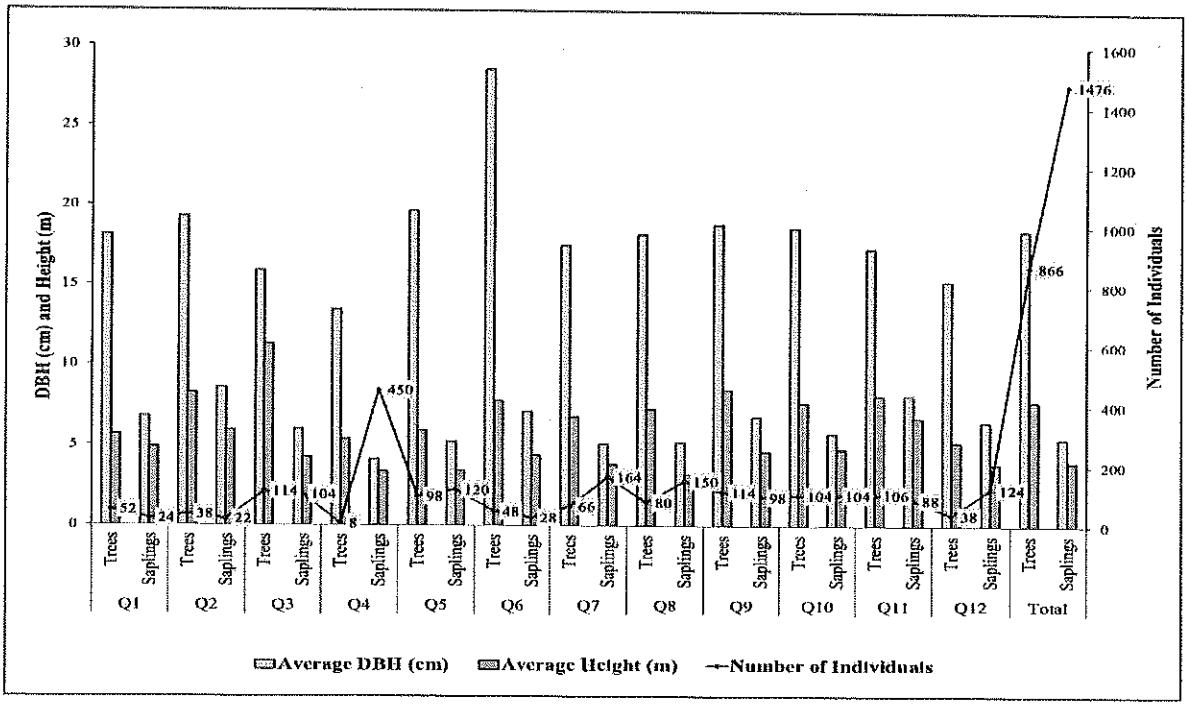


Figure 2: Quadrat-wise comparative growth parameters aud couut of trees and sapliugs duriug vegetatiou survey at Dubua-Sakradihi miue area.

The maximum number of trees i.e., 114 was reported in both of the Quadrats 9 and Quadrat 3. Maximum number of saplings i.e., 450 but lowest number of trees i.e., only 08 was reported from Quadrat 4. Average DBH of the recorded trees in the quadrats varied between 13.46cm (Quadrat 4) to 28.54cm (Quadrat 6) whereas that of saplings varied between 5.22cm (Quadrat 8) to 8.60 (Quadrat 2). Among all the studied quadrats, Quadrat 3 reported to have tallest with average height of 11.32m whereas that of Quadrat 4 were smallest (5.38m) trees (Figure 2).

Species diversity is considered as one of the major factors for determining the overall health of forest ecosystems. In this study, total of 56 different species were found in all the 12 quadrats. *Shorea robusta* (782 individuals) followed by *Diospyros melanoxylon* (386 individuals) were found to be the most common species. Whereas, *Alstonia scholaris, Bombax ceiba, Butea superba, Careya arborea, Cryptolepis buchanani, Ficus benjamina, F. exasperata, F. racemosa, F. religiosa, Gardenia sp., Gmelina arborea, Grewia tilifolia, Hiptage benghalensis, Lannea coromandelica, Psidium guajava* and *Terminalia chebula* were least reported in the studies of quadrats (Figure 3).

For sustainable management of forests, natural regeneration is one crucial component, as it directly affects the survival of the forest. This study indicates that, *Shorea robusta* possesses the highest number of saplings (284) among all the quadrates, followed by *Diospyros melanoxylon* (344), *Croton persimilis* (86) and *Aegle marmelos* (80). Also, no saplings were reported for *Bauhinia roxburghii, Bombax ceiba, Butea superba, Callicarpa arborea, Careya arborea, Dalbergia paniculata, Ficus benjamina, F. exasperata, F. racemosa, F.religiosa, Hiptage benghalensis, Lannea coromandelica, Madhuca indica, Mangifera indica and Mitragyna parvifolia* in the selected sites (Figure 3).

The familial composition of forests is another important criterion for determining the overall diversity of a forest. So, the families of recorded saplings and trees were also analyzed. The families containing highest number of species are Fabaceae with 6 species followed by Moraceae with 5 species. At the same time, the number of individual trees and saplings coming under a family, Dipterocarpaceae (782), Ebenaceae (404) and Combretaceae (232) have the majority, also Bombacaceae, Lecythidaceae, Malpighiaceae and Tiliaceae only have 02 representative individuals in each (Figure 4).

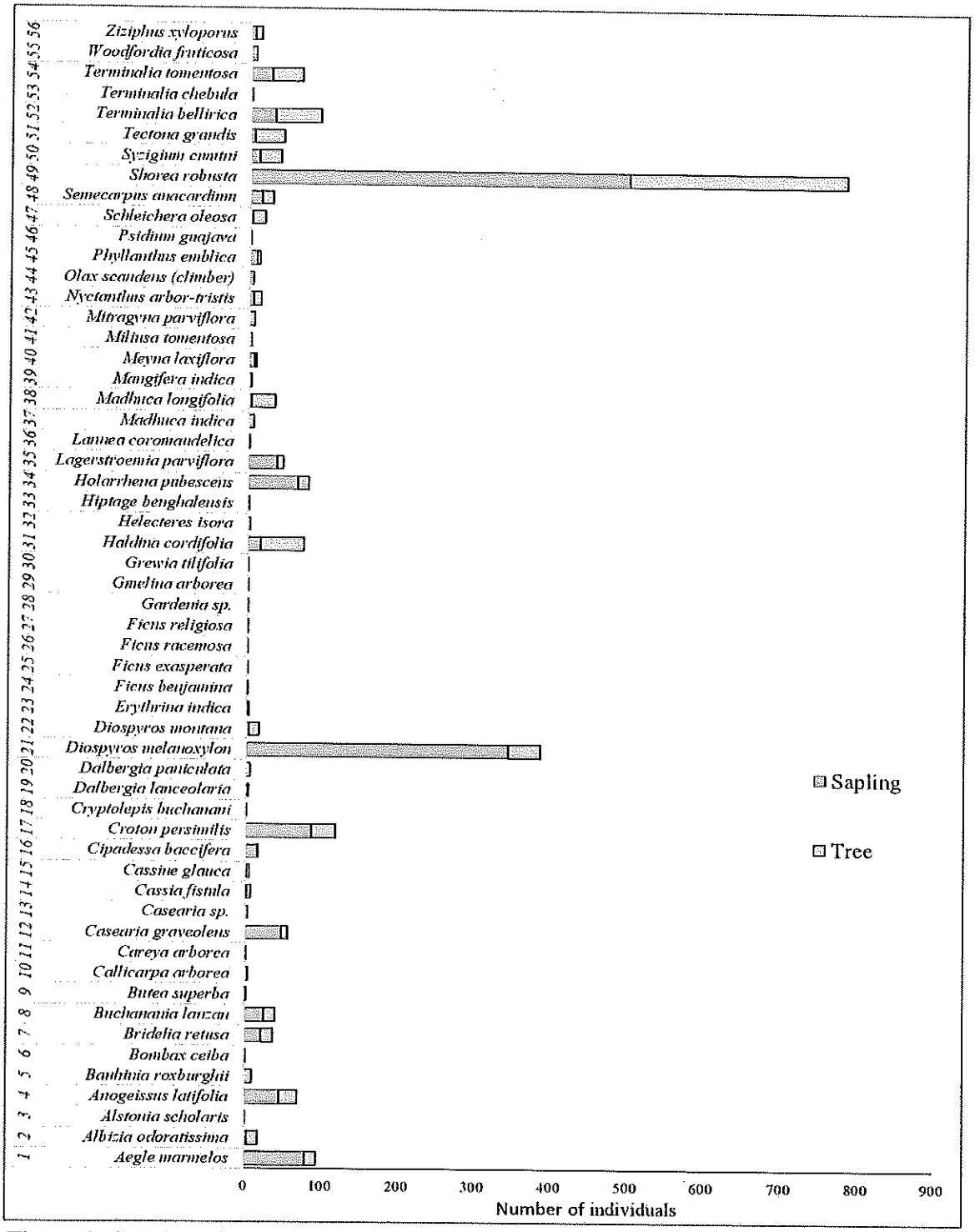


Figure 3: Species-wise regeneration status of studied quadrats at Dubna-Sakradihi mine area.

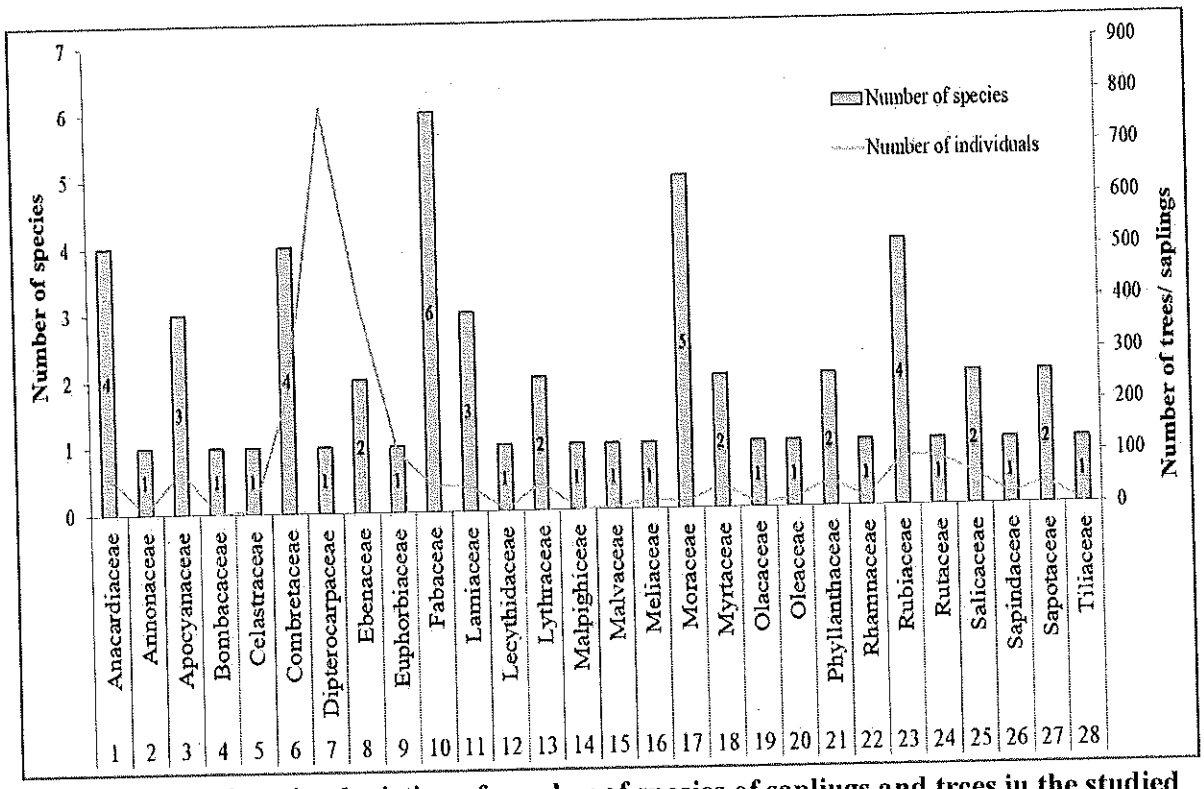


Figure 4: Family-wise depiction of uumber of species of sapliugs and trces iu the studied quadrats at Dubua-Sakradihi miue area.

Phyto-sociological evaluation of the recorded trees

The data collected from the field was then evaluated for different phyto-sociological parameters. Basal area, frequency, density, abundance of trees and frequency of ground flora was calculated for each species following Mishra (1968) and Shukla and Chandel (1989).

$$\text{Frequency (\%)} = \frac{\text{Number of quadrats in which the species occurred}}{\text{Total number quadrats}} \text{ X } 100$$

$$\text{Relative frequency (\%)} = \frac{\text{Frequency of a species}}{\text{Total frequency of all the species}} \text{ X } 100$$

$$\text{Density} = \frac{\text{Total number of individuals of a species in all quadrats}}{\text{Total number of quadrats studied}}$$

$$\text{Relative density (\%)} = \frac{\text{Density of a species}}{\text{Total density of all the species}} \text{ X } 100$$

$$\text{Dominance} = \frac{\text{Basal area of a species in all quadrats}}{\text{Total area of species in the studied quadrats}}$$

$$\text{Relative dominance (\%)} = \frac{\text{Dominance of a species}}{\text{Total dominance of all the species}} \text{ X } 100$$

Thereby, the Importance Value Index (IVI) was calculated to determine the overall ecological importance of a species in the plant community by summing up the *Relative frequency, density* and *dominance* i.e.,

Importance Value Index (IVI)

= Relative Frequency + Relative Density + Relative Dominance

The trees recorded in the selected 12 quadrats were further evaluated for their phyto-sociological status in the diversity of the study area (Table 3).

It was observed that 44 tree species belonged to trees out of the total of 56 different species, including the tree saplings. From this classified group of the data, frequency, relative frequency, density, relative density, dominance, relative dominance and Important Value Index were calculated.

Table 3 : Phyto-sociological details of tree species in the studied quadrats at Dubna-Sakradihi iron and manganese ore mine area, Odisha.

	Species	Common Name	Family	Average DBH	Relative frequency	Relative density	Relative dominanee	IVI
1	*Aegle marmelos*	Bel	Rutaceae	12.06	2.26	1.62	0.53	**4.40**
2	*Albizia odoratissima*	Kala Siris	Fabaceae	27.77	3.01	1.73	3.12	**7.86**
3	*Anogeissus latifolia*	Dhawra	Combretaceae	17.89	3.76	2.77	2.14	**8.67**
4	*Bauhinia roxburghii*	Semla	Fabaceae	20.19	0.75	1.15	1.25	**3.16**
5	*Bombax ceiba*	Semal	Bombacaceae	22.61	0.75	0.23	0.25	**1.24**
6	*Bridelia retusa*	Kasai	Phyllanthaceae	22.02	3.01	1.85	2.43	**7.29**
7	*Buchanania lanzan*	Char/Chironji	Anacardiaceae	13.88	3.01	1.62	0.70	**5.32**
8	*Butea superba*	Lata palash	Fabaceae	18.15	0.75	0.23	0.16	**1.15**
9	*Callicarpa arborea*	Ghiwala	Lamiaceae	17.04	1.50	0.46	0.33	**2.30**
10	*Careya arborea*	Kumbhi	Lecythidaceae	10.19	0.75	0.23	0.05	**1.03**
11	*Casearia graveolens*	Chilla	Salicaceae	12.90	1.50	0.92	0.33	**2.76**
12	*Cassia fistula*	Amaltas	Fabaceae	14.33	2.26	0.69	0.31	**3.26**
13	*Cassine glauca*	Jamrasi	Celastraceae	24.69	1.50	0.46	0.61	**2.57**
14	*Cipadessa baccifera*	Ranabili	Meliaceae	12.10	0.75	0.23	0.07	**1.06**
15	*Croton persimilis*	Croton tree	Euphorbiaceae	14.75	4.51	3.69	1.87	**10.07**
16	*Dalbergia lanceolaria*	Takoli	Fabaceae	15.92	0.75	0.23	0.13	**1.11**
17	*Dalbergia paniculata*	Dhobin	Fabaceae	16.46	2.26	0.69	0.49	**3.44**
18	*Diospyros melanoxylon*	Tendu	Ebenaceae	13.62	6.02	4.85	2.06	**12.93**
19	*Diospyros montana*	Bistendu	Ebenaceae	18.74	3.76	1.62	1.39	**6.76**
20	*Erythrina indica*	Pangara	Fabaceae	12.10	0.75	0.23	0.07	**1.06**
21	*Ficus benjamina*	Pukar	Moraceae	95.54	0.75	0.23	4.54	**5.53**
22	*Ficus exasperata*	Brahma's Banyan	Moraceae	10.83	0.75	0.23	0.06	**1.04**
23	*Ficus racemosa*	Goolar	Moraceae	82.17	0.75	0.23	3.36	**4.34**

	Speeies	Common Name	Family	Average DBH	Relative frequency	Relative density	Relative dominance	IVI
24	*Ficus religiosa*	Peepal	Moraceae	49.68	0.75	0.23	1.23	**2.21**
25	*Haldina cordifolia*	Haldu	Rubiaceae	18.18	4.51	6.47	5.05	**16.03**
26	*Hiptage benghalensis*	Madhavi lata	Malpighiceae	15.92	0.75	0.23	0.13	**1.11**
27	*Holarrhena pubescens*	Indrajao	Apocyanaceae	12.60	2.26	1.62	0.56	**4.43**
28	*Lagerstroemia parviflora*	Lendia	Lythraceae	18.39	2.26	0.92	0.79	**3.97**
29	*Lannea coromandelica*	Goonja	Anacardiaceae	19.11	0.75	0.23	0.18	**1.16**
30	*Madhuca indica*	Mahua	Sapotaceae	22.13	1.50	0.92	1.24	**3.67**
31	*Madhuca longifolia*	Mahua	Sapotaceae	31.62	3.76	3.58	11.90	**19.24**
32	*Mangifera indica*	Mango	Anacardiaceae	18.48	0.75	0.46	0.35	**1.56**
33	*Meyna laxiflora*	Muyna	Rubiaceae	12.10	0.75	0.23	0.07	**1.06**
34	*Mitragyna parviflora*	Kaim	Rubiaceae	14.65	0.75	0.92	0.44	**2.12**
35	*Nyctanthus arbor-tristis*	Har singar	Oleaceae	17.71	1.50	1.15	0.88	**3.54**
36	*Phyllanthus emblica*	Amla	Phyllanthaceae	12.11	1.50	0.46	0.15	**2.11**
37	*Schleichera oleosa*	Kusum	Sapindaceae	32.17	3.01	1.85	6.25	**11.11**
38	*Semecarpus anacardium*	Bhilava	Anacardiaceae	15.88	3.01	1.62	0.90	**5.53**
39	*Shorea robusta*	Sal	Dipterocarpaceae	16.00	6.77	32.79	22.09	**61.65**
40	*Syzigium cumini*	Jamun	Myrtaceae	21.77	5.26	3.23	3.97	**12.47**
41	*Tectona grandis*	Teak, Sagon	Lamiaceae	17.50	0.75	4.39	3.10	**8.24**
42	*Terminalia bellirica*	Baheda	Combretaceae	19.26	6.02	6.93	6.39	**19.33**
43	*Terminalia tomentosa*	Saja	Combretaceae	25.03	5.26	4.62	7.47	**17.36**
44	*Ziziphus xyloporus*	Kath Ber	Rhamnaceae	16.08	2.26	0.92	0.59	**3.77**

These trees were found to belong from 28 different plant families. The third largest flowering plant family i.e., Fabaceae was found to be dominating among the reported tree species. After observing the values of diameter at breast height (DBH), derived from the girth measurements taken in the field, it is evident that, *Ficus benjamina* and *Ficus racemosa* are the species with highest DBH of 95.54 cm and 82.17 cm respectively. The total study area of the 12 quadrats (of the size 250m X 4m) i.e., 12ha and out of the entire tree species evaluated, *Shorea robusta* dominates with a relative dominance value of 22.09%. And the species like *Careya arborea* and *Ficus exasperata* have the low relative dominance value of 0.05 and 0.06 respectively (Table 3).

As relative frequency is used to quantify and describe the distribution of a species in the community, it is derived through the number of times a species occurs in the studied quadrats. Among all the trees *Shorea robusta* (6.77) has the highest relative frequency value and is closely followed by *Diospyros melanoxylon* (6.00) and *Terminalia bellirica* (6.02). They are the most widely distributed species and there are many trees which are scantily distributed in these quadrats with low relative frequency values (Table 3).

Relative density gives the percentage of number of stems occupying a given area and may provide an idea about the ecological relationships happening in that region. In this parameter also *Shorea robusta* is dominating with an incomparable value of 32.79% and many trees have low relative density values since they are represented by fewer numbers of individual trees.

There are different standardized statistical approaches to analyze the quality and provide overall picture of different forests. Importance values rank species within a site based upon three criteria:

- how commonly a species occurs across the entire forest;
- how many total individuals of the species occur across the forest; and
- how much of the total amount of forest area occupied by the species.

In calculating this index, the percentage values of the relative frequency, relative density and relative dominance are summed up (Mishra, 1968; Curtis, 1959; Curtis and McIntosh, 1950). Because it combines relative cover, density and frequency, IVI values range from 0 – 300.

From all these parameters mentioned above IVI of each species were calculated and the values are in the range of 61.65 % to 1.03% (Table 3).

The IVI laid out the clear evidence of ecological importance of each species in the area of study. According to the phytosociological study, the species that depicted highest IVI are represented below.

Table 4: Tree species with highest values of IVI.

Name of Species	IVI	Name of Species	IVI
1) *Shorea robusta*	61.65	7) *Syzigium cumini*	12.47
2) *Terminalia bellirica*	19.33	8) *Schleichera oleosa*	11.11
3) *Madhuca longifolia*	19.24	9) *Croton persimilis*	10.07
4) *Terminalia tomentosa*	17.36	10) *Anogeissus latifolia*	8.67
5) *Haldina cordifolia*	16.03	11) *Tectona grandis*	8.24
6) *Diospyros melanoxylon*	12.93		

Hence according to the conducted vegetation survey, it was observed that the above-mentioned species in Table 4 will perform most successfully in this region

4. Soil characterization

Soil is a dynamic natural body developed as a result of pedogenic processes occurring during and after weathering of rocks, consisting of mineral and organic constituents, possessing definite chemical, physical, mineralogical and biological properties, having a variable depth over the surface of earth and providing a medium for plant growth. Soil provides anchorage to roots enabling plants to stand erect, act as a storehouse of water and nutrients for plant growth, act as an abode of flora and fauna which suitably transform nutrients for uptake by plants roots, provides space for air and aeration which create a healthy environment for the biological activity of soil organisms.

Soils are formed as a result of weathering of rocks and minerals. Weathering is the disintegration and decomposition of rock and minerals by physical and chemical processes. The former involves mainly physical breaking down into smaller particles, whereas the latter is responsible for chemical decomposition leading in course of time to the formation of new products. Soil is composed of partly weathered, unweathered, and transformed products of rocks and rock minerals, and organic matter.

Collectiou of soil samples

In the present study, soil samples were collected from 12 selected sites (Figure 1) of Dubna-Sakradihi Iron and Manganese Ore Mines area. One surface (0-15 cm) and sub-surface (15-30 cm) soil sample from each quadrat was collected and hence, a total of 24 soil samples were collected for analyzing the physico-chemical properties of soil and additionally, a soil sample from each site (12 total) was also collected by using core sampler to determine bulk density of the soil.

Processiug of samples

The collected soil samples were brought to TFRI laboratory and air dried in shade, grounded and screened through 2mm sieve and used for analysis. Care was taken to maintain the identity of each sample at all stages of processing and analysis. The soil samples were analyzed by following the standard methods.

Physico-chemical characteristics of soil samples

Table 5 represents physico-chemical characteristics of soil samples collected from 12 quadrats laid out for vegetation survey.

Bulk density is defined as the mass of a unit volume of oven-dry soil. Bulk density was determined by core sampler method which is widely used being quick, accurate and relatively easy method. The bulk density of samples varied from of 1.10 g/cm^3 to 1.58 g/cm^3.

Texture of soil is basic physical property depends upon particle size distribution in the soil. It was determined by using International Pipette method and found that the soils having Clay to Silty clay loam texture.

The pH (soil reaction) value is a measure of hydrogen ion concentration of the soil water system and expresses the acidity and alkalinity of soil. pH is very important property of soil as it determines the nutrient availability, microbial activity and physical condition of the soil. pH was measured by using glass electrode pH meter in 1:2.5 ratio of soil water suspension (Jackson, 1973). The pH of the surface and sub-surface soil samples was ranged from 4.3 to 6.4 indicating a very strongly acidic to slightly acidic nature of the soil.

Soll electrical conduetivity (EC) denotes the total amount of soluble salts present in the soil. It is a measurement that correlates with soil properties affecting crop productivity, including soil texture, cation exchange capacity (CEC), drainage conditions, organic matter level, and sub-soil characteristics. Excess salts hinder plant growth by affecting the soil-water balance. Salt levels can increase as a result of cropping, irrigation, and land management. Electrical conductivity was measured by using an electrical conductivity meter in supernatant liquid of 1:2.5 ratio of soil water suspension (Jackson, 1973). The electrical conductivity of the surface soil samples ranged from 0.046 to 0.138 dS m^{-1} whereas sub-surface soil samples ranged from 0.023 to 0.089 dS m^{-1}.

Soil organic earbou (SOC) plays a very important role in the maintenance and improvement of soil properties. Organic carbon is an integrative property of soil and it is generally assumed that higher the level of organic carbon, higher the soil fertility. The decomposition of organic matter and production of organic acid have in general effect on soil pH. The organic carbon also influences the availability of nitrogen and phosphorus to the plants. Organic carbon was

determined using the Wet digestion method (Walkley and Black, 1934). The soil samples from the study sites was overall found to have low to high in organic carbon (0.41%-2.52%). Organic carbon content in soils decreased with depth because of the ground cover generally consists of grasses, herbs, ferns etc., and more organic matter decomposition at surface hence the higher value of all nutrients occurs in the surface soil and then it gradually decreases to lower horizons.

Nitrogeu is an essential constituent of metabolically active compounds like amino acids, proteins, enzymes and some non-proteinous compounds. When nitrogen is a limiting factor, the rate and extent of protein synthesis are depressed and as a result plant growth is affected, the plant gets stunted and develops chlorosis, stems or shoots are dwarfed. The nitrogen-deficient plants are light green in color. The lower leaves turn yellow and in some plants they quickly start drying up if suffering from shortage of water. Available N content of the soil was estimated by using alkaline permanganate method outlined by Alkaline permanganate method (Subbiah and Asija, 1956). The available nitrogen in the surface soil samples ranged from 100.35 to 332.42 kg ha^{-1} whereas sub-surface soil samples ranged from 137.98 to 326.14 kg ha^{-1}. The available nitrogen was observed low to medium throughout all sites.

Phosphorus is a structural component of cell membranes, chloroplasts and mitochondria and a constituent of sugar phosphates, viz., ADP, ATP and nucleic acid, phospholipids and phosphatides. Phosphorus plays an important role in energy transformations and metabolic processes in plants. It stimulates root growth. It is a constituent of the cell nucleus, essential for cell division and the development of tissues at the growing points. It makes 0.1 to 0.5% of dry weight of the plant. Therefore, plants which cannot absorb adequate quantities of phosphorus from the soil have small root system and leaves, and their growth is stunted. Optimum quantity of phosphorus available to the crop in combination with nitrogen balances their shoot and root growth. Available phosphorus was determined by using Bray's No.1 method (Bray and Kurtz, 1945). The available phosphorus in the surface soil samples ranged from 0.44 to 1.27 kg ha^{-1} whereas sub-surface soil samples ranged from 0.68 to 1.33 kg ha^{-1}. Low available phosphorus content was detected in all the collected soil samples from surface and sub-surface soils of Dubna Sakradihi mine areas. This was evident as phosphorus is never readily soluble in the soil but is most available in soil with a pH range centered around 6.5 and the soil of the study area was acidic as discussed previously.

Table 5: Physico-chemical characteristics of soil samples collected from quadrats laid out for vegetation survey Dubna-Sakradihi, Odisha

Site No.	Bulk density (g cm^{-3})	Surface/ Sub-Surface	pH	EC (dS m^{-1})	OC (%)	Available nutrients				Exchangeable cations (meq/100 g of soil)			Available nutrients (ppm)				Mechanical analysis (%)			Texture
						N (kg/ha)	P (kg/ha)	K (kg/ha)	S (ppm)	Ca	Mg	K	Mn	Fe	Cu	Zn	Sand	Silt	Clay	
1	1.12	S	5.45	0.084	1.94	213.25	1.22	449.01	4.043	7.20	11.40	0.113	36.21	5.98	2.34	0.40	16.80	54.4	28.8	Silty clay loam
		SS	5.21	0.055	1.80	238.34	1.19	695.63	3.441	6.80	8.80	0.064	45.77	7.13	2.54	0.31	15.00	44.8	40.2	Silty clay
2	1.37	S	4.59	0.059	0.80	200.70	0.81	925.57	3.957	2.80	3.60	0.040	32.75	20.93	0.86	0.17	2.60	57.2	40.2	Silty clay
		SS	4.30	0.047	0.48	175.62	0.89	1004.98	4.904	3.20	2.80	0.025	16.55	9.48	0.53	0.05	20.60	47.6	31.8	Clay loam
3	1.24	S	5.50	0.138	2.34	332.42	1.21	685.33	4.732	12.00	12.40	0.041	-	-	-	-	25.20	42.2	32.6	Clay loam
		SS	5.34	0.083	2.27	225.79	1.14	642.88	3.699	9.20	10.40	0.089	21.64	18.21	1.24	0.18	22.80	51.4	25.8	Silt loam
4	1.17	S	5.47	0.070	1.04	225.79	0.76	529.65	3.871	6.40	7.20	0.023	32.27	4.10	0.99	0.11	29.40	41.0	29.6	Clay loam
		SS	5.58	0.069	0.87	137.98	0.75	378.56	3.871	8.00	7.60	0.025	26.92	3.12	0.89	0.07	20.60	28.6	50.8	Clay
5	1.53	S	5.70	0.046	2.52	163.07	0.92	923.55	3.355	6.80	8.00	0.023	10.65	10.94	0.56	0.16	34.00	23.2	42.8	Clay
		SS	5.60	0.047	2.13	225.79	0.91	810.54	2.581	7.60	10.80	0.019	9.24	7.72	0.61	0.08	27.40	28.8	43.8	Clay
6	1.51	S	4.46	0.072	1.32	150.53	0.70	1121.9	4.215	11.60	3.60	0.031	36.02	33.66	0.37	0.18	22.00	41.0	37.0	Clay loam
		SS	4.37	0.061	0.98	163.07	0.68	803.71	4.301	12.80	2.40	0.028	19.79	28.31	0.31	0.14	21.80	43.2	35.0	Clay loam
7	1.28	S	5.51	0.100	2.39	288.51	0.44	962.30	4.818	10.40	8.40	0.036	24.82	20.35	1.90	0.44	23.60	51.0	25.4	Silt loam
		SS	4.84	0.053	1.41	301.06	0.78	817.38	3.613	7.60	5.60	0.022	40.93	31.28	2.57	0.21	9.20	54.8	36.0	Silt Clay loam
8	1.58	S	5.38	0.062	1.20	250.88	1.27	336.78	4.215	18.00	6.80	0.030	22.84	6.97	1.70	0.27	26.60	46.6	26.8	Loam
		SS	4.94	0.041	0.92	238.34	1.30	479.81	5.420	16.40	6.00	0.025	28.83	8.70	1.72	0.23	31.60	36.2	32.2	Clay loam
9	1.15	S	5.11	0.091	1.20	301.06	1.02	707.06	3.527	7.20	9.20	0.030	38.16	9.35	1.10	0.15	20.40	29.0	50.6	Clay
		SS	4.89	0.087	0.84	326.14	1.13	817.38	3.269	12.00	8.40	0.031	32.75	4.84	0.91	0.10	21.40	78.4	0.2	Silt loam
10	1.10	S	5.39	0.145	2.01	263.42	0.70	479.81	3.613	10.40	12.80	0.057	26.04	13.59	1.19	0.22	11.60	61.4	27.0	Silt Clay loam
		SS	5.56	0.089	1.85	275.97	0.95	876.62	4.387	7.20	8.80	0.051	16.81	9.83	1.26	0.15	1.00	44.8	54.2	Silt clay
11	1.23	S	4.88	0.053	1.43	238.34	0.49	145.82	2.753	6.40	6.80	0.029	26.33	15.28	0.51	0.14	19.40	56.2	24.4	Silt loam
		SS	5.11	0.023	1.35	263.42	1.11	533.34	2.753	4.80	7.60	0.026	32.32	13.06	0.48	0.11	30.80	45.4	23.8	Loam
12	1.23	S	6.40	0.064	0.41	100.35	0.79	462.11	4.043	9.20	10.00	0.015	1.36	1.24	0.98	0.36	31.20	39.2	29.6	Clay loam
		SS	5.83	0.063	0.80	225.79	1.33	823.31	4.215	8.00	11.60	0.030	12.90	11.43	3.34	0.36	34.60	28.4	37.0	Clay loam
Average	**1.29**	**S**	**5.32**	**0.082**	**1.55**	**227.36**	**0.86**	**644.07**	**3.929**	**9.03**	**8.35**	**0.015**	**26.13**	**12.94**	**1.14**	**0.24**				
		SS	**5.13**	**0.060**	**1.31**	**233.11**	**1.01**	**723.68**	**3.871**	**8.63**	**7.57**	**0.113**	**25.37**	**12.76**	**1.37**	**0.16**				
		Total	5.23	0.071	1.43	230.23	0.94	683.88	3.900	8.83	7.96	0.039	25.73	12.85	1.26	0.20				

Potassium plays an important role in the maintenance of cellular organizations by regulating permeability of cell membranes and keeping the protoplasm in a proper degree of hydration. It activates the enzyme in protein and carbohydrates metabolism and translocation of carbohydrates and impart diseases resistance to plants. Unlike nitrogen and phosphorus, potassium is not a constituent of the carbohydrates, oils, fats and proteins, the substances which form the fabric of the plants. But it plays a vital role in the formation or synthesis of amino acids and proteins from ammonium ions which are absorbed from the soil. It is also considered essential in the photosynthetic activity of the leaves. When potassium is in short supply, the carbon dioxide is synthesized into sugars more slowly than when it is available in optimum quantity. The relative concentration of sodium and calcium also influences the activity of potassium in the plant. Available potassium was estimated by using Neutral Normal Ammonium Acetate method (Stanford and English, 1949). The available potassium in the sampled soil samples was mostly high (336.78-1121.90 kg ha^{-1}) i.e., >280 kg ha^{-1} besides that in surface soil of site 11 having 145.82 kg ha^{-1} medium range of available potassium.

Sulphur (S) is an essential element in forming proteins, enzymes, vitamins, and chlorophyll in plants. It is crucial in nodule development and efficient nitrogen fixation in legumes. Protein synthesis requires large amounts of sulphur, especially in the formation of oils within the seed, and sulphur is a constituent of several amino acids and vitamins found in both plants and animals. Thus, sulphur is an important factor in determining the nutritional quality of foods. Sulphur was estimated to be low (2.581-5.420 ppm) in all the samples collected from sites of Dubna Sakradihi mine area. Organic sulphur, which is mineralised into plant-available sulphate sulphur, is more prevalent in soils with high clay and gravel content. Sandier soils from higher rainfall areas do not have any ability to restrict the leaching of water-soluble sulphate sulphur.

Exchaugeable calcium is essential for the formation of cell walls, as calcium forms part of the middle layer of the cell wall. The middle lamella regulates the entry of only those nutrients which are not toxic to the plant. In root tips calcium is very essential for the meristematic activity or formation of new tissues. It also helps to keep up sustained activity of the nodule bacteria in legumes. Besides its direct nutrient value, calcium when applied to acid soils increases the availability of other nutrients, like phosphorus, nitrogen and molybdenum. Excess of calcium in the calcareous soils depresses the uptake of potassium and magnesium. In the present study,

exchangeable Ca varied from 2.80 meq/100g of soil to 18meq/100g of soil in all the soil samples collected from the quadrats. Average Ca content in surface samples was observed more (9.03 meq/100g of soil) than sub-surface samples (8.63 meq /100g of soil).

Exchangeable Magnesium is a constituent of chlorophyll and chromosomes. It is known to play a catalytic role as an activator of a number of enzymes, most of which are concerned with carbohydrate metabolism. The chlorophyll development is much reduced when magnesium uptake is restricted because it is an integral part of the pigment. It maintains the dark-green color of leaves and regulates the uptake of other materials, particularly nitrogen and phosphorus. It appears to play an important role in the transport of phosphorus, particularly into the seeds. It is also said to promote formation of oils and fats, possibly by increasing photosynthetic activity in the leaves. The average exchangeable Mg content in sub surface soil samples was found more (12.80 meq/100g of soil) in comparison to surface samples (2.40meq/100g of soil).

Exchangeable Potassium is the third most likely element to limit plant productivity after nitrogen and phosphorus as it plays significant role as an activator of the various enzymes responsible for various processes (e.g., nitrate reduction, protein synthesis, breakdown of carbohydrates, photosynthesis). Only 1-2 % of the total potassium in the soil is available as either exchangeable potassium adsorbed on soil colloidal surfaces (i.e., clay particles and organic colloids) and/or in soil solution. Exchangeable potassium content in the collected soil samples was found in low amounts varying from 0.015meq/100g to 0.0113meq/100g. Average exchange K was found more in surface samples (0.039meq/100g) than sub-surface samples (0.036meq/100g).

Based on the results of soil physico-chemical analysis, it was observed that the sites of Dubna Sakradihi mine area are acidic in nature, low to high in organic carbon content, low to medium in available nitrogen, low in available phosphorus & sulphur and high in potassium content.

5. Plantation sites and Suggested species

The land use details as provided by the Odisha Mining Cooperation Limited (Table 6) and the representative map (Figure 5) is given below: -

Table 6: Land use details of Dubua-Sakradihi irou and maugauesc orc mines in Keoujhar district of Odisha

Sl. No.	Land Use	Category	Area (ha)	Total area (ha)	Remarks
1.	Total lease area			1332.019	
2.	Broken area	Forest land	258.599	261.919*	• Verified broken prior to 25.10.1980 • More minerals will be extracted after getting forest clearance
		Non-forest land	3.320		
3.	Area to be taken up in next 5 years	Mining and ancillary activities	326.9818	358.7282	• Includes already broken area of 261.919 ha • Area for safety zone and green belt shall be utilized for raising plantation by OMC as per the scheme approved by the State Forest Department. • Area for public purpose will be used for construction of pond, cremation ground, grazing land, road, market place etc. It has been excluded from the diversion proposal and shall be used by villagers.
		Safety zone	24.8200		
		Green belt	1.3478		
		Public purpose	5.5786		
4.	Area to be used after 5 years	6-10 years	500.00	914.7028	App. 500 ha area may be used during 6-10 years for mining activities
		> 10 years	414.7028		The remaining 414.7028 ha area may be used after 10 years for mining activities.
6.	Private land inside lease area			58.588	Not proposed for any activity related to mining.

Source: OMCL

* Included within 358.7282 ha area for mining and ancillary activities.

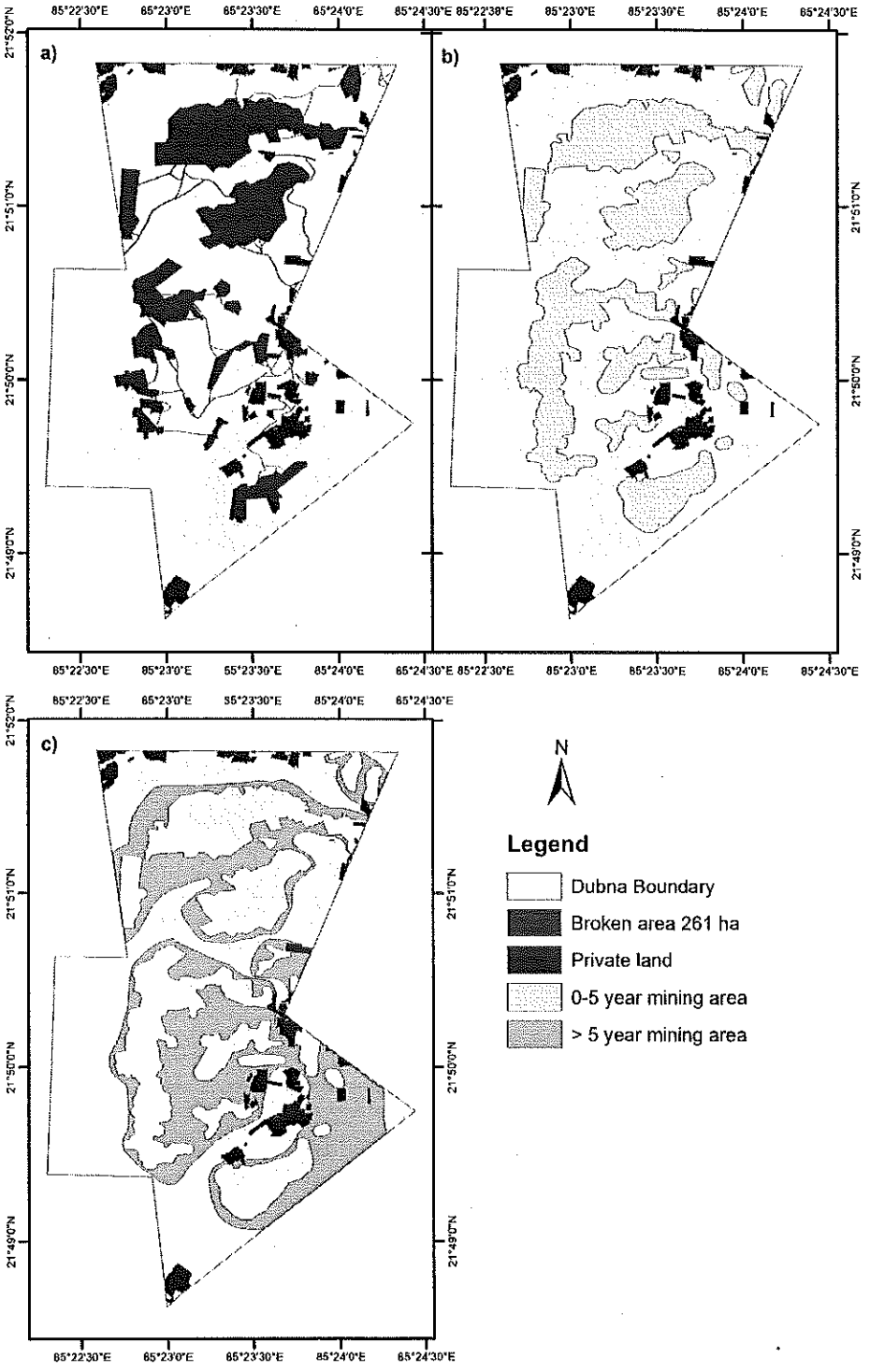
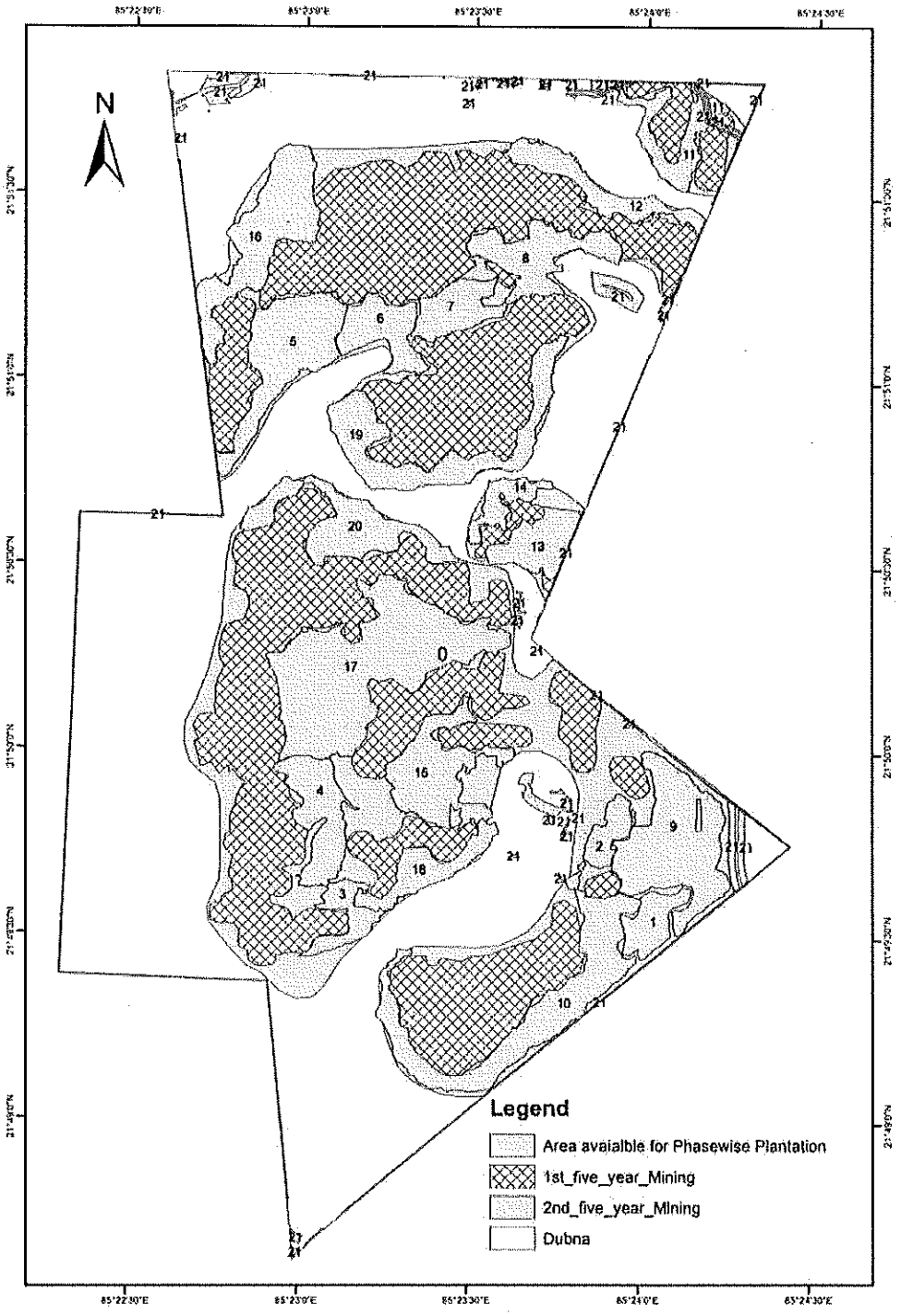


Figure 5: Laud use details of Dubna-Sakradihi iron and mangauesc ore mines in Kcoujhar district of Odisha.

On the basis of the studies conducted studies and details provided by OMCL (Table 6), tentative plantation plan recommended for Dubna Sakradhi mine area with short-rotation forestry crops is given below in Table 7.

Table 7: Selected tree species for raising plantation at Dnbna-Sakradihi iron and manganese ore mines in Keonjhar district of Odisha

Land Use		Total area ha)	Area (ha) for plantation in (% of respective total areas)	Tree species
1.	Total lease area	1332.019	343.06 (25.75%)	--
2.	Broken area	261.919	--	--
3.	Area to be taken up in next 5 years for mining and aneillary activities (Excluding safety zone and green belt) plus public purpose	332.5604	--	--
4.	Area to be taken up for mining and ancillary activities between 6 and 10 years	500.00	197.75 (39.55%)	*Bamboo spp.* *Eucalyptus hybrid* *Populus deltoids* *Gmelina arborea* *Leucaena leucocephala*
5.	Area to be taken up for mining and aneillary activities after 10 years	414.70	119.14 (28.73%)	*Gmelina arborea* *Acacia auriculiformis* *Leucaena leucocephala* *Melia azedarach* *Dalbergia sissoo* *Dalbergia latifolia*
6.	Safety zone and green belt	26.17	26.17 (100%)	*Tectona grandis* *Azadirachta indica* *Haldina cordifolia* *Madhuca longifolia*
7.	Private land inside lease area	58.588	--	--



Fignre 6: Map depicting mining plan and assigned area for plantation of forestry crops at Dubna-Sakradihi iron and manganese ore mines in Keonjhar district of Odisha

Table 8: Site-wise selected tree species for raising plantation at Dubna-Sakradihi iron and manganese ore mines in Keonjhar district of Odisha

S. No.	Plot No.	Suggested tree species	Rotation age (years)	Area (ha)
1	**1**	*Bamboo spp., Eucalyptus spp., Populus deltoids, Gmelina arborea* and *Leucaena leucocephala*	<10years	6.61
2	**2**			5.31
3	**3**			6.34
4	**4**			13.38
5	**9**			27.71
6	**10**			29.13
7	**13**			9.41
8	**14**			5.15
9	**15**			18.01
10	**17**			50.71
11	**18**			8.96
12	**20**			17.03
Area under plantation with rotation age <10 years				**197.75**
13	**5**	*Gmelina arborea, Acacia auriculiformis, Leucaena leucocephala, Melia azedarach, Dalbergia sissoo* and *Dalbergia latifolia*	>10years	21.56
14	**6**			10.26
15	**7**			8.9
16	**8**			13.95
17	**11**			9.26
18	**12**			10.38
19	**16**			23.05
20	**19**			21.78
Area under plantation with rotation age >10 years				**119.14**
21	**21**	*Tectona grandis, Azadirachta indica, Haldina cordifolia and Madhuca longifolia.*	Long rotation	**26.17**
Total plantation area				**343.06**

Hence, following are evident from Table 6, 7 & 8 and Figure No. 6 that -

- Foremost mining and ancillary activities in the first 5 years will be carried out in 332.56 ha and hence this area will not be considered for any plantation.
- Second phase of mining during 6 -10 years is proposed in area of 500 ha. Out of it, 39.55% i.e., 197.75 ha will undergo plantation with forestry crops having rotation age <10 years like *Bamboo spp., Eucalyptus spp., Populus deltoids, Gmelina arborea* and *Leucaena leucocephala* (Table 7). This included plantation on Plot no. 1 2, 3, 4, 9, 10, 13, 14, 15, 17, 18 and 20 as depicted in Figure 6.
- Plantation of species like *Gmelina arborea, Acacia auriculiformis, Leucaena leucocephala, Melia azedarach, Dalbergia sissoo, Dalbergia latifolia* having rotation age >10years will be undertaken in Plot no. 5, 6, 7, 8, 11, 12, 16 and 19 covering 119.14 ha i.e., 28.73% of 414.70 ha area that is expected to undergo mining only after 10 years.
- A permanent area of 26.17 ha is dedicated for developing safety zone and green belt. This entire area will be used for plantation with long term forestry crops like *Tectona grandis, Azadirachta indica, Haldina cordifolia and Madhuca longifolia,* selected on the basis of vegetation survey and ecological importance as derived by IVI.
- Hence, a total area of 343.06 ha i.e., 25.75% of the leased area of Dubna-Sakradihi iron and manganese ore mines in Keonjhar district, Odisha will be undertaken for plantation with forestry crops.

Justification for selection of the above mentioned 12 species for raising plantation in Dubna Sakradihi Iron Manganese Ore Mines is given below: -

1. ***Dendrocalamus strictus (Bamboo)***

   It is drought resistant and frost hardy bamboo species which grows on well drained soils and stony soils on hill slopes. The average life of a culm is 7 years. The following table gives a model for harvest management in bamboo and the potential culm yield of bamboo.

Year after planting	No. of cnlms harvested
4	4
7	8
10	12
13	15
16	18
19	20
22	21
25	25
28	30
30	150 and above

2. ***Eucalyptus sp. (Nilgiri)***

   Eucalyptus camaldulensis is an exotic fast-growing species which is best suitable for areas which receive mean annual rainfall of 250-600 mm. In plantations, the crop has a clear bole of 20 m with an erect, lightly branched crown. The success of Eucalyptus is attributed to its superiority to other trees in production of wood on non-fertile dry lands, its tolerance of drought and high temperature. This species thrives on a variety of soil types, ranging from red soils to sandy alluvial soils. It can also grow well in salt affected areas. In Tamil Nadu, yield of about 25-30 t/ha at a rotation of 6-7 years was realized through seed raised plantations during early 1990's. Introduction of clones increased the yield up to 60-70 t/ha in six years rotation. The species *Eucalyptus teriticornis* is reported to have a rotation of Four years (For clonal varieties), with an average yield of 40 tons per acre in places where water is available (CABI, 2022).

3. ***Populus deltoides (Poplar)***

   Poplar is a large tree with a clear bole and an open spreading crown. Assured irrigation facility is a perquisite for Poplar plantation. Areas with high water table are best suited for the

growth of *Populus deltoides*. It has very high growth rate (mean annual increment of 20 to 25 m^3 /ha/year) in India. Farmers in the foothills of the northwestern and central Himalaya commonly plant *Populus deltoides* with rotations of 8 to 12 years. The rotation for irrigated *Populus deltoides* on agricultural lands in Indo-Gangetic plains is 4 to 8 years (Christersson and Verma, 2006; Palanisamy et al.,2010; Nayak et al., 2011; Kumar and Singh, 2012;).

4. ***Gmelina arborea* (Ghamhar)**

Gmelina arborea is a fast-growing deciduous tree. It usually prefers moist fertile soils with an average rainfall of 750-4500 mm per annum. The tree attains grows to an average height of 25-30 m, with girth of 1.2 to 4.5 m with a clear bole of 9-15 m. The wood has a specific gravity is 0.42-0.64. The trees can be harvested 4-5 years after planting for pulp wood, and fire wood, and at 10-12 years after planting for timber. Under good management regime, each trees yield about 1.5 to 2 tonnes. The total yield per hectare is around 250-300 tonnes/ha (Nayak et al, 2011).

5. ***Leucaena leucocephala* (Subabul)**

Leucaena leucocephala is a leguminous tree belonging to the family fabaceae. The species prefers mean annual rainfall of 650-3000 mm. The tree grows extensively and can even be planted in wastelands or lands unsuitable for crop cultivation. With an aggressive root system, subabul is an excellent soil binder and moisture retainer. It is known to tolerate salinity and alkalinity up to pH 8.3. Subabul is a high yielding short rotation tree with an average yield of 100 tonnes per hectare in 3 to 4 years. Rotation period varies from 4 to 6 years depending on location of planting (TNAU, 2022).

6. ***Acacia auriculiformis* (Australian Babul)**

Acacia auriculiformis is an exotic evergreen tree belonging to the family Fabaceae. This fast-growing species is known to grow over 15-20 meters tall, with a trunk up to 12 m long and 50 cm in diameter. The species grows well in all types of soil and climate, and is used especially for afforestation of grasslands, reforestation of degraded forests and avenue planting. The rotation period is 10 years, when the species attains a height of about 12 m and a girth of about 60 cm (at breast height). It is also reported that in humid tropical areas of north eastern

India, *A. auriculiformis* can be harvested four years after planting, with excellent biomass yields (Christersson and Verma, 2006; Shukla et al., 2007)

7. ***Melia azedarach*** **(Bakaiu)**

Melia azedarach, commonly called as chinaberry tree is a fast-growing deciduous tree is known to grow over 35 meters tall, the crop prefers subtropical climatic zone with mean annual temperature of 23-27^{0}C, and mean annual rainfall of 350-2000 mm. Deep, fertile, sandy loam soils favor the optimum growth of the crop. *M. azedarach* wood has a density of 510-660 kg/cubic meters (Orwa et al., 2009).

8. ***Dalbergia sissoo*** **(Shisham)**

Dalbergia sissoo is a deciduous medium-sized tree growing up to 30 meters tall. It is adapted to a seasonal monsoon climate and a dry season of up to 6 months. It has been planted successfully in regions with 600-900 mm annual rainfall. However, for optimal growth more than 1,000 mm of annual rainfall is required and it can succeed in areas with 4,500mm. Young trees may grow fast and reach up to 3.7 meters in 1 year.

9. ***Dalbergia latifolia*** **(Kala Shisham)**

It is commonly called as Black Rosewood and is a predominantly single-stemmed deciduous tree that can grow up to 20-40m tall. The diameter of the trunk can be up to 1.5 to 2 m. *D. latifolia* prefers a tropical to subtropical climate and moderate to well-drained soil. It is propagated mainly through seeds and germination takes up to 7-25 days. In 5-7 years, the trees can grow to a height of 5-6m and the diameter of trunk can reach 13-14cm. The trees are harvested through clear felling and will be used for timber to firewood purposes depending upon the grade of the wood.

10. ***Tectona grandis*** **(Teak)**

Tectona grandis is a large deciduous tree species that can reach up to 30-40 m height and 2 m in diameter. The crop prefers well drained sandy loam soil with pH not exceeding 8.5 for optimum growth and is a light demanding species. With mean annual rainfall requirement of over 750 mm, teak yields a volume of 1.58 cum of timber per year per tree (increment). In natural forests, rotation period is 100-120 years, while in artificial regeneration, it is 70-80 years and in coppice regeneration, teak has a reduced rotation period of 40-60 years. In

response to recent commercial plantation activity in central and southern India, there is also renewed interest in growing teak on short rotations (Christersson and Verma 2006; TNAU, 2022).

11. *Azadirachta indica* (Neem)

Azadirachta indica is a large evergreen tree belonging to the family Meliaceae. The tree grows to an average height of 12 to 18 meters with 1.8 to 2.4 meters in girth, and usually has a straight bole and long spreading branches forming a broad crown. It can grow on a wide range of soils upto pH 10. Neem thrives in all kinds of soil types including clayey, saline, alkaline and acidie soils. It grows better than many other species on dry stony saline soils with a waterless sub-soil. The rate of growth of Neem in plantation varies with the quality of soil. It is reported that neem grows rapidly upto the age of 5 years after which it slows down. The plant attains a height of 4 m at 5 years and 10 m at 25 years. The mean annual girth increment is 2.3-3.0 cm (TNAU, 2022).

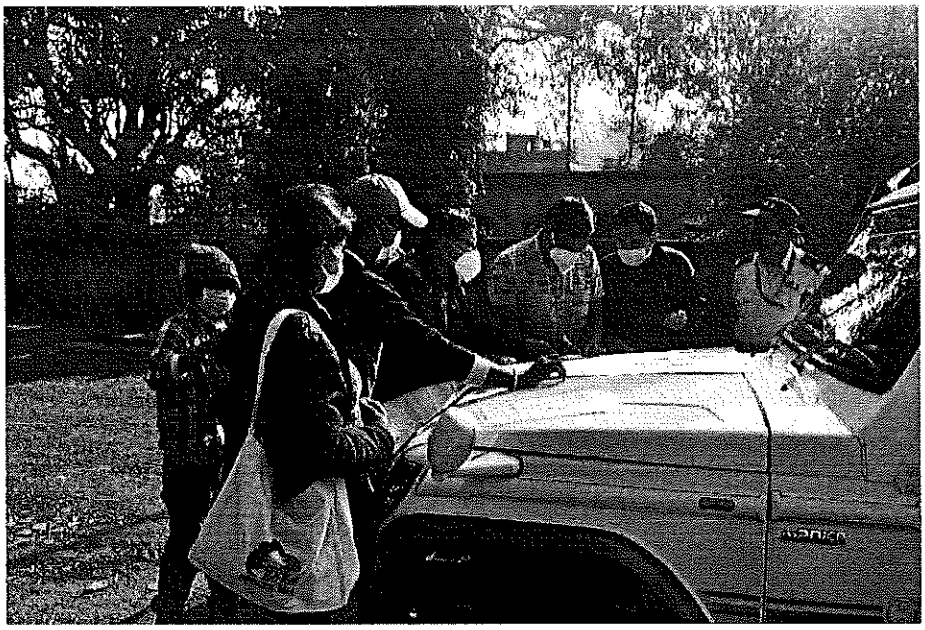
12. *Haldina cordifolia* (Haldu)

Haldina cordifolia is a deciduous tree which grows to an average height of 20-25 meters, however it is known to grow over 35 meters tall in freely drained soil. A light-demanding tree, Adina also establishes well in lower slopes of hills among boulders. It grows on a wide range of soils and tolerates pH up to 8.3 (ENVIS, 2011).

13. *Madhuca longifolia* (Mahua)

It is a deeiduous, medium sized tree, attaining an average height of 12-18 m, usually with a short bole and a girth of 2-4 m. Mahua thrives on a wide variety of soils, but prefers sandy soils and alluvial soils of the Indo-Gangetic plains. It is a tree of dry tropical and subtropical climate and requires mean annual rainfall of 750-1875 mm (TNAU, 2022).

Photo Gallery

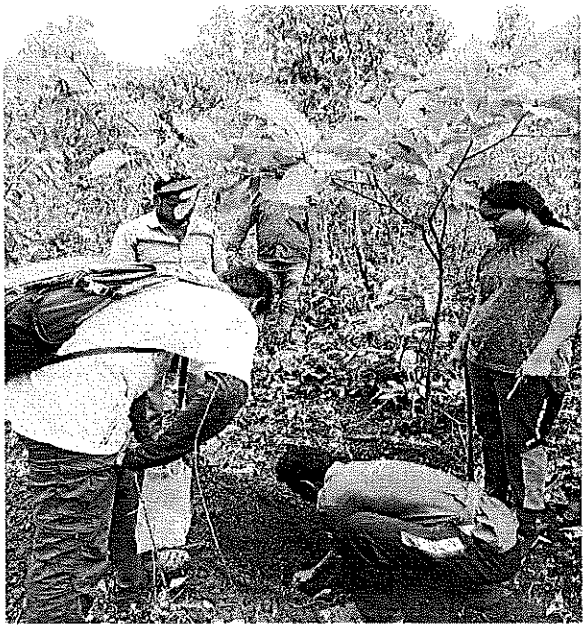


Detailed discussion with the offieials for selcctiou of quadrats for couducting vegetatiou studies at Dubna-Sakradhi ore miue area

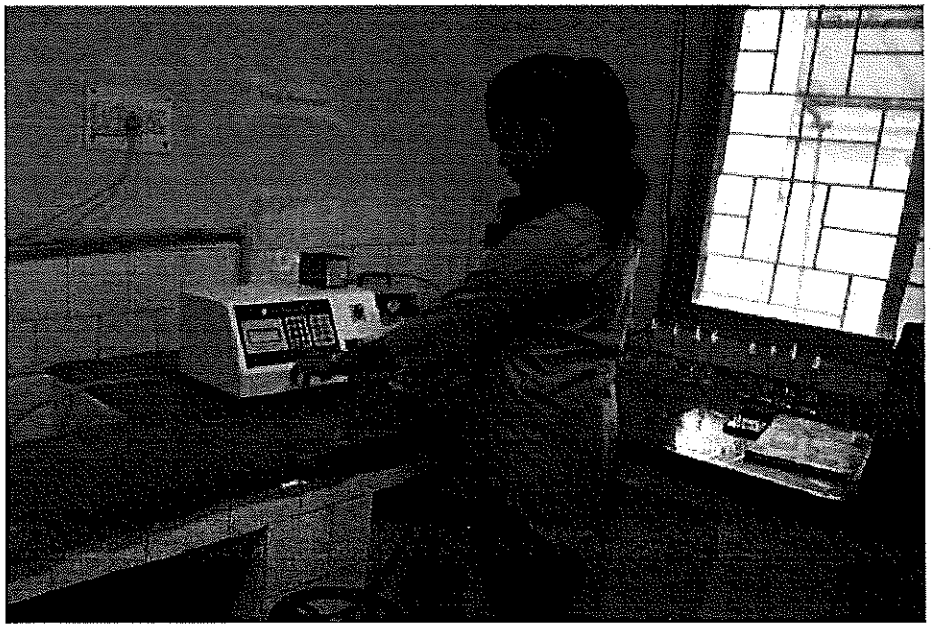
A view of the surveyed forest areas of Dubua-Sakradhi ore mine area

Layiug of tree transeets/quadrats for vegetatiou survey at the study site

Measuriug of growth parameters duriug vegetation survey at Dubna-Sakradhi vegetation study



Soil samples collection from Dubna Sakradihi mines



Analysis of soil samples iu TFRI laboratories

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Acknowledgement

We are grateful to Shri Sandeep Tripathi, PCCF and HOFF (Retd.), Odisha State Forest Department and Shri D.K. Pattanaik, Consultant, Odisha Mining Corporation Limited for providing continuous assistance to conduct this study starting from selection of sites till final report preparation. We thank mine manager, Dubna-Sakradihi and his team to help TFRI teams visiting the site for conducting studies. Finally, we feel grateful to technical officers, staff and project fellows of Forest Ecology & Climate Change Division for analyzing samples in TFRI laboratories.

(3) 23/12 (623) 621

OMC | ODISHA NEW OPPORTUNITIES

Letter No. 21369 /OMC/F&E/2022

15th December, 2022 22nd

To

The Divisional Forest Officer,
Keonjhar Forest Division.

Snb.: Proposal for non-forestry use of 1243.27 ha of forest land for mining of Iron and Manganese Ore in Dubna-Sakradihi Mines in favour of M/s Odisha Mining Corporation Ltd in District Keonjhar (Odisha) - reg.

Ref: (i) Lctter No. 8-26/2019FC dt 05.08.2022 by MoEF & CC, Govt. of India.
(ii) Letter No.6658/Mining dt 02.09.2022 by DFO, Keonjhar.

Sir

The point wise compliance to the observation raised by MoEF & CC, Govt. of India vide letter under reference (i) and subsequent instruction given by DFO, Keonjhar to comply the observation vide letter under reference (ii) pertaining to Dubna-Sakradih Iron and Manganese ore mines of OMC Ltd in Keonjhar district of Odisha for diversion of 1243.27 ha of forest land is given as under:

i. In compliance to condition no. 4 of Stage-I approval regarding removal of encroachment, it is informed by the State that the rights have been settled under the FRA. The submission by the State does not seem to be addressing the compliance of extant condition completely i.e. to support the compliance, the State Government categorically needs to confirm that all encroachments, referred to in the condition, pertains to legitimate pattas granted in the lease area under the FRA, 2006 and no unauthorized users/encroachers have possession of the forest land.

In compliance, it is submitted that Handibhanga, Bada-Kalimati, Jampani, Dubuna, Purunadih, Basantapur, Naibaga & Pedipokhari village limits are coming within Dubna-Sakradih mining lease area under the revenue jurisdiction of Tahasildar, Jhumpura and Barbil.

Tahasildar, Jhumpura vide letter No.4044 dt 14.12.2022 certified that out of 27 encroachers within Dubna-Sakradih mining lease area of OMC, legitimate land rights have been issued in favour of 07 claimants and additional 15 persons have been settled as recommended by Sub Divisional Level Committee (SDLC) on dt 29.11.2022 and further decided by District Level Committee (DLC) on dt 05.12.2022. The remaining 05 cases have been found ineligible to grant patta under FRA 2006 and thus steps for eviction regarding unauthorized encroachers have been initiated as per OPLP Act, 1972. The copy of the forwarding letter by Tahasildar, Jhumpura enclosed with the list of eligible cases and settled through FRA Act, 2006 and approved by DLC along with the copy of the list of encroachers who are ineligible to settle through FRA, 2006 have been booked as per OPLP Act 1972 is enclosed as **Annexure-I** for reference.

In addition, Tahasildar, Barbil vide letter No.4277 dt 13.12.2022 certified that out of 26 listed encroachers within Dubna-Sakradih ML area of OMC, legitimate land rights have been issued in favour of 10 claimants and additional 04 persons have been settled as recommended by SDLC on dt 29.11.2022 and further decided by DLC on dt 05.12.2022. The remaining 12 cases have been found ineligible to grant patta under FRA 2006 and thus steps for eviction regarding unauthorized encroachers have been initiated as per OPLP Act, 1972. The copy of the forwarding letter by Tahasildar, Barbil enclosed with the list of eligible cases and settled through FRA Act, 2006 and approved by DLC along with the copy of the list of encroachers who are ineligible to settle through FRA, 2006 have been booked as per OPLP Act 1972 is enclosed as **Annexnre-II** for reference.

D/C

ii. ***In compliance to condition no. 10 of Stage-I approval, it is mentioned that report in this regard has been prepared by the TFRI and a copy of the same has been submitted. The Study report does not seem to contain any recommendation. The State Government may therefore submit their specific comments on the relevant outcome of the study, if any, matching with the parameters envisioned in the condition no. 10 of the Stage-I approval.***

In compliance, it is submitted that TFRI has recommended the following to continue the eco-logical services with additional revenue generation opportunity to OMC as a model to be implemented within the mining lease:

1. A total of 1332.019 ha land has been provided to Odisha Mining Corporation Limited in Keonjhar district of Odisha.
2. Out of the total, 261.919 ha have been verified broken prior to 25.10.1980, which includes 258.599 ha forest land and 3.320 ha of non-forest land. The broken up area contains a substantial amount of mineral reserve, which will be further extracted after getting forest clearance.
3. In the first 5 years, OMCL has proposed to utilize 326.9818 ha for mining and ancillary activities, which includes 261.919 ha already broken up area. Moreover, 5.5786 ha land will be kept for public purpose like cremation ground, market place, roads, pond and grazing purpose. The land for public purpose has been excluded from the diversion proposal and shall be used by villagers. Hence, a total of 332.5604 ha land will not be available for raising plantations.
4. Around 500 ha land will be taken up for mining activities between 6 and 10 years, 39.55% of which means 177.77 ha land can be brought under short rotation forest species having less than 10 years rotation age like *Bamboo spp., Eucalyptus spp., Populus deltoids, Gmelina arborea and Leucaena leucocephala*. The National Forest Policy of India (1988) describes the goal of achieving more than 33% of the geographical area of the country under forest and tree cover. Moreover, according to India State of Forest Report (2021), the natural forest in Odisha state is 33.50% of the geographical area of the state. Hence, it was decided to bring 33% area under green cover in the present case.
5. The remaining 414.7028 ha land will be taken up for mining activities after 10 years, 28.73% of which means 119.13 ha land can be brought under plantations of tree species having more than 10 years rotation age like *Gmelina arborea, Acacia auriculiformis, Leucaena leucocephala, Melia azedarach, Dalbergia sissoo and Dalbergia latifolia.*
6. An area of 26.17 ha designated for safety zone and green belt will never be used for extracting minerals hence the whole area can be utilized for raising plantation of long rotation tree species like *Tectona grandis, Azadirachta indica, Haldina cordifolia and Madhuca longifolia.*
7. As a whole, plantations can be raised on 328.0197 ha (165.0 ha + 136.8519 ha + 26.1678 ha) land, which is 25.76% of total lease area of 1332.019 ha. All the plantations can be raised in either first or second year of getting clearance for augmentation and continuous flow of ecological goods and services.
8. Plantations of all the species can be raised with 2m x 2m spacing, except Eucalyptus and Poplar which can be planted with 1m x 1m spacing.

The photo-copy of the final report by TFRI, ICFRE, Jabalpur is enclosed as **Annexnre-III** for kind perusal. An undertaking by OMC at **Annexnre-IV** is given to implement the recommendations in the ML area once the mine is put to operation and the outcome at regular interval shall be informed to the State Government for needful action.

iii. ***Examination of the degraded forest land using Google Satellite Imagery revealed that patch-I, involving degraded forest land of 28 ha, is completely planted while gap plantation seems to have been done in Patch-II. The***

State Government may, therefore, comment on the suitability of these areas for raising fresh afforestation as per the CA scheme approved by the RCCF, Rourkela.

In compliance, it is submitted that an alternate area over 31.981 ha in Chamakpur PRF under Champua Range of Keonjhar Forest Division has been examined and selected for plantation against 1.5 times the safety zone area. Accordingly, a scheme has been approved by RCCF, Rourkela on dt 16.11.2022 to undertake AR plantation @1000 plants/ha with a total financial outlay of Rs 1, 70, 86,100/-. On receiving the demand from DFO, Keonjhar vide letter No.9002/Mining-98/2021 dt 21.11.2022, OMC deposited the differential amount of Rs 32, 32,200/- (Rs 1, 70, 86,100 - Rs 1, 38, 53,900/-) vide UTR No. UBINJ 22337708874 dt 03.12.2022. The copy of the approval letter by RCCF along with the scheme, demand letter by DFO and payment receipt by OMC is enclosed as **Annexnre-V Series.** The copy of the kml file is enclosed in form of a CD for kind reference.

iv. ***Site specific Wildlife Plan was initially approved for a financial outlay of Rs. 12.184 lakh by the CWLW of the State and now the Plan has been revised involving fiuancial provisions of Rs. 600.867 lakh. The State Government may, therefore, inform whether the revised Plan has been approved by the CWLW or otherwise.***

In compliance, it is submitted that the financial outlay of Rs 12.184 lakhs mentioncd in the observation relates to the Site Specific Wildlife Conservation Plan approved by PCCF (WL) & CWLW, Odisha vide letter No. 9432/1WL-SSP-62/2016 dt 30.11.2016 pertaining to Dubna-Sakradih ML area of 1332.019 ha. The plan though approved in 2016 no work has been implemented by OMC and no work has been executed by Forest Department due to non-deposit of the funds by OMC in the absence of stage-I Forest Clearance.

Before the said amount is deposited, as per condition No.11 of the letter No.8-26/2019-FC dt 06.05.2021 by MoEF & CC, the Site Specific Wildlife Conservation Plan of Dubna-Sakradih ML area was revised and got it approved by PCCF (WL) & CWLW, Odisha vide letter no.13876/CWLW-FDWC-FD-0053-2021 dt. 20.12.2021 with a financial outlay of Rs. 600.867 lakhs. The Executive Summary (p-xv) of the SSWLCP approved on dt 20.12.2021 indicates that ***"On event of its approval it will supersede the previous plan".*** Therefore, DFO, Keonjhar vide letter No. 9184/Mining-98/2011 dt 21.12.2021 raised a demand of Rs 600.867 lakh. OMC deposited Rs 20, 91, 08,458/- online vide UTR No. UBINJ 22076649463 dt 17.03.2022 which includes Rs. 600.867 lakhs. A copy of the approval letter by CWLW, demand letter by DFO, proof of the deposit by OMC and copy of the relevant page No.xv of approved SSWLCP is enclosed as **Annexnre-VI Series** for reference.

v. The Management Plan lacks clarity on the mitigation measnres proposed exclnsively for elephants and locations in which these measnres wonld be implemented. Considering interstate elephant movement in these areas, there shonld be clear long term strategies to allow free passage of elephants to rednce hnman-elephant conflict in these areas. Tberefore, elephant specific mitigation plan keeping in view the comments of Project Elephant Division as mentioned in the Stage-I, needs to be prepared with inpnts from scientific institntion and resubmitted.

In compliance, it is requested that an elephant specific mitigation plan pertaining to diversion of 1243.27 ha of forest land at Dubna-Sakradih Mines may be submitted by the State Government.

It is therefore requested to consider the above compliance and recommend to higher quarter for grant of Stage-II Forest Clearance.

An early action is highly solicited.

Yours faithfully,

Encls. as above.

Executive Director (F&E)

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ANNEXURE-I

OFFICE OF THE TAHASILDAR, JHUMPURA

Letter No. 4044/Date. 14.12.2022

To

RM ,Barbil
Odisha Minning Corporation
Barbil.

Sub: **Issuance of certificate for compliance regarding settlement of rights under FRA with respect to Dubuna-Sakradibi Iron & Mn. Mines**

Sir,

With reference to the subject cited above ,this is to certify that Out of 27 listed encroachers within Dubuna Sakradihi Iron and Mn. mines Minning Lease area of M/S OMC, Ltd under Barbil Tahasil , legitimate land rights have been issued in favor of 07 claimants and additional 15 persons have been settled as recommended by SDLC on dt:29th Nov'22 and further decided by DLC on dt 05th Dec'22.The remaining 05 cases have been found ineligible to grant patta under FRA 2006 and thus steps for eviction regarding unauthorized encroachers have been initiated as per OPLP Act.1972.

Yours Faithfuliy

14.12.22

Tahasildar Jhumpura

TAHASILDAR
Jhumpura

Enclosure:-

1. Eligible land settled through Forest Right Act, 2006 and approved vide DLC Committee in Annexure-I.
2. List of encroachers who are ineligible to settle through Forest Right Act, 2006 have been booked as per OPLP Act 1972 in Annexure-II.

Annexure-I

Sl. No	Name of the Benificary	Father's/Husbands Name	Address	Category	Tahsil
1	Rala Laguri	Routa Laguri	Naibuga	ST	Jhumpura
2	Arjun Daraiburu	Dama Daraiburu	Naibuga	ST	Jhumpura
3	Jai Singh Munda	Dalo Munda	Naibuga	ST	Jhumpura
4	Jayaram Munda	Baram Munda	Naibuga	ST	Jhumpura
5	Bhaiga Munda	Desa Munda	Naibuga	ST	Jhumpura
6	Nandu Munda	Mangal Munda	Naibuga	ST	Jhumpura
7	Janam Singh Munda	Nandu Munda	Naibuga	ST	Jhumpura
8	Putu Munda	Sanatana Munda	Naibuga	ST	Jhumpura
9	Sandri Kamal	Krushna Kamal	Naibuga	ST	Jhumpura
10	Mohan Munda	Birsingh Munda	Naibuga	ST	Jhumpura
11	Jogandra Naik	Ainthu Naik	Naibuga	ST	Jhumpura
12	Panda Naik	Manu Naik	Naibuga	ST	Jhumpura
13	Chaga Munda	Sukura Munda	Naibuga	ST	Jhumpura
14	Gama Munda	Manglu Munda	Naibuga	ST	Jhumpura
15	Sukura Munda	Dursu Munda	Naibuga	ST	Jhumpura
16	Majura Munda	Dursu Munda	Naibuga	ST	Jhumpura
17	Gura Munda	Pandu Munda	Naibuga	ST	Jhumpura
18	Raijan Munda	Tanguru Munda	Naibuga	ST	Jhumpura
19	Jhunu Munda	Langala Munda	Naibuga	ST	Jhumpura
20	BirMohan Munda	Pandu Munda	Naibuga	ST	Jhumpura
21	Butu Munda	Pandu Munda	Naibuga	ST	Jhumpura
22	Ghasi Munda	Persu Munda	Naibuga	ST	Jhumpura

14.12.22

TAHASILDAR
Jhumpura

Annexure-II

Sl. No	Name of the Benificary	Father's/Husbands Name	Address	Category	Tahsil
1	Asha Tanti	Dasaratha Tanti	Naibuga	SC	Jhumpura
2	Jagadish Tanti	Dubaraj Tanti	Naibuga	SC	Jhumpura
3	Galai Giri	Tunu Giri	Naibuga	OBC	Jhumpura
4	Parsu Munda	Bagina Munda	Naibuga	ST	Jhumpura
5	Muku Munda	Bagina Munda	Naibuga	ST	Jhumpura

14.12.22
TAHASILDAR
Jhumpura

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See Rule 3(1)

nt of unauthorised occupation of Govt. land in village of Tahasil, Sub-Division-Champua,
Keonjhar during the month of Dec 2022
Serial No. 208

Name, Father's Name Address of the person in unauthorised occupation. Asha Tamuli,
Whether the person belongs to Schedule Caste Tribe - W/o- Dadhyabadhi Tamuli
Description of the land unauthorisedly Occupied - At- Malibaga
a) Village - Malibaga P.O. Dalami
b) Holding No. - 124 P.S. Ramchandi
c) Plot No. - 321 Dist. Keonjhar
d) Kissam - Parbata-II
e) Full extent of plot - A 16.38
f) Extent occupied with boundary A0.04

Class of land encroached i e. whether Gocher, Canal, Embankment, Rakhita, Sarbasadharana, Set apart for common use of villagers used for house site, Temple site likely to be required for any development scheme, belongs to an establishment of Govt. / Corporation. (A.A.P)

Whether he is in Rural area/Municipality /Notified area/Urban area

If the land is Municipality or Notified area Whether :

i) The person or any member of his family living with him in common mess owns house or house site in that Municipality or notified area .

ii) The land being adjacent to the holding owned by the person enjoyment of such holding or for the residential purpose beneficial necessary of the person or

iii) The land is reserved for the purpose of any Govt. for any development purpose .

Whether the person is land less, not :

a) Total extent of land owned by him (including his homestand)

b) Extent of land owned by all the members of his family who are living with him in common mess

c) Extent of home stead land owned by him

Income of the encroacher and other members of his family who are living with him in mess from sources other than agriculture . 25,000/-

0. Mode of occupation by :
   a) Cultivation :
   b) Erection of house :
   c) Any other manner :
1. Date of Inspection of the R.I. 8/11/2022
2. Whether encroachment was booked previously if so the case No.
3. Rate of assessment [Taram assessment of the village]
4. If not assessed rate of assessment of lands similar description and advantage of the vivinity .
5. Assessment of the Extent occupied .
6. Remarks of the Revenue Inspector

1. L
1. 0
1. L
8.

For Section.

Full Signature of the Reporting Officer

(Revenue Inspector _____)

Revenue Inspector
Malda

ment of unauthorised occupation of Govt. land in village of Tahasil Sub-Division-Champua

Ke[illegible]har during the month of Nov 2022

eral No. 6697

ame Father's Name Address of the person in unauthorised occupation: Jagadish Tanti
S/o Jubaraj Tanti
At- Nalidaga
po- Dabuna
ps- Bamebagan
Dist: Keonjhar

Whether the person belongs to Schedule Caste Tribe -

escription of the land unauthorisedly Occupied -

) Village - Nowbaje

) Holding No. - 124

) Plot No. - 321

) Kissam - Pabbatea-II

) Full extent of plot - A-16.38

Extent occupied with boundary A-0.05

lass of land encroached i.e. whether Gocher, Canal, Embankment, Rakhita, Sarbasadharana, et apart for common use of villagers, used for house site, Temple site likely to be required for ny development scheme, belongs to an establishment of Govt. / Corporation (A-A-A)

Whether he is in Rural area/Municipality /Notified area/Urban area

f the land is Municipality or Notified area Whether :

) The person or any member of his family living with him in common mess owns house or house site in that Municipality or notified area .

i) The land being adjacent to the holding owned by the person enjoyment of such holding or for the residential purpose beneficial necessary of the person or

ii) The land is reserved for the purpose of any Govt. for any development purpose

Whether the person is land less, not :

a) Total extent of land owned by him (including his homestand)

b) Extent of land owned by all the members of his family who are living with him in common mess

c) Extent of home stead land owned by him

Income of the encroacher and other members of his family who are living with him in mess from sources other than agriculture . 85,000/-

Mode of occupation by :

a) Cultivation

b) Erection of house

c) Any other manner

Date of Inspection of the R.I. 8/11/2022

Whether encroachment was booked previously If so the case No.

Rate of assessment [Taram assessment of the village]

If not assessed rate of assessment of lands similar description and advantage of the vivinity .

Assessment of the Extent occupied

Remarks of the Revenue Inspector

1.0
1.2
3.0

Encl:Nil.

Full Signature of the Reporting Officer

(Revenue Inspector _____ Revenue Inspector
Malda

ring the month of ... of Govt. land in village of Tahasil Sub-Division ...

... 112 ... 7 Nov 2022

me, Father's Name Address of the person in unauthorised occupation. Gopal Oram
ether the person belongs to Schedule Caste Tribe - S/o - Turce Oram
scription of the land unauthorisedly Occupied - At-Patapur Nuabag
Village - Nuabag P.O. Dabuna
Holding No. - 124 P.S. Bamebagar
Plot No - 321 Dist. Keonjhar
Kissam - Pasbata-II
Full extent of plot - A-16.38
Extent occupied with boundary 0.05
s of land encroached i.e. whether Gocher, Canal, Embankment, Rakhita, Sarbasadharana,
part for common use of villagers used for house site, Temple site likely to be required for
development scheme, belongs to an establishment of Govt. / Corporation (A.A.A)
her he is in Rural area/Municipality /Notified area Urban area
land is Municipality or Notified area Whether
he person or any member of his family living with him in common mess owns house or
house site in that Municipality or notified area
he land being adjacent to the holding owned by the person enjoyment of such holding or
the residential purpose beneficial necessary of the person or
e land is reserved for the purpose of any Govt. for any development purpose .
er the person is land less, not .
al extent of land owned by him (including his homestand)
ent of land owned by all the members of his family who are living with him in common
ss
ent of home stead land owned by him
of the encroacher and other members of his family who are living with him in mess
urces other than agriculture . 90,000/-
f occupation by .
vation .
tion of house : 1.00
other manner : 1.00
nspection of the R.I. 8/11/2022 1.00
encroachment was booked previously if so the case No. 3.00
ssessment [Taram assessment of the village]
essed rate of assessment of lands similar description and advantage of the vivinity
ent of the Extent occupied .
of the Revenue Inspector

5 (Rs 100/-)

Full Signature of the Reporting Officer
(Revenue Inspector Revenue Inspector)

612

FORM - G

See Rule 3(2)

ment of unauthorised occupation of Govt. land in village of Tanasi, Sub-Division Champua,
Keonjhar during the month of Nov / 2022

Serial No. 111

Name, Father's Name Address of the person in unauthorised occupation. Parshu Munda
S/o- Bageina Munda
At- Nuabaga
Po- Dobuna
PS- Barmeban
Dist- Keonjhar

Whether the person belongs to Schedule Caste Tribe :

Description of the land unauthorisedly Occupied :

a) Village :- Nuabaga

b) Holding No. :- 123

c) Plot No. :- 332

d) Kissam :- Jungal

e) Full extent of plot A 3.11

f) Extent occupied with boundary A 0.05

Class of land encroached i.e. whether Gochar, Canal, Embankment, Rakhita, Sarbasadharana,
Set apart for common use of villagers used for house site, Temple site likely to be required for
any development scheme, belongs to an establishment of Govt. / Corporation

Whether he is in Rural area/Municipality /Notified area Urban area

If the land is Municipality or Notified area Whether

) The person or any member of his family living with him in common mess owns house or
house site in that Municipality or notified area

) The land being adjacent to the holding owned by the person enjoyment of such holding or

for the residential purpose beneficial necessary of the person or

) The land is reserved for the purpose of any Govt. for any development purpose .

Whether the person is land less, not :

Total extent of land owned by him (including his homestead)

Extent of land owned by all the members of his family who are living with him in common
mess

Extent of home stead land owned by him

ome of the encroacher and other members of his family who are living with him in mess

n sources other than agriculture . 90,000/-

de of occupation by :

Cultivation :

Erection of house :

ny other manner :

of Inspection of the R.I. 8/11/2022

her encroachment was booked previously if so the case No.

of assessment [Taram assessment of the village]

assessed rate of assessment of lands similar description and advantage of the vivinity .

sment of the Extent occupied .

rks of the Revenue Inspector

1.5
1.0
1.2
3.10

Encl(00).

Full Signature of the Reporting Officer

(Revenue Inspector _____)

611

FORM - G

See Rule 3(1)

...tement of unauthorised occupation of Govt. land in village of Tahasil, Sub-Division-Champua.

...ecord that during the month of Nov 2022

Serial No. 110

Name, Father's Name Address of the person in unauthorised occupation. Pluku Munda
s/o- Bagina Munda
At- Laibaga
Po- Dabanka
Ps- Bamebaga
Dist- Keonjhar

Whether the person belongs to Schedule Caste Tribe -

Description of the land unauthorisedly Occupied -

a). Village- Laibaga

b). Holding No. - 123

c) Plot No. - 332

d). Kissam - Jungal

e). Full extent of plot - A 3.11

f) Extent occupied with boundary A 0.03

Class of land encroached i.e. whether Gochar, Canal, Embankment, Rakhita, Sarbasadharana,
set apart for common use of villagers used for house site, Temple site likely to be required for
any development scheme, belongs to an establishment of Govt. / Corporation (A.G.A)

Whether he is in Rural area/Municipality /Notified area/ Urban area

The land is Municipality or Notified area Whether

The person or any member of his family living with him in common mess owns house or
house site in that Municipality or notified area .

The land being adjacent to the holding owned by the person enjoyment of such holding or
for the residential purpose beneficial necessary of the person or

The land is reserved for the purpose of any Govt. for any development purpose .

Whether the person is land less, not :

Total extent of land owned by him (including his homestand)

Extent of land owned by all the members of his family who are living with him in common
mess

Extent of home stead land owned by him

Name of the encroacher and other members of his family who are living with him in mess
sources other than agriculture . 80,000/-

Mode of occupation by :

Cultivation :

Erection of house :

By other manner :

Date of Inspection of the R.I. 23/11/2022

Whether encroachment was booked previously if so the case No.

Land assessment [Taram assessment of the village] 1.00
3.00

Assessed rate of assessment of lands similar description and advantage of the vivinity :

Measurement of the Extent occupied

Remarks of the Revenue Inspector

Date

Full Signature of the Reporting Officer

610

ANNEXURE -II

OFFICE OF THE TAHASILDAR, BARBIL

Letter No. 4277/Date. 13.12.2022

To

RM ,Barbil
Odisha Minning Corporation
Barbil.

Sub: Issuance of certificate for compliance regarding settlement of rights under FRA with respect to Dubuna-Sakhradihi Iron & Mn. Mines

Sir,

With reference to the subject cited above ,this is to certify that Out of 26 listed encroachers within Dubuna Sakhradihi Iron and Mn. mines minning lease area of M/S OMC, Ltd under Barbil Tahasil , legitimate land rights have been issued in favor of 10 claimants and additional 4 persons have been settled as recommended by SDLC on dt:29th Nov'22 and further decided by DLC on dt 05th Dec'22.The remaining 12 cases have been found ineligible to grant patta under FRA 2006 and thus steps for eviction regarding unauthorized encroachers have been initiated as per OPLP Act.1972.

Yours Faithfully

Tahasildar Barbil

TAHASILDAR
BARBIL

Enclosure:-

1. Eligible land settled through Forest Right Act, 2006 and approved vide DLC Committee in Annexure-i.
2. List of enclosure who are in eligible to settle through Forest Right Act, 2006 have been booked as per OPLE Act 1972 in Annexure-II.

Annexure-I

SL no	Name of the Beneficiary	Father's /Husbands Name	Address	Category	Tahasil
1	Jania Champia	Raya Champia	Sundara,Kadakala	ST	Barbil
2	Guian Singh (Dead)	Rata Champia	Jampani	ST	Barbil
3	Sukumar Champia	Rama Champia	Jampani	ST	Barbil
4	Chandan Champia	Gura Champia	Jampani	ST	Barbil
5	Dala Gagrai	Xendor Gagrai	Jampani	ST	Barbil
6	Rohi Das Gagrai	Susil Gagrai	Jampani	ST	Barbil
7	Dabar Champia	Sambra Champia	Jampani	ST	Barbil
8	Chambru Champia	Gura Champia	Jampani	ST	Barbil
9	Jania Champia	Raya Champia	Jampani	ST	Barbil
10	Budhuram Champia	Banaram Champia	Jampani	ST	Barbil
11	Raya Munda	Rout Munda	Handibhanga	ST	Barbil
12	Jadumani Munda	Dasra Munda	Handibhanga	ST	Barbil
13	Sankaj Munda	Bishnu Munda	Handibhanga	ST	Barbil
14	Minju Munda	Raya Munda	Handibhanga	ST	Barbil

TAHASILDAR
BARBIL

Annexure-il

SL no	Name of the Beneficiary	Father's /Husbands Name	Address	Category	Tahasil
1	Ghasinath Barik	Purna Barik	At-Kirakudar Po-Dubna Keonjhar	OBC	Barbil
2	Rama Patra	Hiren Patra	At-Khuntapada Jhumpura	SC	Barbil
3	Niranjan Barik(Dead)	Laxmidhar Barik	At-Jogimatha, Banajodi	OBC	Barbil
4	Patu Patra	Chandramani Patra		SC	Barbil
5	Renuka Patra	Kalicharan Patra	At-Arsala,Jhumpura	SC	Barbil
6	Nishlkanta Barik	Kaiia Barik	At-Pldipokhori, Dubna	OBC	Barbll
7	Santilata Behera	Dilip Parida	Dubna	OBC	Barbil
8	Rama Patra	Nargeswar Patra	Balabhadrapur	SC	Barbil
9	Kalakrushna Patra	Rama chandra patra	Kesana	SC	Barbil
10	Narshing Munda	Thupulu Munda	Gudguda	ST	Barbil
11	Hari Munda	Sunaram Munda	Loabeda	ST	Barbil
12	Bana Champia	Sunia Champia	Begna,Podang	ST	Barbil

TAHASILDAR
BARBIL

607

(1)

202

FORM - C

[See Rule 3 (1)]

Statement of unauthorised Occupation of Govt. Land in Village Dabuna.
in the Circle Dabuna Tahasil Barbil
Sub-Division - Champua, Dist. Keonjhar, for the month of

a) Ll No. 129	b) Ghasinath Barik S/o- purna Barik at - Dabuna PS - Barabari Dist Keonjhar.
a) Father's Name & Address of the person unauthorised occupation	
b) whether the person belongs to Scheduled Caste/Tribe	
c) Description of the land unauthorisedly occupied	

a) Village	b) Holding	c) Plot	d) Full extent of the Plot	e) Extent Kisan Occupied
Dabuna. (AJA).	97	656	A7.00	A0 04 Kisam-patita.

a) Class of land encroached, i. e. whether Nochar canal, embankment, Rakhita, Gorbasadharana set apart from communal use of villagers, used for house sites, temple sites likely to be required for any development purpose / scheme belongs to an establishment of Govt./Corpn.	AJA
b) Whether the land is in Rural Area, Municipality/Notified area/Urban area	Rural Area
c) If the land is in Municipality or NAC area, whether :-	
(i) the person or any member of his family living with him in common mess owns a house or house site in the Municipal or Notified area.	—
(ii) the land being adjacent to the holding owned by the person is necessary for the beneficial enjoyment of such holding or for residential purpose of the person.	—
(iii) the land is reserved for the purpose of any Govt or for any development	—

606

[illegible]

a) Total extent of land owned by him (including his homestead land) —

b) Extent of land owned by all the members of his family who are living with him in common mess —

c) Extent of homestead land owned by him —

9. Income of the encroacher and other members of the family [illegible] with him in one mess from [illegible] than agriculture 100000.00

10. Mode of occupation: Cultivation purpose.

a) Cultivation

b) Erection of house

c) Any other manner

11. Date of inspection of [illegible] 8/11/22.

12. Whether encroachment was [illegible] previously, if so, the Case No.

13. Rate of assessment (Term assessed of the village) 3.00

14. If not assessed, rate of assessment of lands of similar description and advantage of the vicinity —

15. Assessment of the extent [illegible]

L. R.	Cess	N. C.
1.00	1.00	1.00.

16. Remarks of the Revenue Inspector

605

2

827

FORM [illegible]

(See Rule 3(1))

Statement of unauthorised Occupation of Govt. Land in Village Dabuna.

in the Circle Dabuna., Police Station Barbil

Sub-Division Champua, Dist. Keonjhar, for the month of

a) Case No. 130	b) Name & Address of the person unauthorised occupation, whether the person belongs to Scheduled Caste/Tribe	c) Description of the land unauthorisedly occupied			
	Rama Patra. S/o Hiren Patra. at - Dabuna. P.S - Barabari Dist - Keonjhar				
Village	by Holding	c) Plot	d) Full extent of the Plot	e) Extent Kisan Occupied	
Dabuna (AJA)	97	656	A7.00	A0.04 Kisam Patita.	

a) Use of land encroached, i.e., whether water course, embankment, Nakkita, Gochadharana set apart from communal use of villagers, used for house sites, temple likely to be required for any develop-ment purpose / scheme belongs to any Govt. Department of Govt. Undertaking.

AJA

b) Whether the land is in Rural Area, Semi Urban/Notified area/Urban area.

Rural Area

c) If the land is in Municipality or NAC area, whether

i) the person or any member of his family living with him is owning any house or house site in the Municipal or Notified area.

—

ii) the land being adjacent to the holding owned by the person is necessary for the beneficial enjoyment of such holding or for residential purpose of the person.

—

iii) the land is reserved for the purpose

—

a) Total extent of land owned by him (including his [illegible]) —

b) Extent of land owned by the members of his family [illegible] with him in common [illegible] —

c) Extent of [illegible] land [illegible] him —

9. Income of the [illegible] members of [illegible] with him [illegible] than agriculture [illegible] 100000.00

10. Mode of occupation

a) Cultivation

b) Erection of house [illegible]

c) Any other [illegible]

Cultivation Purpose

11. Date of inspection [illegible] 8/11/22

12. Whether encroachment [illegible] viously, if so, the [illegible]

13. Rate of assessment (Term assessed [illegible]) 3.00

14. If not assessed, [illegible] lands of similar [illegible] tage in the vicinity —

15. Assessment of [illegible]

	[illegible]	Cess	[illegible]
	1.00	1.00	1.00

16. Remarks of the [illegible]

FORM - G
(See Rule 3(1))

Statement of unauthorised Occupation of Govt. Land in Village - in the Circle, Tahasil - Barbil Sub-Division - Champua, Dist. Keonjhar, for the month of

Sl No. 131

Name, Father's Name & Address of the person making unauthorised occupation
Niranjan Barik
S/o Laxmidhar Barik
At - Dabuna,
PS - Bamebari
Dist - Keonjhar

Whether the person belongs to Scheduled Caste/Tribe

Description of the land unauthorisedly occupied

a) Village	b) Holding	c) Plot	d) Full extent of the plot	e) Extent Kisam Occupied
Dabuna (AJA)	97	656	A-7.00	A0.04 Kisam - Palika.

Class of land encroached, i.e. whether orbar canal, embankment, Rakhita, or Sasadharana set apart from communal use of villagers, used for house sites, temple etc. likely to be required for any development purpose / scheme belongs to an establishment of Govt./Corpn. — AJA

Whether the land is in Rural Area, Municipality/Notified area/Urban area — Rural Area.

If the land is in Municipality or NAC area, whether -

a) the person or any member of his family living with him in common mess owns a house or house site in the Municipal or Notified area. —

b) the land being adjacent to the holding owned by the person is necessary for the beneficial enjoyment of such holding or for residential purpose of the person. —

c) the land is reserved for the purpose of any Govt. or for any development —

602

a) Total extent of land ... including the extent of land ...	—
b) Extent of land ... members ... with him in ...	—
c) Extent of ... Law	—
9. Income of the ... members ... with him in ... than agriculture	100000.00
10. Mode of disposal a) Cultivation b) Revenue of land c) Any other source	Cultivation Purpose
11. Date of ...	8.11.22
12. Whether ... viously, if so, ...	
13. Rate of assessment (Term assessed ...	3.00
14. Is any ... lands of similar ... type of the ...	—
15. Assessment of ...	D. Class B C 1.00 1.00 1.00
16. Remarks of ...	

601

FORM [illegible]

(See Rule 3(1))

Statement of encroachment of Government land for Village [illegible]

in the Circle [illegible], Tahasil: Barbil

Sub Division: Champua, Dist: Keonjhar, for the month of

1. Case No. 132	
2. Name, Father's Name & Address of the encroacher/unauthorised occupator	Palu Patra S/o Chandramani Patra at- Dabuna P.S- Barbil Dist- Keonjhar
3. Whether the person belongs to Scheduled Caste/Tribe	
4. Description of the land encroached/occupied	

a) Village	b) Holding	c) Plot	d) Full extent of the plot	e) Extent Kissam Occupied
Dabuna (AJA)	97	656	A 7.00	A 0.04 Kissam - Patita.

5. Area of land encroached, i.e. whether under canal, embankment, Rakhita, Gochharana set apart from communal use of villagers, used for house sites, temporary likely to be required for any development purpose / scheme belongs to encroachment of Govt / Gaon: AJA

6. Whether the land is in Rural Area, Municipality/Notified area/Urban area: Rural Area.

7. If the land is in Municipality or NAC area, further:

a) the person or any members of his family living with him in common mess owns a house or house site in the Municipal or Notified area: —

b) the land being adjacent to the holding owned by the person is necessary for the comfortable enjoyment of such holding or for residential purposes of the person: —

c) the land is reserved for the purpose [illegible]: —

600

a) Total [illegible]
(including [illegible]) —

b) Extent of [illegible]
members [illegible]
with him [illegible] —

c) Extent of [illegible]
[illegible] —

9 Income of [illegible]
members [illegible]
with [illegible]
than [illegible] 100000.00

10 Mode [illegible]
a) Cultivation Cultivation Purpose.
b) [illegible]
c) Any other [illegible]

11 Date of [illegible] 8.11.22

12 Whether [illegible]
wisely, if [illegible]

13. Rate of assessment 3.00
(Term [illegible]

14 Is not [illegible]
lands of [illegible] —
tage of the [illegible]

15 Assessment of [illegible]

1.00	1.00	1.00

16 Remarks of [illegible]

599

FORM IV
(See Rule 3(f))

Register of unauthorised Occupation of Govt. Land in Village
in the Circle , Jamadar Circle
Sub-Division Champua, Dist. Keonjhar, for the month of

1. Case No.	133
2. Father's Name & Address of the person making unauthorised occupation	Renuka Patra. W/o Kalicharana Patra. at - Dabuna. PS - Barabani Dist - Keonjhar.
3. Whether the person belongs to Scheduled Caste/Tribe	
4. Description of the land unauthorisedly occupied	

a) Village	b) Holding No.	c) Plot No.	d) Full extent of the plot	e) Extent Kisam Occupied
Dabuna.	97	656	A 7.00	A0.04 Kisam- Parita.

5. Whether the land encroached, i.e., whether it is a canal, embankment, Rakhita, Gochharana set apart for communal use of villagers, used for house sites, temple sites likely to be required for any development purpose / scheme belongs to any Government of Govt. Organ. — AJA

6. Whether the land is in Rural Area, Municipality/Notified area/Urban area. — Rural Area.

7. If the land is in Municipality or NAC area, further —

8. Whether the person or any member of his family living with him in common mess owns a house or house site in the Municipal or Notified area. —

9. Whether the land being adjacent to the holding owned by the person is necessary for the beneficial enjoyment of such holding or for residential purpose of the person. —

10. Whether the land is reserved for the purpose of any Govt. or for any development

598

[illegible]

a) [illegible]
[illegible] —

b) [illegible]
[illegible] —

c) [illegible]
[illegible] —

[illegible] 100000.00

[illegible]
a) [illegible] Cultivation Purpose.
b) [illegible]
c) [illegible]

[illegible] 8.11.22

[illegible]
[illegible]

[illegible] 3.00

[illegible]
[illegible] —

[illegible]

1.00 1.00 1.00

[illegible]

FORM - ...
(See Rule 3(I))

Statement of unauthorised Occupation of Govt. land in Villages in the Circle ..., Tahasil - Barbil
Sub-Division - Champua Dist. Keonjhar, for the month of

...al No. 134

... Father's Name & Address of the ... unauthorised occupation — Nishikanta Banik S/o Kalia Banik at - Dabuna. PS - Bamebani Dist - Keonjhar.

...ether the person belongs to ...heduled Caste/Tribe

...scription of the land unauthorisedly ...cupied

Village	(b) Holding	(c) Plot	(d) Full extent of the plot	(e) Extent Kisam Occupied
Dabuna.	97	656	A 7.00	A0.04 Kisam - Palita.

...lass of land encroached, i.e., whether ...rbar canal, embankment, Rakhita, ... or Gochar/Sarbasadharana set apart from communal ...se of villagers, used for house sites, temple ... likely to be required for any develop...ment purpose / scheme belongs to any ...partment of Govt./Corpn. — AJA

...Whether the land is in Rural Area, ...Municipality/Notified area/Urban area — Rural Area.

... If the land is in Municipality or NAC area, ...whether:

... the person or any member of his family living with him in common mess own ...a house or house site in the Municipal ...or Notified area. — -

...) the land being adjacent to the holding owned by the person is necessary for the beneficial enjoyment of such holding or for residential purpose of the person. — -

...) the land is reserved for the purpose — -

a) Total extent of [illegible]
(including [illegible]) —

b) Extent of [illegible]
members [illegible]
with him in [illegible] —

c) Extent of [illegible]
him —

9 Income of [illegible]
members [illegible]
with him [illegible] 100000.00
than agriculture

10 Mode of occupation
a) Cultivation Cultivation
b) Possession of house Purpose.
c) Any other source

11 Date of inspection 8.11.22

12 Whether assessed [illegible]
viously, if so the [illegible]

13 Rate of assessment
(Term assessed [illegible] 3.00

14 If not assessed [illegible]
lands of similar [illegible]
type of the village —

15 Assessment of the land

1.00	1.00	1.00

16 Remarks of [illegible]

595

[See Rule 3 (1)]

Statement of unauthorised Occupation of Govt. Land in Village Dabera.
in the Circle Dabera. Tehsil Barbil
Sub-Division Champua, Dist. Keonjhar, for the month of

1. Sl No	135				
2. Father's Name & Address of the person unauthorised occupation	Santilata Behera W/O - Dillip Behera At - Dabera. PS- Barabare.				
3. Whether the person belongs to Scheduled Caste/Tribe					
4. Description of the land unauthorisedly occupied					
	a) Village	b) Holding	c) Plot	d) Full extent of the plot	e) Extent Kisan Occupied
	Dabera.	97	656	47.00	40.04.

5. Area of land encroached, i.e., whether water course, canal, embankment, Rakhita, Gochar, Sadharana set apart from communal use of villagers, used for house sites, temporary likely to be required for any development purpose / scheme belongs to any category of Govt. Lands. — AJA

6. Whether the land is in Rural Area, Municipality/Notified area/Urban area. — Rural Area

7. If the land is in Municipality or NAC area, mention. —

8. Whether the person or any member of his family living with him in common mess owns a house or house site in the Municipal or Notified area. —

9. Whether the land being adjacent to the holding owned by the person is necessary for the beneficial enjoyment of such holding or for residential purpose of the person.

10. Whether the land is reserved for the purpose

a) Total extent of ... (including ...) —

b) Extent of ... members of his family ... with him in common ... —

c) Extent of ... him —

9. Income ... members ... with him ... their ... 100000.00

10. Mode of occupation
a) Cultivation
b) Erection of house
c) Any other ...

Cultivation purpose.

11. Date of ... 08/11/22

12. Whether ... previously, if so, the ...

13. Rate of assessment ... 3.00

14. If ... lands of similar ... of the village —

15. Assessment of ...

1.00	1.00	1.00

16. Remarks of the ...

593

FORM - C

(See Rule 3(1))

Statement of unauthorised Occupation of Govt. Land in Village , in the Circle , Tahasil- Barbil Sub-Division - Champua, Dist. Keonjhar, for the month of

(a) Sl No 136

(b) Father's Name & Address of the person making unauthorised occupation: Rama Patra. S/o Nageswar Patra. at- Dabuna PS - Bamebari Dist. Keonjhar

(c) Whether the person belongs to Scheduled Caste/Tribe

(d) Description of the land unauthorisedly occupied

(a) Page	(b) Holding	(c) Plot	(d) Full extent of the plot	(e) Extent Kisan Occupied
Dabuna (AJAS)	97	656	A7.00	A0.04 Kisam Patita.

Class of land encroached, i.e. whether Gochar, canal, embankment, Rakhita, Abadi/adharana set apart from communal use of villagers, used for house sites, temple, likely to be required for any development purpose / scheme belongs to an establishment of Govt./Corpn: AJA

Whether the land is in Rural Area, Municipality/Notified area/Urban area: Rural Area.

If the land is in Municipality or NAC area, whether: —

If the person or any member of his family living with him in common mess owns a house or house site in the Municipal or Notified area: —

If the land being adjacent to the holding owned by the person is necessary for the beneficial enjoyment of such holding or for residential purpose of the person: —

(h) the land is reserved for the purpose of any Govt. or for any development: —

[illegible]

a) Total extent of [illegible] (including [illegible]) — —

b) Extent of [illegible] members of the family [illegible] with him in common [illegible] — —

c) Extent of [illegible] him — —

9. Income of [illegible] members [illegible] with him [illegible] than [illegible] — 100000.00

10. Mode of [illegible] — Cultivation Purpose.

a) Cultivation

b) Erection of house

c) Any other [illegible]

11. Date of [illegible] — 8.11.22

12. Whether [illegible] viously, if so, the [illegible]

13. Rate of assessment (Dry assessed [illegible]) — 3.00

14. If not assessed [illegible] lands of similar [illegible] tage of the vicinity — —

15. Assessment of [illegible]

[illegible]	Cess	[illegible]
1.00	1.00	1.00

16. Remarks of the [illegible]

[illegible]

FORM - G

(See Rule 3(1))

Statement of unauthorised Occupation of Govt. Land in Village - Dabuna in the Circle Dabuna, Tahasil - Barbil Sub-Division - Champua, Dist. Keonjhar, for the month of

Sl. No. 137

Name, Father's Name & Address of the person making unauthorised occupation: Kalakrushna patria S/o - Ramachandra. At - Dabuna PS - Bamebari

Whether the person belongs to Scheduled Caste/Tribe

Description of the land unauthorisedly occupied:

a) Village	b) Holding	c) Plot	d) Full extent of the plot	e) Extent Kisam Occupied
Dabuna.	97	656	17.00	10.04 Kissan-patita

Class of land encroached, i.e., whether Gochar, canal, embankment, Rakhita, Sarbasadharana set apart from communal use of villagers, used for house sites, temple etc. likely to be required for any development purpose / scheme belongs to an establishment of Govt./Corp. etc.: AJA.

Whether the land is in Rural Area, Municipality/Notified area/Urban area: Rural Area

If the land is in Municipality or NAC area, whether:

the person or any member of his family living with him in common mess owns a house or house site in the Municipal or Notified area.: Yes

the land being adjacent to the holding owned by the person is necessary for the beneficial enjoyment of such holding or for residential purpose of the person.: —

—

the land is reserved for the purpose

8. a) Total extent of land ... [illegible] (including ... [illegible]) — —

b) Extent of land ... [illegible] members of ... [illegible] with him in common ... [illegible] — —

c) Extent of ... [illegible] land

9. Income of the ... [illegible] members of ... [illegible] with him ... [illegible] than agriculture — 100000.00

10. Mode of occupation

a) Cultivation — Cultivation purpose.

b) Erection of ... [illegible]

c) Any other ... [illegible]

11. Date of ... [illegible] — 08/11/22

12. Whether ... [illegible] viously, if so, ... [illegible]

13. Rate of assessment (from assessed ... [illegible]) — 2.00

14. If not assessed ... [illegible] lands of similar ... [illegible] tage of the vicinity — —

15. Assessment of ... [illegible]

L.R.	Cess	M.C.
1.00	1.00	1.00

16. Remarks of the ... [illegible]

589

PROFORMA

(See Rule 3(1))

Statement of unauthorised Occupation of Govt. Land in Village

in the Circle Gatanga Tahsil

Sub Division Champua, Dist. Keonjhar, for the month of

Sl.No. 138

1. Name & Address of the person unauthorised occupation

whether the person belongs to Scheduled Caste/Tribe

Description of the land, unauthorisedly occupied

Nanshing Munda.
S/O Thupulu Munda.
At - Dabuna.
PS - Barbil
Dist. Keonjhar.

a) Village	b) Holding	c) Plot	d) Extent of the land	e) Extent Kisan Occupied
Dabuna. (AJA)	97	656	A 7.00	A 0.04 Kisam Patita.

Type of land encroached, i.e., whether water, canal, embankment, Rakhita, Gochardhanara set apart from communal use of villagers, used for house sites, temple etc likely to be required for any development purpose / scheme belonging to and in possession of Govt./Corpn.

AJA

Whether the land is in Rural Area, Municipality/Notified area/Urban area.

Rural Area.

If the land is in Municipality or NAC area, whether

a) the person or any member of his family living with him in common mess owns a house or house site in the Municipal or Notified area.

—

b) the land being adjacent to the holding owned by the person is necessary for the beneficial enjoyment of such holding or for residential purpose of the person.

—

c) the land is reserved for the purpose of any Govt. or any development

—

588

a) Total extent of ... (including ...) —

b) Extent of ... members of ... with him in common ... —

c) Extent of ... —

9 Income of ... members ... with him ... them ... 100000.00

10 Mode of ... Cultivation Purpose

a) Cultivation

b) ...

c) Any other ...

11 Date of ... 8.11.22

12 Whether ... viously, if ...

13 Rate of ... (... 3.00

14 If not ... lands of similar ... tage of the ... —

15 Assessment of ...

1.00	1.00	1.00

16 Remarks of ...

587

PROFORMA

(See Rule 3(B))

Statement of unauthorised Occupation of Govt. Land in Village Dabuna

in the Circle Dabuna, Tehsil Bachi

Sub-Division Champua, Dist. Keonjhar, for the month of

a) Sl No.	139				
b) Father's Name & Address of the person unauthorised occupation	Hari Munda S/o-Sevaram Munda at - Dabuna PS.-Bamebari				
c) whether the person belongs to Scheduled Caste/Tribe					
d) Description of the land unauthorisedly occupied					
a) Village	b) Holding	c) Plot	d) Full extent of the plot	e) Extent Kisan Occupied	
Dabuna	97	656	97.00	4.04 Kisan-patita	

a) Class of land encroached, i.e., whether Sechar canal, embankment, Rakhita, Basudharana set apart from communal use of villagers, used for house sites, temple sites likely to be required for any developmental purpose / scheme belongs to encroachment of Govt./Gaon. — AJA.

b) Whether the land is in Rural Area, Municipality/Notified area/Urban area. — Rural Area.

c) If the land is in Municipality or NAC area, whether — —

d) the person or any member of his family living with him in common mess owns a house or house site in the Municipal or Notified area. — Yes

e) the land being adjacent to the holding owned by the person is necessary for the beneficial enjoyment of such holding or for residential purpose of the person — —

f) the land is reserved for the purpose

a) Total extent of land ... by him (including his ...)

b) Extend of land ... members of his family ... with him in common ...

c) Extent of ... him

9. Income of the ... members ... with him ... their ... — 100000.00

10. Mode of ...
a) Cultivation
b) Erection of house
c) Any other purpose — Cultivation purpose

11. Date of ... — 08/11/22

12. Whether ... viously, if so, ...

13. Rate of assessment (from assessed ...) — 3.00

14. If not assessed, ... lands of similar ... tage of the ... —

15. Assessment of ... — 1.00 1.00 1.00

16. Remarks of ...

585

FORM - C

(See Rule 3(1))

Statement of unauthorised Occupation of Govt. Land in Village

in the Circle , Tahsil Barbil

Sub Division - Champua, Dist. Keonjhar, for the month of

Lot No 140

a) Father's Name & address of the person unauthorisedly occupied where the person belongs to Scheduled Caste/Tribe

Bana Champia.
S/o Sunia Champia.
at - Dabuna.
P.S - Banspani
Dist - Keonjhar.

b) Description of the land unauthorisedly occupied

Village	b) Holding	c) Plot	d) Full extent of the plot	e) Extent Kisam Occupied
Dabuna. AJA	97	656	A 7.00	A 0.04 Kisam Patita.

f) Class of land encroached, i.e., whether water, canal, embankment, Rakhita, Gochharbharana set apart from communal use of villagers, used for house sites, temporarily likely to be required for any development purpose / whether belongs to any Government of Govt. (Corp).

AJA

g) Whether the land is in Rural Area, Municipality/Notified area/Urban area.

Rural Area.

h) If the land is in Municipality or NAC area, whether

i) the person or any members of his family living with him in such municipality owns a house or house site in the Municipal or Notified area;

—

ii) the land being adjacent to the holding owned by the person is necessary for the beneficial enjoyment of such holding or for residential purpose of the person;

—

iii) the land is reserved for the purpose

—

a) Total extent of [illegible] by him (including [illegible] land) —

b) Extent of land [illegible] members [illegible] with him in common [illegible] —

c) Extent of [illegible] him —

9 Income of [illegible] members [illegible] with him [illegible] than [illegible] — 100000.00

10 Mode of [illegible] — Cultivation Purpose

a) Cultivation

b) Erection of house

c) Any other [illegible]

11 Date of [illegible] — 8.11.22

12 Whether [illegible] viously, if [illegible]

13 Rate of assessment (Harm assessed [illegible]) — 3.00

14 If not assessed [illegible] lands of similar [illegible] tage of the vicinity — —

15 Assessment of [illegible]

[illegible]	Cess	N.C.
1.00	1.00	1.00

16 Remarks of [illegible]

[signature]

MINUTES OF DISCUSSION IN THE SDLC (FOREST RIGHTS) CHAMPUA HELD ON 29.11.2022 AT 12.00 NOON IN THE OFFICE CHAMBER OF THE SUB-COLLECTOR-CUM-CHAIRMAN, SDLC, CHAMPUA.

Members present: - (Attendance enclosed)

1. Sub-Collector-cum-Chairman, SDLC, Champua.
2. Forest Range Officer, Champua
3. Smita Naik, PS Member, GP Padua, Block Champua
4. Chandra Mohan Naik, PS Member, GP Karanjia, Block Champua
5. ADWO, Champua

The Sub-divisional Level Committee meeting (FRA) was held on 29.11.2022 at 12.00 noon in the Office Chamber of the Sub-Collector, Champua under the Chairmanship of Sub-Collector -cum-Chairman, SDLC Champua.

At the outset, the Sub-Collector-cum-Chairman, SDLC welcomed all members and sought their active cooperation in implementation of the scheme i.e. ST & Others Traditional Forest Dwellers (Recognition of Forest Rights) Act, 2006. The following discussions are made.

1. Disposal of Individual Forest Right claims

   ADWO, Champua appraised that 15 no of IFR proposals have been received from Tahasildar, Jhumpura and 04 no of IFR proposals have been received from Tahasildar Barbil for approval in the SDLC as detailed below.

Sl. No.	Name of the Tahasil	No. of IFR claims received
1.	Jhumpura	15
2.	Barbil	4

All proposals were verified and the committee decided to approve all the 19 proposals The details of the claims are given below.

List of claimants under ST & SC Traditional Forest Dwellers (Recognition of Forest Rights) Act, 2006 As on 29.11.2022													
Sl. No.	Case Record No.	Name of the applicant & father's/ Husband's name	Caste	Tahasil	G.P	Village	Khata No.	Plot No.	Kissam	Purpose/ Area (In Acre)			Remarks
										Ghar bari	Agril.	Total	
1.	1/22	Putu Munda S/O-Sanatana Munda	ST Kolha	Jhum pura	Basan tpur	Naibu ga	124	321/7	Ghara bari	0.03		0.03	
2.	2/22	Sandhya naik W/O-Padana Naik	ST Bhum ija	Jhum pura	Basan tpur	Naibu ga	124	321/2	Ghara bari	0.04		0.04	
3.	3/22	Ghasi Munda S/o – Sukura munda	ST Kolha	Jhum pura	Basan tpur	Naibu ga	121	399/3	Ghara bari	0.10		0.10	
4.	4/22	Jogendra naik S/o-Ainthu Naik	ST Bhum ija	Jhum pura	Basan tpur	Naibu ga	124	321/3	Ghara bari	0.07		0.07	
5.	5/22	Lakhan Munda S/o-Majura munda	ST Kolha	Jhum pura	Basan tpur	Naibu ga	121	399/4	Ghara bari	0.20		0.20	

6.	6/22	Gura Munda S/o- Pandu Munda	ST Kolha	Jhum pura	Basan tpur	Naibu ga	121	399/5	Ghara bari	0.12		0.12
7.	7/22	Laxman Giri S/O- Tunu Giri	ST bhuin a	Jhum pura	Basan tpur	Naibu ga	124	171/B	Ghara bari	0.03		0.03
8.	8/22	Butu Munda S/o- Pandu munda	ST Kolha	Jhum pura	Basan tpur	Naibu ga	123	335/2	Ghara bari	0.06		0.06
9.	9/22	Lulu Munda S/o- Jhunu Munda	ST Kolha	Jhum pura	Basan tpur	Naibu ga	124	383/2	Ghara bari	0.08		0.08
10.	10/22	Sandhir kamal S/o- Misanu kamal	ST Kolha	Jhum pura	Basan tpur	Naibu ga	124	321/4	Ghara bari	0.04		0.04
11.	11/22	Ghasi Munda S/o- Pandu Munda	ST Kolha	Jhum pura	Basan tpur	Naibu ga	123	335/1	Ghara bari	0.06		0.06
12.	12/22	Biramohan Munda S/o- Pandu Munda	ST Kolha	Jhum pura	Basan tpur	Naibu ga	123	335	Ghara bari	0.13		0.13
13.	13/22	Rajen Munda S/o- Nandu Munda	ST Kolha	Jhum pura	Basan tpur	Naibu ga	124	383/1	Ghara bari	0.10		0.10
14.	14/22	Mohan Munda S/o-Birsingh Munda	ST Kolha	Jhum pura	Basan tpur	Naibu ga	124	321/1	Ghara bari	0.04		0.04
15.	15/22	Nursingh Munda S/o- Mangulu munda	ST Kolha	Jhum pura	Basan tpur	Naibu ga	121	399/1	Ghara bari	0.11		0.11
16	16/22	Raya munda S/O- Routa Munda	ST Kolha	Barbil	Badak alimat i	Handi bhan ga	36	325/5 07/1	Janga la	0.04		0.04
17	17/22	Jadumani Munda S/O- Dasara Munda	ST Kolha	Barbil	Badak alimat i	Handi bhan ga	36	427/1	Janga la	0.04		0.04
18	18/22	Sukuram Munda S/o- Bishnu Munda	ST Kolha	Barbil	Badak alimat i	Handi bhan ga	36	326	Janga la	0.04		0.04
19	19/22	Karamu Munda S/O- Raya Munda	ST Kolha	Barbil	Badak alimat i	Handi bhan ga	36	326/1	Janga la	0.04		0.04
Total										1.37		1.37

The committee decided to send the above 19 IFR proposals to DLC, Keonjhar for approval.

The meeting was ended with vote of thanks to the Chair and members participated.

Sub-Collector-cum-Chairman
SDLC, Champua
Sub-Collector
Champua

Memo No. 6724 /Dt. 29-11-2022

Copy forwarded to all members of SDLC for information and necessary action

Copy forwarded to All BDOs/ All Tahasildars for information and necessary action.

Sub-Collector-cum-Chairman
SDLC, Champua

Memo No. 6725 /Dt. 29-11-2022

Copy submitted to the PA, ITDA, Keonjhar-cum-Nodal Officer, DLC, Keonjhar for information and necessary action.

Sub-Collector-cum-Chairman,
SDLC, Champua

Memo No. 6726 /Dt. 29-11-2022

Copy submitted to the Collector & District Magistrate, Keonjhar for kind information.

Sub-Collector-cum-Chairman,
SDLC, Champua

SDLC Meeting on Forest Right Act held on 29.11.2022 at 12.00 Noon in the office Chamber of Sub. Collector, Chaibasa.

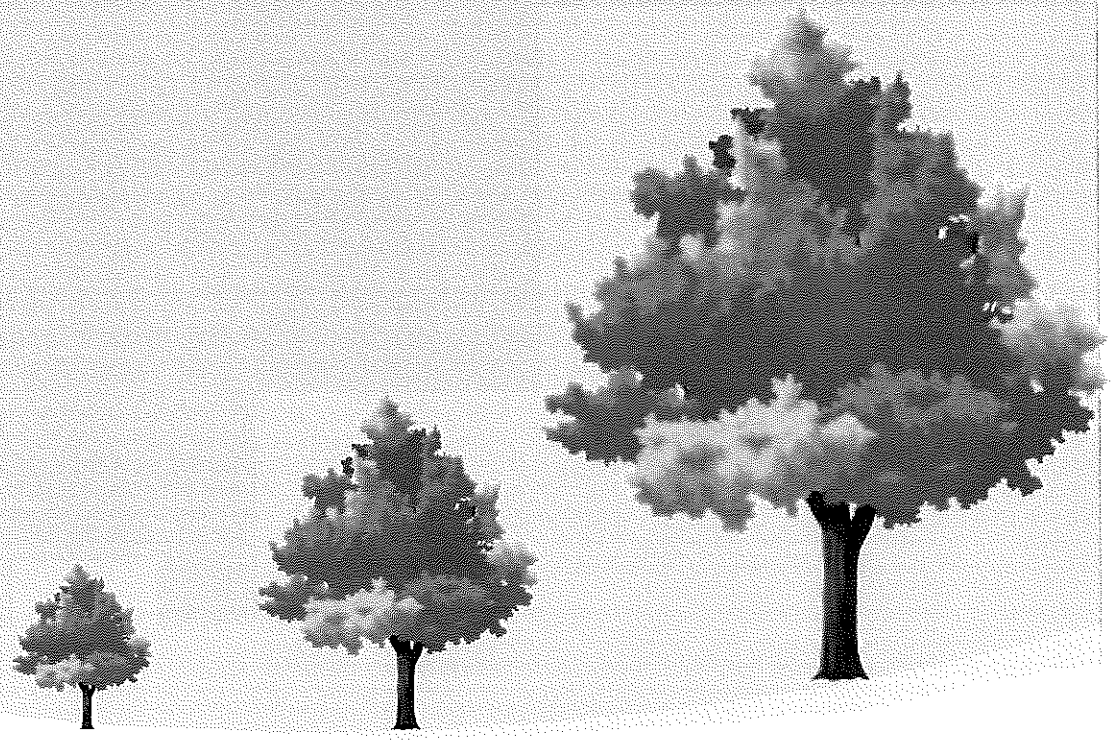
Members Present

1. Sub-Collector cum Chairman, SDLC, Chaibasa Sub-Division — 29/11/2022
2. Forest Range Officer, Chaibasa. — 29/11/2022
3. Sri. Gyana Ranjan Khuntia, P.S. Member Joda
4. Smt. Smita Hoby, P.S. Member, Chaibasa.
5. Sri Chandra Mohan Hoby, P.S. Member, Chaibasa.
6. A.D.W.O, Chaibasa.
7. Special Officer, TDH Chaibasa.

2022

Final Report

RAISING SHORT ROTATION FORESTRY CROPS FOR INTERMITTENT PERIODS AT DUBNA-SAKRADIHI IRON AND MANGANESE ORE MINES IN KEONJHAR DISTRICT OF ODISHA



Forest Ecology and Climate Change Division

Tropical Forest Research Institute

Indian Council of Forestry Research & Education

(An autonomous Council under the Ministry of Environment Forests and Climate Change, Govt. of India)

P.O. - RFRC, Mandla Road, Jabalpur – 482021 (M.P.)

Final Report

RAISING SHORT ROTATION FORESTRY CROPS FOR INTERMITTENT PERIODS AT DUBNA-SAKRADIHI IRON AND MANGANESE ORE MINES IN KEONJHAR DISTRICT OF ODISHA

PRINCIPAL INVESTIGATOR

Dr. Avinash Jain, Principal Investigator
Scientist F & Head, Forest Ecology and Climate Change Division

VEGETATION SURVEY

Dr. Nidhi Mehta
Jyoti Desai
Amrutha Balakrishnan
Sooraj Swain
Ashish Tiwari

SOIL SURVEY

Dr. Jangam Deepika
Shweta Yadav
Sooraj Swain

MAP PREPARATION, SITE AND SPECIES SELECTION

Dheeraj Gupta
M. Rajkumar
Ajin Sekhar

Forest Ecology and Climate Change Division
Tropical Forest Research Institute
Indian Council of Forestry Research & Education
(An autonomous Council under the Ministry of Environment Forests and Climate Change, Govt. of India)
P.O. - RFRC, Mandla Road, Jabalpur – 482021 (M.P.)

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Executive Summary

1. A total of 1332.019 ha land has been provided to Odisha Mining Corporation Limited in Keonjhar district of Odisha.
2. Out of the total, 261.919 ha land has been verified broken prior to 25.10.1980, which includes 258.599 ha forest land and 3.320 ha non-forest land. The broken up area contains a substantial amount of mineral reserve, which will be further extracted after getting forest clearance.
3. In the first 5 years, OMCL has proposed to utilize 326.9818 ha land for mining and ancillary activities, which includes 261.919 ha already broken area. Moreover, 5.5786 ha land will be kept for public purpose like cremation ground, market place, roads, pond and grazing purpose. The land for public purpose has been excluded from the diversion proposal and shall be used by villagers. Hence, a total of 332.5604 ha land will not be available for raising plantations.
4. Around 500 ha land will be taken up for mining activities between 6 and 10 years, 39.55% of which means 177.77 ha land can be brought under short rotation forest species having less than 10 years rotation age like *Bamboo spp., Eucalyptus spp., Populus deltoids, Gmelina arborea* and *Leucaena leucocephala*. The National Forest Policy of India (1988) describes the goal of achieving more than 33% of the geographical area of the country under forest and tree cover. Moreover, according to India State of Forest Report (2021), the natural forest in Odisha state is 33.50% of the geographical area of the state. Hence, it was decided to bring more than 33% area under green cover in the present case.
5. The remaining 414.7028 ha land will be taken up for mining activities after 10 years, 28.73% of which means 119.13 ha land can be brought under plantations of tree species having more than 10 years rotation age like *Gmelina arborea, Acacia auriculiformis, Leucaena leucocephala, Melia azedarach, Dalbergia sissoo* and *Dalbergia latifolia*.
6. An area of 26.17 ha designated for safety zone and green belt will never be used for extracting minerals hence the whole area can be utilized for raising plantation of long rotation tree species like *Tectona grandis, Azadirachta indica, Haldina cordifolia* and *Madhuca longifolia*.

7. As a whole, plantations can be raised on 343.07 ha land, which is 25.76% of total lease area of 1332.019 ha. All the plantations can be raised in either first or seeond year of getting clearance for augmentation and continuous flow of ecological goods and services.
8. Plantations of all the species can be raised with 2m x 2m spacing, except Eucalyptus and Poplar which can be planted with 1m x 1m spacing.

1. Introduction

The Indian state of Odisha is the leading mineral producing state with the highest and over half of the iron ore production of the country (Jaganmohan, 2021). The state also tops the total reserves/resources with 44% shares and as the third largest producer of the mineral manganese. Mining of the minerals involves drilling, blasting, vehicles movement on haul roads, collection, transportation, handling, screening, sizing and segregation, storage and various other activities. All these activities invariably affect the existing environmental, ecological structure and health (MoEFCC, 2010). Mining is currently responsible for 4 to 7 percent of greenhouse-gas (GHG) emissions globally (Delevingne et al., 2020). India's Intended Nationally Determined Contribution to UNFCCC pledges to reduce the greenhouse gas (GHG) emission intensity of its GDP by 33 to 35 per cent by 2030 from 2005 level. In accord to the commitments, industries are committed to mitigate challenges of global warming caused by emission of CO_2 by various anthropogenic activities.

Forest cover is an important natural resource due to its rich species diversity and vast array of environmental services (Boyle et al., 2016) yet, ecological and economical contribution of plantations cannot be ignored. Evidently, with less than 5% of the world's total forest area, plantations account for nearly 35% of the wood products (Zhang and Stanturf, 2008). Industrial afforestation and plantations of trees serves no less to provide various invaluable tangible and intangible goods and services including timber, non-timber forest products, soil erosion control, aesthetics, carbon sequestration and climate change mitigation etc.

More importantly, afforestation using short-rotation forestry crops delivers multi-functional benefits addressing the economical (material requirements, income/employment generation, industrial growth, etc.), environmental (rehabilitates degraded lands, conserve soil, enhances soil fertility & biodiversity captures atmospheric carbon and mitigates effects of climate change etc.) and social (empower local people, discourages rural migration etc.) issues (Chauhan et al., 2017). Christersson L. and Verma K., 2006 defines short-rotation forestry as the silvicultural practice under which high-density, sustainable plantations of fast-growing tree species (having a rotation period of less than 30 years) produce woody biomass on agricultural land or on fertile but degraded forest land. Such plantation consists of high variety, pest resistant tree species that are well maintained through timely irrigation, weeding and fertilizers understanding their ecological

and economical impacts. Also, these are fenced to avoid unwanted incidences of grazing, browsing and human interferences. Plantations are harvested when the yearly growth rate no longer exceeds the mean annual increment. Short-rotation forestry is surely a way to go ahead for open-casted mineral mines like that of iron and manganese.

This consultancy project is regarding seeking prior approval of the Central Government on "Proposal for non-forestry use of 1243.27 ha of forest land for mining of Iron and Manganese Ore in Dubna-Sakradihi Mines in favor of M/S Odisha Mining Corporation Limited in Keonjhar district of Odisha" under Section 2 of the Forest (Conservation) Act, 1980. Ministry of Environment, Forests and Climate Change, Government of India has sought additional information and the proposal has been examined by the Forest Advisory Committee constituted by the Central Government under Section-3 of the aforesaid Act.

Tropical Forest Research Institute (TFRI), Jabalpur (M.P.), one of the institutes of Indian Council of Forestry Research and Education (ICFRE) under Ministry of Environment, Forests and Climate Change, Government of India has been bestowed with the responsibility to execute this project on "Raising short rotation forestry crops for intermittent periods at Dubna-Sakradihi Iron and Manganese Ore Mines in Keonjhar district of Odisha".

2. Study area and selection of sites

The study has been conducted at Dubna-Sakradihi iron and manganese ore mines located in Keonjhar district of Odisha. The climate of the district is characterized by hot summer, high humidity and well distributed monsoons. Summer generally commences in the month of March and temperature rises rapidly attaining the maximum in the month of May. The temperature varies between 38°C to 7°C and average annual rainfall is around 1534.5 mm in the region.

The forest of Keonjhar can be classified into two major forest type (according to the revised Champion and Seth classification) - a) Group C: Northern Tropical Moist Deciduous Forest and b) Group 5B: Northern Tropical Dry Deciduous Forest. Several variations occur due to edaphic and biotic factors within the above two main groups, as a result the forests are further sub groups as under: a) 3C/c2e Moist Peninsular Valley Sal, b) 5B/C 1C Dry Peninsular Sal Forests c) 5B/C2 Northern Dry Mixed Deciduous Forests. Besides, the above three main sub-groups Dry Sal Forests and E4 Lateritic Semi Evergreen Forests and DSl Dry Deciduous Scrub Forest are also reported in small extent in the district. The main species are *Shorea robusta, Anogeissus latifolio, Terminalia crenulata, Madhuca latifolia, Diospyros melanoxylon, Lannea coromandilica* etc.

Selection of sites

Random sampling was adopted after surveying and detailed discussion with the officers of the mining area. A total of 12 quadrats were laid to enumerate the number of species and collect soil samples from the study area. GPS location of each site/quadrat were recorded (Table 1) and plotted on the map of the study area (Figure 1).

Table 1: GPS location of selected sites for vegetation snrvey and soil sample collection from Dubna-Sakradihi Irou and Mangauese Mine Area

Site/ Quadrat No.	GPS Location		Slte/ Quadrat No.	GPS Loeation	
	Latitnde	Longitude		Latitnde	Longitude
1	22.86269°N	85.40374°E	7	21.86188°N	85.38207°E
2	21.86174°N	85.39800°E	8	21.86278°N	85.38435°E
3	22.18159°N	85.39238°E	9	21.83142°N	85.38829°E
4	21.84741°N	85.39711°E	I0	21.84565°N	85.38024°E
5	21.83332°N	85.38487°E	1I	21.85249°N	85.38429°E
6	21.86000°N	85.39957°E	12	21.82980°N	85.40505°E

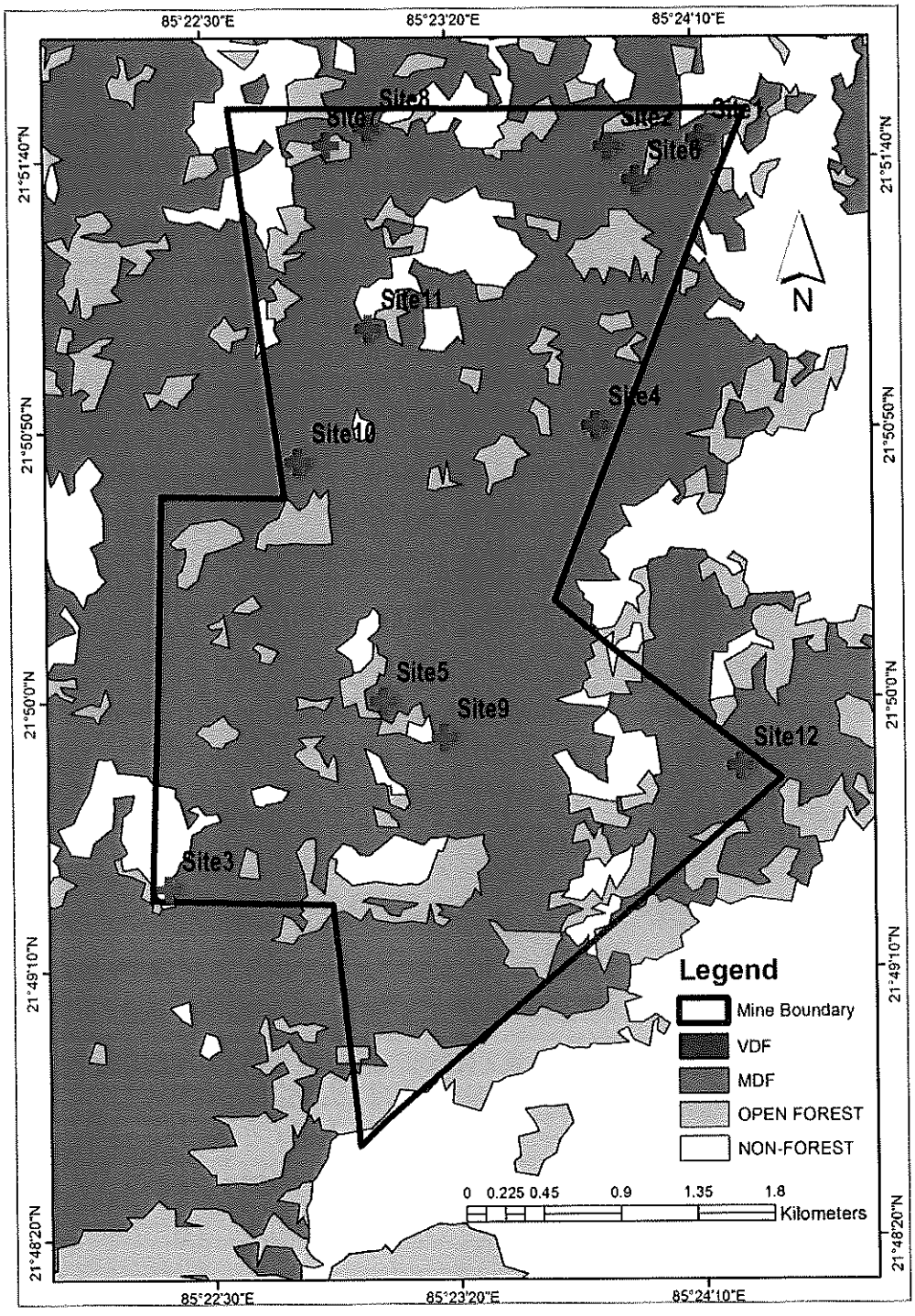

Figure 1: Map depicting 12 sites/quadrats for vegetation diversity and phyto-sociological assessment at Dubna-Sakradihi Iron and manganese ore miue area In Keonjhar, Odisha.

3. Assessment of vegetation diversity

Assessment of floral diversity of an area presents the qualitative and quantitative spectrum of vegetation of the area. The type of vegetation met within a given locality depends on climate, soil and past treatments. The ground flora diversity and grass production under plantation are reported to vary with species (Singh et al., 1986) depending on species type, age of plants, density, soil type, climatic and geographic factors etc. Good soil conditions and site support luxuriant under growth of vegetation (Rajvanshi et al., 1983). Proper under growth in a forest is essential for maintenance of nutrient status, ecological balance and wildlife habitat of the forest ecosystem.

Hence, vegetation survey, phyto-sociological assessment and soil analysis of Dubna-Sakradihi Iron and Manganese Ore Mine Area in Keonjhar District of Odisha was conducted to study biodiversity at species level in the natural forests and plantations in and around mining area. Identification of indigenous species performing exceptionally in terms of growth in the local climate and result of the edaphic factors including soil will assist in selection of best suited species for plantation as forestry crop in the area.

Vegetation diversity and its distribution evaluation

A thorough survey and discussion was conducted prior to selection of sites for vegetation survey at the Dubna Sakradhi mine area in order to cover all the major density and types of forests at the study area. Vegetation study was conducted using quadrat method in the 12 quadrats (Figure 1) of 0.1 ha i.e., 250m X 4m each were laid at various locations to enumerate the number of species of the study area. GPS location of each site/quadrat was also recoded and plotted on the map of the study area. Growth parameters (girth and height) of all tree species present inside the quadrates were recorded.

The enumeration from the survey revealed a total of 2342 trees along with its saplings with average height and DBH of 5.41 m and 10.30 cm, respectively in the selected 12 quadrats of the study area (Table 2).

Maximum DBH was recorded for the tree *Ficus benjamina* (95.54cm) whereas the tree of *Ficus racemosa* (16m) was recorded to be the tallest followed by *Shorea robusta* and *Terminalia tomentosa* trees showing a height of 14m. *Syzigium cumini* (2m), *Bridelia retusa* (2m) and

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Bauhinia roxburghii (2.5m) were found to be the smallest among the enumerated trees.The most diverse was quadrat 5 containing 28 different species, while quadrat 2 had only 02 species. Also, *Diospyros melanoxylon* and *Shorea robusta* occurred in maximum number of quadrats i.e., 10 out of 12 followed by *Lagerstroemia parviflora* and *Terminalia bellirica* which occurred in 09 quadrats (Table 2).

Table 2: List of recordcd trecs, saplings and their growth parameters during vegetation snrvey at Dubna-Sakradihi iron and manganese ore minc area, Odisha.

Site/ Qnadrat No.	Form	Name of Species	Number of Indlvldnals	Growth Parameters	
				DBH (cm)	Height (m)
I	Tree	*Buchanania lanzan*	4	12.74	3.50
	Tree	*Dalbergia paniculata*	2	11.15	3.50
	Tree	*Diospyros melanoxylon*	4	11.94	4.75
	Tree	*Lagerstroemia parviflora*	4	15.45	5.50
	Tree	*Madhuca longifolia*	6	38.43	7.17
	Tree	*Meynalaxiflora*	2	12.10	6.50
	Tree	*Semecarpus anacardium*	6	15.71	5.50
	Tree	*Syzigium cumini*	2	17.52	5.50
	Tree	*Terminalia bellirica*	18	18.26	6.17
	Tree	*Terminalia tomentosa*	2	12.74	4.50
	Tree	*Ziziphus xyloporus*	2	11.78	6.50
	Sapling	*Bridelia retusa*	6	7.64	5.50
	Sapling	*Buchanania lanzan*	8	6.21	4.63
	Sapling	*Croton persimilis*	2	5.41	4.50
	Sapling	*Diospyros melanoxylon*	2	9.55	5.00
	Sapling	*Madhuca longifolia*	2	9.24	3.50
	Sapling	*Olax scandens (climber)*	2	3.18	5.50
	Sapling	*Syzigium cumini*	2	6.37	5.00
2	Tree	*Shorea robusta*	36	18.40	8.41
	Tree	*Syzigium cumini*	2	35.67	6.00
	Sapling	*Shorea robusta*	22	8.60	5.92
3	Tree	*Albizia odoratissima*	2	32.17	13.00
	Tree	*Dalbergia paniculata*	2	27.07	10.00
	Tree	*Ficus exasperata*	2	10.83	8.00
	Tree	*Ficus racemosa*	2	82.17	16.00
	Tree	*Hiptage benghalensis*	2	15.92	6.00
	Tree	*Mangifera indica*	4	18.47	8.00
	Tree	*Shorea robusta*	98	13.24	11.54
	Tree	*Terminalia bellirica*	2	52.55	11.00

Site/ Quadrat No.	Form	Name of Species	Number of Individuals	Growth Parameters	
				DBH (cm)	Height (m)
	Sapling	*Buchanania lanzan*	4	5.10	3.75
	Sapling	*Diospyros melanoxylon*	88	5.75	3.73
	Sapling	*Lagerstroemia parviflora*	6	7.64	6.00
	Sapling	*Shorea robusta*	6	8.60	10.67
4	Tree	*Dalbergia paniculata*	2	11.15	4.00
	Tree	*Syzigium cumini*	2	19.75	8.00
	Tree	*Terminalia bellirica*	4	11.46	4.75
	Sapling	*Aegle marmelos*	42	3.42	2.69
	Sapling	*Diospyros melanoxylon*	40	4.58	3.06
	Sapling	*Semecarpus anacardium*	6	3.50	4.00
	Sapling	*Shorea robusta*	356	4.13	3.48
	Sapling	*Terminalia bellirica*	6	6.58	4.17
5	Tree	*Aegle marmelos*	2	17.20	9.00
	Tree	*Albizia odoratissima*	4	21.18	7.50
	Tree	*Bauhinia roxburghii*	10	20.19	5.40
	Tree	*Bridelia retusa*	6	19.53	7.83
	Tree	*Callicarpa arborea*	2	23.57	9.00
	Tree	*Casearia graveolens*	2	12.10	3.00
	Tree	*Cassia fistula*	2	16.56	6.50
	Tree	*Croton persimilis*	8	16.72	4.80
	Tree	*Dalbergia lanceolaria*	2	15.92	9.00
	Tree	*Diospyros melanoxylon*	6	13.38	5.67
	Tree	*Diospyros montana*	4	18.95	4.50
	Tree	*Erythrina indica*	2	12.10	4.00
	Tree	*Ficus religiosa*	2	49.68	11.00
	Tree	*Haldina cordifolia*	4	25.00	5.50
	Tree	*Holarrhena pubescens*	8	13.46	3.25
	Tree	*Madhuca longifolia*	2	74.84	8.00
	Tree	*Nyctanthus arbor-tristis*	2	15.92	3.00
	Tree	*Semecarpus anacardium*	2	12.10	3.00
	Tree	*Shorea robusta*	2	15.29	3.00
	Tree	*Syzigium cumini*	8	20.22	4.38
	Tree	*Terminalia bellirica*	10	19.17	5.90
	Tree	*Terminalia tomentosa*	8	18.15	10.13
	Sapling	*Alstonia scholaris*	2	5.73	3.80
	Sapling	*Bridelia retusa*	4	4.14	3.00
	Sapling	*Casearia graveolens*	10	4.90	3.12

Site/ Quadrat No.	Form	Name of Species	Numher of Iudividuals	Growth Parameters	
				DBH (cm)	Height (m)
	Sapling	*Croton persimilis*	26	6.15	3.49
	Sapling	*Cryptolepis buchanani*	2	4.78	4.00
	Sapling	*Diospyros melanoxylon*	14	4.78	3.50
	Sapling	*Erythrina indica*	2	5.73	3.50
	Sapling	*Gmelina arborea*	2	8.92	3.50
	Sapling	*Holarrhena pubescens*	32	4.42	2.84
	Sapling	*Lagerstroemia parviflora*	2	7.01	3.20
	Sapling	*Phyllanthus emblica*	2	1.53	4.00
	Sapling	*Semecarpus anacardium*	10	5.60	3.85
	Sapling	*Shorea robusta*	4	6.37	3.35
	Sapling	*Terminalia tomentosa*	2	9.55	10.20
	Sapling	*Woodfordia fruticosa*	6	4.25	3.67
6	Tree	*Cassia fistula*	2	12.10	5.00
	Tree	*Cassine glauca*	2	23.89	5.00
	Tree	*Croton persimilis*	2	12.10	3.80
	Tree	*Diospyros montana*	2	30.25	8.00
	Tree	*Ficus benjamina*	2	95.54	10.00
	Tree	*Haldina cordifolia*	10	20.38	8.30
	Tree	*Holarrhena pubescens*	2	11.15	3.50
	Tree	*Mitragyna parviflora*	8	14.65	5.13
	Tree	*Schleichera oleosa*	2	70.06	10.00
	Tree	*Semecarpus anacardium*	2	19.75	10.00
	Tree	*Terminalia bellirica*	2	21.66	5.00
	Tree	*Terminalia tomentosa*	12	38.00	10.83
	Sapling	*Aegle marmelos*	2	7.96	3.50
	Sapling	*Bridelia retusa*	6	3.61	4.83
	Sapling	*Cipadessa baccifera*	2	3.82	3.00
	Sapling	*Croton persimilis*	2	9.55	5.00
	Sapling	*Dalbergia lanceolaria*	2	9.55	4.00
	Sapling	*Haldina cordifolia*	2	8.92	6.50
	Sapling	*Holarrhena pubescens*	6	9.13	4.00
	Sapling	*Nyctanthus arbor-tristis*	4	7.96	5.10
	Sapling	*Psidium guajava*	2	5.73	3.00
7	Tree	*Albizia odoratissima*	7	26.39	9.14
	Tree	*Anogeissus latifolia*	2	13.38	9.00
	Tree	*Buchanania lanzan*	2	10.51	7.00
	Tree	*Careya arborea*	2	10.19	4.00

Site/ Quadrat No.	Form	Name of Species	Number of Individuals	Growth Parameters	
				DBH (cm)	Height (m)
	Tree	*Diospyros melanoxylon*	2	12.74	5.50
	Tree	*Diospyros montana*	4	19.75	8.25
	Tree	*Haldina cordifolia*	28	16.22	5.75
	Tree	*Lannea coromandelica*	2	19.11	8.00
	Tree	*Madhuca indica*	2	41.40	10.00
	Tree	*Madhuca longifolia*	7	18.38	7.06
	Tree	*Shore arobusta*	8	12.26	6.88
	Sapling	*Albizia odoratissima*	2	7.64	5.30
	Sapling	*Anogeissus latifolia*	24	4.25	4.49
	Sapling	*Bridelia retusa*	4	7.33	5.10
	Sapling	*Buchanania lanzan*	2	7.01	4.00
	Sapling	*Casearia graveolens*	4	5.42	3.25
	Sapling	*Croton persimilis*	10	7.26	4.79
	Sapling	*Diospyros melanoxylon*	58	4.36	3.51
	Sapling	*Diospyros montana*	4	8.28	5.33
	Sapling	*Haldina cordifolia*	4	6.53	4.90
	Sapling	*Holarrhena pubescens*	4	5.73	3.50
	Sapling	*Lagerstroemia parviflora*	10	3.44	3.30
	Sapling	*Miliusa tomentosa*	4	6.85	4.25
	Sapling	*Shorea robusta*	34	5.54	3.34
8	Tree	*Anogeissus latifolia*	2	12.10	4.50
	Tree	*Buchanania lanzan*	2	14.33	4.50
	Tree	*Callicarpa arborea*	2	10.51	6.00
	Tree	*Casearia graveolens*	6	13.16	5.33
	Tree	*Cipadessa baccifera*	2	12.10	6.00
	Tree	*Croton persimilis*	2	11.15	3.50
	Tree	*Diospyros melanoxylon*	2	12.10	4.50
	Tree	*Diospyros montana*	2	11.46	4.00
	Tree	*Haldina cordifolia*	6	18.05	4.67
	Tree	*Lagerstroemia parviflora*	2	12.10	5.50
	Tree	*Madhuca indica*	6	15.71	5.00
	Tree	*Shorea robusta*	38	20.06	9.32
	Tree	*Syzigium cumini*	2	47.13	7.50
	Tree	*Terminalia tomentosa*	4	24.52	8.25
	Tree	*Ziziphus xyloporus*	2	15.92	7.00
	Sapling	*Anogeissus latifolia*	4	4.62	4.00
	Sapling	*Buchanania lanzan*	6	4.46	2.67
	Sapling	*Casearia graveolens*	4	7.49	3.25

Site/ Quadrat No.	Form	Name of Species	Number of Iudividuals	Growth Parameters	
				DBH (cm)	Height (m)
	Sapling	*Casearia sp.*	4	7.32	2.50
	Sapling	*Cassia fistula*	2	6.37	5.00
	Sapling	*Cipadessa baccifera*	6	5.84	3.33
	Sapling	*Diospyros melanoxylon*	78	4.11	2.70
	Sapling	*Gardenia sp.*	2	6.05	3.00
	Sapling	*Haldina cordifolia*	2	9.55	5.00
	Sapling	*Holarrhena pubescens*	12	6.16	3.42
	Sapling	*Lagerstroemia parviflora*	6	7.85	3.43
	Sapling	*Phyllanthus emblica*	2	7.32	6.00
	Sapling	*Shorea robusta*	8	4.06	4.25
	Sapling	*Syzigium cumini*	2	7.32	1.25
	Sapling	*Terminalia bellirica*	4	7.97	5.75
	Sapling	*Terminalia chebula*	2	6.37	5.00
	Sapling	*Terminalia tomentosa*	6	8.49	4.67
9	Tree	*Aegle marmelos*	6	11.89	6.33
	Tree	*Anogeissus latifolia*	10	22.42	9.20
	Tree	*Bombax ceiba*	2	22.61	12.00
	Tree	*Bridelia retusa*	2	46.50	12.00
	Tree	*Butea superba*	2	18.15	12.00
	Tree	*Cassia fistula*	2	14.33	6.00
	Tree	*Croton persimilis*	10	15.86	6.20
	Tree	*Diospyros melanoxylon*	8	11.15	7.25
	Tree	*Holarrhena pubescens*	4	11.62	5.75
	Tree	*Schleichera oleosa*	10	32.10	10.20
	Tree	*Shorea robusta*	44	17.31	8.58
	Tree	*Syzigium cumini*	6	18.68	8.83
	Tree	*Terminalia bellirica*	2	18.47	10.00
	Tree	*Terminalia tomentosa*	6	21.23	10.17
	Sapling	*Aegle marmelos*	24	6.02	4.17
	Sapling	*Anogeissus latifolia*	2	9.55	6.00
	Sapling	*Casearia graveolens*	2	6.37	3.00
	Sapling	*Cipadessa baccifera*	8	5.81	4.50
	Sapling	*Croton persimilis*	16	5.77	4.19
	Sapling	*Diospyros melanoxylon*	18	8.32	5.28
	Sapling	*Holarrhenapubescens*	8	7.00	4.88
	Sapling	*Lagerstroemia parviflora*	2	7.32	7.50
	Sapling	*Meyna laxiflora*	4	6.69	3.00

Site/ Quadrat No.	Form	Name of Species	Number of Iudividuals	Growth Parameters	
				DBH (cm)	Height (m)
	Sapling	*Schleichera oleosa*	2	9.24	5.50
	Sapling	*Shorea robusta*	8	7.72	5.91
	Sapling	*Syzigium cumini*	4	6.69	3.25
10	Tree	*Bridelia retusa*	6	20.06	9.00
	Tree	*Croton persimilis*	2	11.15	6.00
	Tree	*Diospyros melanoxylon*	14	14.38	5.73
	Tree	*Haldina cordifolia*	6	20.06	8.00
	Tree	*Madhuca longifolia*	14	32.21	8.64
	Tree	*Nyctanthus arbor-tristis*	8	18.15	7.50
	Tree	*Schleichera oleosa*	2	10.51	7.00
	Tree	*Semecarpus anacardium*	4	16.08	8.50
	Tree	*Shorearobusta*	36	16.15	8.22
	Tree	*Syzigiumcumini*	6	15.92	6.33
	Tree	*Terminalia bellirica*	4	18.47	8.50
	Tree	*Terminalia tomentosa*	2	22.93	4.50
	Sapling	*Aegle marmelos*	6	3.61	2.83
	Sapling	*Anogeissus latifolia*	4	6.53	6.25
	Sapling	*Bridelia retusa*	2	9.55	8.00
	Sapling	*Buchananialanzan*	2	6.37	2.00
	Sapling	*Casearia graveolens*	20	4.81	4.45
	Sapling	*Croton persimilis*	16	6.77	4.31
	Sapling	*Diospyros melanoxylon*	16	5.73	5.00
	Sapling	*Helecteresisora*	4	3.82	3.50
	Sapling	*Holarrhenapubescens*	2	5.73	1.50
	Sapling	*Lagerstroemia parviflora*	6	5.74	4.83
	Sapling	*Meynalaxiflora*	2	3.82	4.00
	Sapling	*Nyctanthusarbor-tristis*	2	6.37	4.50
	Sapling	*Olax scandens (climber)*	4	4.46	4.00
	Sapling	*Phyllanthus emblica*	2	3.18	3.50
	Sapling	*Shorearobusta*	14	7.74	7.43
	Sapling	*Syzigiumcumini*	2	6.05	5.00
11	Tree	*Aegle marmelos*	6	10.51	6.83
	Tree	*Albizia odoratissima*	2	41.40	10.00
	Tree	*Anogeissus latifolia*	6	17.09	8.50
	Tree	*Croton persimilis*	8	13.85	6.38
	Tree	*Diospyros melanoxylon*	4	20.38	7.75
	Tree	*Lagerstroemia parviflora*	2	30.57	8.50
	Tree	*Phyllanthus emblica*	2	13.06	8.50

Site/ Quadrat No.	Form	Name of Species	Number of Iudividuals	Growth Parameters	
				DBH (cm)	Height (m)
	Tree	*Schleicheraoleosa*	2	16.24	7.50
	Tree	*Shorearobusta*	12	14.97	9.50
	Tree	*Tectona grandis*	38	17.50	8.08
	Tree	*Terminalia bellirica*	18	18.33	8.22
	Tree	*Terminalia tomentosa*	6	17.20	8.17
	Sapling	*Aegle marmelos*	6	7.54	6.50
	Sapling	*Anogeissus latifolia*	8	8.52	5.75
	Sapling	*Casearia graveolens*	4	7.96	5.75
	Sapling	*Croton persimilis*	14	8.32	6.64
	Sapling	*Diospyros melanoxylon*	2	8.28	4.00
	Sapling	*Haldina cordifolia*	2	6.37	8.50
	Sapling	*Schleicheraoleosa*	2	6.69	7.00
	Sapling	*Shorearobusta*	16	8.44	7.16
	Sapling	*Syzigiumcumini*	2	8.28	6.00
	Sapling	*Tectona grandis*	6	7.43	4.25
	Sapling	*Terminalia bellirica*	22	8.51	7.91
	Sapling	*Terminalia tomentosa*	4	7.33	7.50
12	Tree	*Anogeissus latifolia*	4	12.90	6.00
	Tree	*Bridelia retusa*	2	10.83	2.00
	Tree	*Buchananialanzan*	6	15.61	5.83
	Tree	*Cassine glauca*	2	25.48	6.00
	Tree	*Diospyros melanoxylon*	2	11.15	6.50
	Tree	*Diospyros montana*	2	12.10	4.00
	Tree	*Haldina cordifolia*	2	15.61	6.50
	Tree	*Madhuca longifolia*	2	10.19	4.00
	Tree	*Phyllanthus emblica*	2	11.15	3.50
	Tree	*Shorearobusta*	10	17.07	5.30
	Tree	*Ziziphus xyloporus*	4	18.31	5.75
	Sapling	*Albizia odoratissima*	2	4.78	4.00
	Sapling	*Anogeissus latifolia*	4	7.17	5.50
	Sapling	*Buchananialanzan*	4	8.13	4.75
	Sapling	*Casearia graveolens*	4	6.85	3.75
	Sapling	*Cassine glauca*	2	4.78	4.50
	Sapling	*Diospyros melanoxylon*	28	6.16	3.69
	Sapling	*Grewia tilifolia*	2	6.05	6.00
	Sapling	*Haldina cordifolia*	8	8.28	3.83
	Sapling	*Holarrhenapubescens*	2	7.96	3.50
	Sapling	*Lagerstroemia parviflora*	6	5.41	3.33

Site/ Quadrat No.	Form	Name of Species	Number of Individuais	Growth Parameters	
				DBH (cm)	Height (m)
	Sapling	*Madhuca longifolia*	2	9.87	5.00
	Sapling	*Meynalaxiflora*	2	7.96	3.50
	Sapling	*Phyllanthus emblica*	4	8.12	4.75
	Sapling	*Shorearobusta*	30	5.90	3.63
	Sapling	*Terminalia tomentosa*	16	6.77	3.88
	Sapling	*Woodfordiafruticosa*	2	1.59	2.50
	Sapling	*Ziziphus xyloporus*	6	7.75	4.17
			2342	**10.30**	**5.41**

The assessment of the vegetation in the quadrats revealed that, a total of 1476 saplings and 866 number of trees were reported wherein, the average DBH and height of the former was measured to be 5.48cm and 5.99m, respectively whereas that of the latter was 18.51cm and 7.81m, respectively (Figure 2).

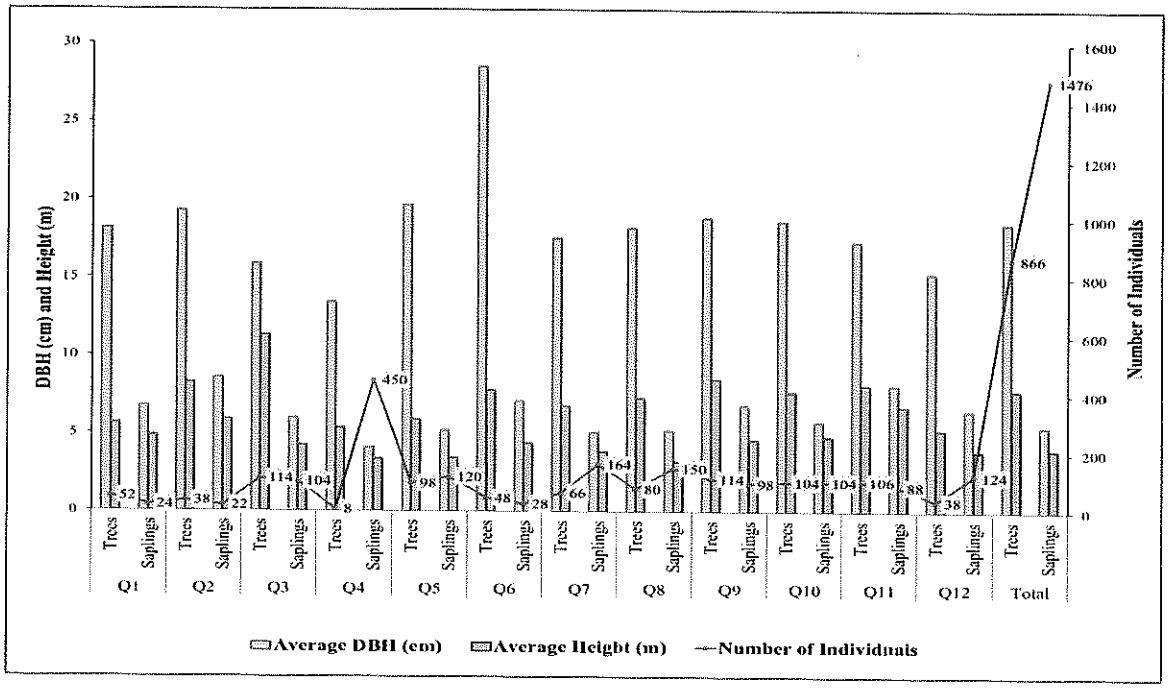

Figure 2: Quadrat-wise comparative growth parameters aud couut of trees and saplings during vegetation survey at Dubua-Sakradihi miue area.

The maximum number of trees i.e., 114 was reported in both of the Quadrats 9 and Quadrat 3. Maximum number of saplings i.e., 450 but lowest number of trees i.e., only 08 was reported from Quadrat 4. Average DBH of the recorded trees in the quadrats varied between 13.46cm (Quadrat 4) to 28.54cm (Quadrat 6) whereas that of saplings varied between 5.22cm (Quadrat 8) to 8.60 (Quadrat 2). Among all the studied quadrats, Quadrat 3 reported to have tallest with average height of 11.32m whereas that of Quadrat 4 were smallest (5.38m) trees (Figure 2).

Species diversity is considered as one of the major factors for determining the overall health of forest ecosystems. In this study, total of 56 different species were found in all the 12 quadrats. *Shorea robusta* (782 individuals) followed by *Diospyros melanoxylon* (386 individuals) were found to be the most common species. Whereas, *Alstonia scholaris, Bombax ceiba, Butea superba, Careya arborea, Cryptolepis buchanani, Ficus benjamina, F. exasperata, F. racemosa, F. religiosa, Gardenia sp., Gmelina arborea, Grewia tilifolia, Hiptage benghalensis, Lannea coromandelica, Psidium guajava* and *Terminalia chebula* were least reported in the studies of quadrats (Figure 3).

For sustainable management of forests, natural regeneration is one crucial component, as it directly affects the survival of the forest. This study indicates that, *Shorea robusta* possesses the highest number of saplings (284) among all the quadrates, followed by *Diospyros melanoxylon* (344), *Croton persimilis* (86) and *Aegle marmelos* (80). Also, no saplings were reported for *Bauhinia roxburghii, Bombax ceiba, Butea superba, Callicarpa arborea, Careya arborea, Dalbergia paniculata, Ficus benjamina, F. exasperata, F. racemosa, F.religiosa, Hiptage benghalensis, Lannea coromandelica, Madhuca indica, Mangifera indica and Mitragyna parvifolia* in the selected sites (Figure 3).

The familial composition of forests is another important criterion for determining the overall diversity of a forest. So, the families of recorded saplings and trees were also analyzed. The families containing highest number of species are Fabaceae with 6 species followed by Moraceae with 5 species. At the same time, the number of individual trees and saplings coming under a family, Dipterocarpaceae (782), Ebenaceae (404) and Combretaceae (232) have the majority, also Bombacaceae, Lecythidaceae, Malpighiaceae and Tiliaceae only have 02 representative individuals in each (Figure 4).

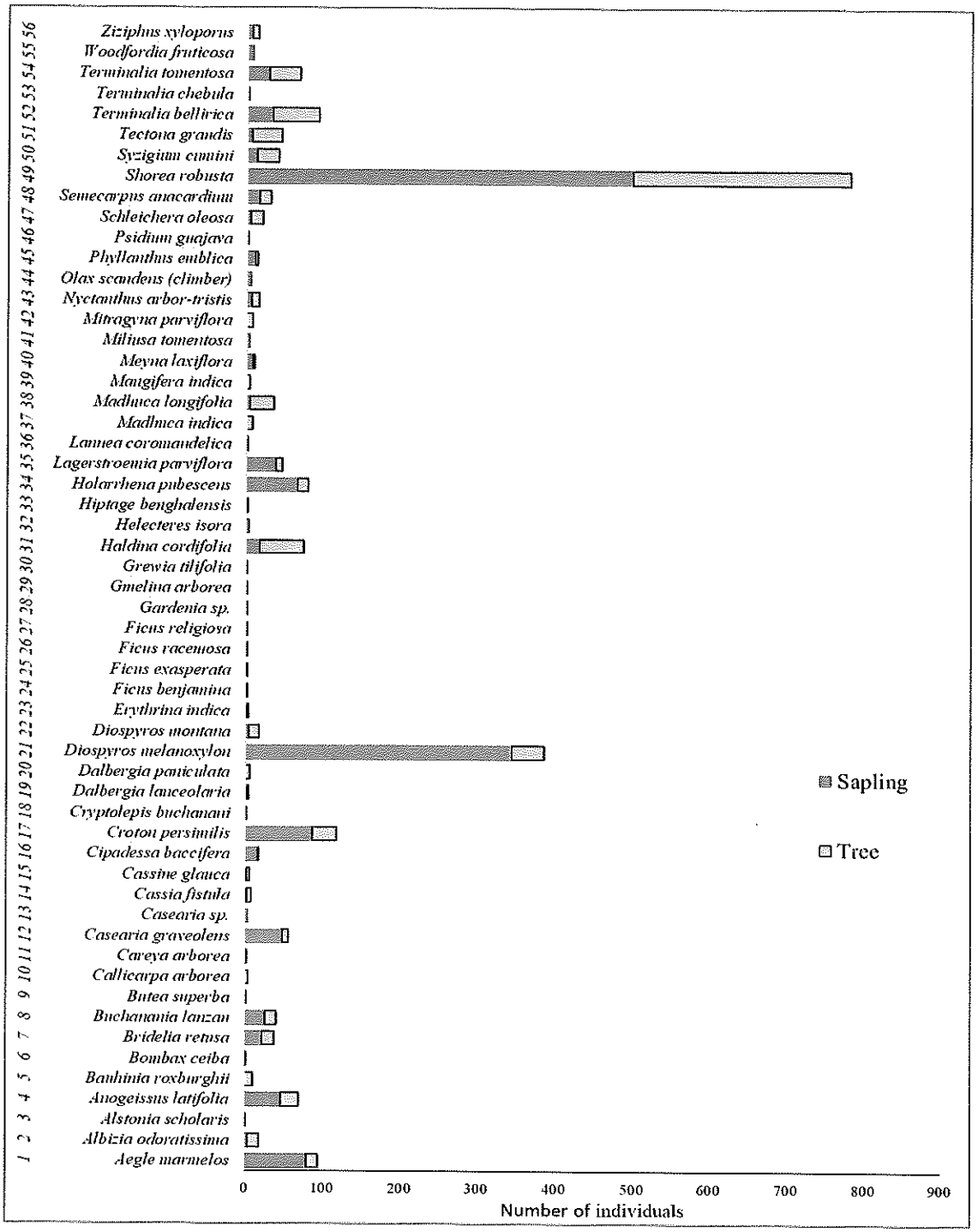

Figure 3: Species-wise regeueratiou status of studied quadrats at Dubua-Sakradihi mine area.

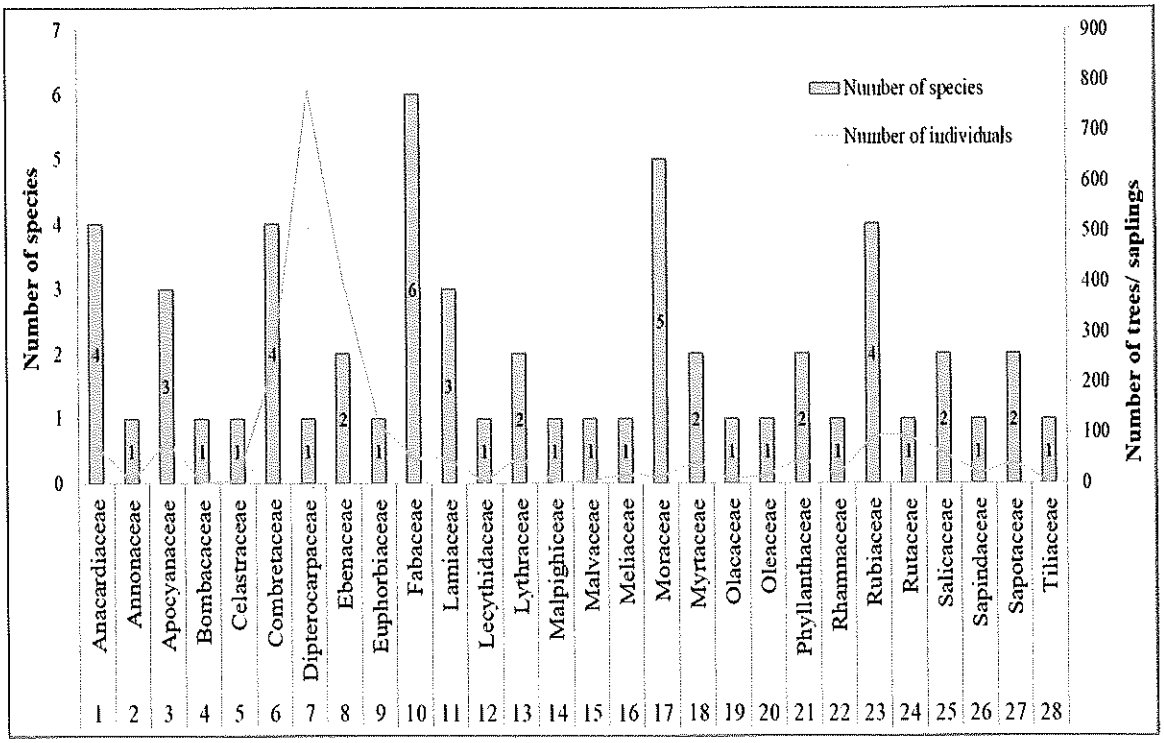

Figure 4: Family-wise depiction of number of species of saplings aud trees iu the studied quadrats at Dubna-Sakradihi miue area.

Phyto-sociological evaluation of the recorded trees

The data collected from the field was then evaluated for different phyto-sociological parameters. Basal area, frequency, density, abundance of trees and frequency of ground flora was calculated for each species following Mishra (1968) and Shukla and Chandel (1989).

$$\text{Frequency (\%)} = \frac{\text{Number of quadrats in which the species occurred}}{\text{Total number quadrats}} \text{ X } 100$$

$$\text{Relative frequency (\%)} = \frac{\text{Frequency of a species}}{\text{Total frequency of all the species}} \text{ X } 100$$

$$\text{Density} = \frac{\text{Total number of individuals of a species in all quadrats}}{\text{Total number of quadrats studied}}$$

$$\text{Relative density (\%)} = \frac{\text{Density of a species}}{\text{Total density of all the species}} \text{ X } 100$$

$$\text{Dominance} = \frac{\text{Basal area of a species in all quadrats}}{\text{Total area of species in the studied quadrats}}$$

$$\text{Relative dominance (\%)} = \frac{\text{Dominance of a species}}{\text{Total dominance of all the species}} \text{ X } 100$$

Thereby, the Importance Value Index (IVI) was calculated to determine the overall ecological importance of a species in the plant community by summing up the *Relative frequency, density* and *dominance* i.e.,

Importance Value Index (IVI)

= Relative Frequency + Relative Density + Relative Dominance

The trees recorded in the selected 12 quadrats were further evaluated for their phyto-sociological status in the diversity of the study area (Table 3).

It was observed that 44 tree species belonged to trees out of the total of 56 different species, including the tree saplings. From this classified group of the data, frequency, relative frequency, density, relative density, dominance, relative dominance and Important Value Index were calculated.

Table 3 : Phyto-sociological details of tree species in the studied quadrats at Dubna-Sakradihi iron and manganese ore mine area, Odisha.

	Species	Common Name	Family	Average DBH	Relative frequency	Relative density	Relative dominance	IVI
1	*Aegle marmelos*	Bel	Rutaceae	12.06	2.26	1.62	0.53	**4.40**
2	*Albizia odoratissima*	Kala Siris	Fabaceae	27.77	3.01	1.73	3.12	**7.86**
3	*Anogeissus latifolia*	Dhawra	Combretaceae	17.89	3.76	2.77	2.14	**8.67**
4	*Bauhinia roxburghii*	Semla	Fabaceae	20.19	0.75	1.15	1.25	**3.16**
5	*Bombax ceiba*	Semal	Bombacaceae	22.61	0.75	0.23	0.25	**1.24**
6	*Bridelia retusa*	Kasai	Phyllanthaceae	22.02	3.01	1.85	2.43	**7.29**
7	*Buchanania lanzan*	Char/Chironji	Anacardiaceae	13.88	3.01	1.62	0.70	**5.32**
8	*Butea superba*	Lata palash	Fabaceae	18.15	0.75	0.23	0.16	**1.15**
9	*Callicarpa arborea*	Ghiwala	Lamiaceae	17.04	1.50	0.46	0.33	**2.30**
10	*Careya arborea*	Kumbhi	Lecythidaceae	10.19	0.75	0.23	0.05	**1.03**
11	*Casearia graveolens*	Chilla	Salicaceae	12.90	1.50	0.92	0.33	**2.76**
12	*Cassia fistula*	Amaltas	Fabaceae	14.33	2.26	0.69	0.31	**3.26**
13	*Cassine glauca*	Jamrasi	Celastraceae	24.69	1.50	0.46	0.61	**2.57**
14	*Cipadessa baccifera*	Ranabili	Meliaceae	12.10	0.75	0.23	0.07	**1.06**
15	*Croton persimilis*	Croton tree	Euphorbiaceae	14.75	4.51	3.69	1.87	**10.07**
16	*Dalbergia lanceolaria*	Takoli	Fabaceae	15.92	0.75	0.23	0.13	**1.11**
17	*Dalbergia paniculata*	Dhobin	Fabaceae	16.46	2.26	0.69	0.49	**3.44**
18	*Diospyros melanoxylon*	Tendu	Ebenaceae	13.62	6.02	4.85	2.06	**12.93**
19	*Diospyros montana*	Bistendu	Ebenaceae	18.74	3.76	1.62	1.39	**6.76**
20	*Erythrina indica*	Pangara	Fabaceae	12.10	0.75	0.23	0.07	**1.06**
21	*Ficus benjamina*	Pukar	Moraceae	95.54	0.75	0.23	4.54	**5.53**
22	*Ficus exasperata*	Brahma's Banyan	Moraceae	10.83	0.75	0.23	0.06	**1.04**
23	*Ficus racemosa*	Goolar	Moraceae	82.17	0.75	0.23	3.36	**4.34**

	Species	Common Name	Family	Average DBH	Relative frequency	Relative density	Relative dominance	IVI
24	*Ficus religiosa*	Peepal	Moraceae	49.68	0.75	0.23	1.23	**2.21**
25	*Haldina cordifolia*	Haldu	Rubiaceae	18.18	4.51	6.47	5.05	**16.03**
26	*Hiptage benghalensis*	Madhavi lata	Malpighiceae	15.92	0.75	0.23	0.13	**1.11**
27	*Holarrhena pubescens*	Indrajao	Apocyanaceae	12.60	2.26	1.62	0.56	**4.43**
28	*Lagerstroemia parviflora*	Lendia	Lythraceae	18.39	2.26	0.92	0.79	**3.97**
29	*Lannea coromandelica*	Goonja	Anacardiaceae	19.11	0.75	0.23	0.18	**1.16**
30	*Madhuca indica*	Mahua	Sapotaceae	22.13	1.50	0.92	1.24	**3.67**
31	*Madhuca longifolia*	Mahua	Sapotaceae	31.62	3.76	3.58	11.90	**19.24**
32	*Mangifera indica*	Mango	Anacardiaceae	18.48	0.75	0.46	0.35	**1.56**
33	*Meyna laxiflora*	Muyna	Rubiaceae	12.10	0.75	0.23	0.07	**1.06**
34	*Mitragyna parviflora*	Kaim	Rubiaceae	14.65	0.75	0.92	0.44	**2.12**
35	*Nyctanthus arbor-tristis*	Har singar	Oleaceae	17.71	1.50	1.15	0.88	**3.54**
36	*Phyllanthus emblica*	Amla	Phyllanthaceae	12.11	1.50	0.46	0.15	**2.11**
37	*Schleichera oleosa*	Kusum	Sapindaceae	32.17	3.01	1.85	6.25	**11.11**
38	*Semecarpus anacardium*	Bhilava	Anacardiaceae	15.88	3.01	1.62	0.90	**5.53**
39	*Shorea robusta*	Sal	Dipterocarpaceae	16.00	6.77	32.79	22.09	**61.65**
40	*Syzigium cumini*	Jamun	Myrtaceae	21.77	5.26	3.23	3.97	**12.47**
41	*Tectona grandis*	Teak, Sagon	Lamiaceae	17.50	0.75	4.39	3.10	**8.24**
42	*Terminalia bellirica*	Baheda	Combretaceae	19.26	6.02	6.93	6.39	**19.33**
43	*Terminalia tomentosa*	Saja	Combretaceae	25.03	5.26	4.62	7.47	**17.36**
44	*Ziziphus xyloporus*	Kath Ber	Rhamnaceae	16.08	2.26	0.92	0.59	**3.77**

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These trees were found to belong from 28 different plant families. The third largest flowering plant family i.e., Fabaceae was found to be dominating among the reported tree species. After observing the values of diameter at breast height (DBH), derived from the girth measurements taken in the field, it is evident that, *Ficus benjamina* and *Ficus racemosa* are the species with highest DBH of 95.54 cm and 82.17 cm respectively. The total study area of the 12 quadrats (of the size 250m X 4m) i.e., 12ha and out of the entire tree species evaluated, *Shorea robusta* dominates with a relative dominance value of 22.09%. And the species like *Careya arborea* and *Ficus exasperata* have the low relative dominance value of 0.05 and 0.06 respectively (Table 3).

As relative frequency is used to quantify and describe the distribution of a species in the community, it is derived through the number of times a species occurs in the studied quadrats. Among all the trees *Shorea robusta* (6.77) has the highest relative frequency value and is closely followed by *Diospyros melanoxylon* (6.00) and *Terminalia bellirica* (6.02). They are the most widely distributed species and there are many trees which are scantily distributed in these quadrats with low relative frequency values (Table 3).

Relative density gives the percentage of number of stems occupying a given area and may provide an idea about the ecological relationships happening in that region. In this parameter also *Shorea robusta* is dominating with an incomparable value of 32.79% and many trees have low relative density values since they are represented by fewer numbers of individual trees.

There are different standardized statistical approaches to analyze the quality and provide overall picture of different forests. Importance values rank species within a site based upon three criteria:

- how commonly a species occurs across the entire forest;
- how many total individuals of the species occur across the forest; and
- how much of the total amount of forest area occupied by the species.

In calculating this index, the percentage values of the relative frequency, relative density and relative dominance are summed up (Mishra, 1968; Curtis, 1959; Curtis and McIntosh, 1950). Because it combines relative cover, density and frequency, IVI values range from 0 – 300.

From all these parameters mentioned above IVI of each species were calculated and the values are in the range of 61.65 % to 1.03% (Table 3).

The IVI laid out the clear evidence of ecological importance of each species in the area of study. According to the phytosociological study, the species that depicted highest IVI are represented below.

Table 4: Tree species with hlghest values of IVI.

Name of Species	IVI	Name of Species	IVI
1) *Shorea robusta*	61.65	7) *Syzigium cumini*	12.47
2) *Terminalia bellirica*	19.33	8) *Schleichera oleosa*	11.11
3) *Madhuca longifolia*	19.24	9) *Croton persimilis*	10.07
4) *Terminalia tomentosa*	17.36	10) *Anogeissus latifolia*	8.67
5) *Haldina cordifolia*	16.03	11) *Tectona grandis*	8.24
6) *Diospyros melanoxylon*	12.93		

Hence according to the conducted vegetation survey, it was observed that the above-mentioned species in Table 4 will perform most successfully in this region

4. Soil characterization

Soil is a dynamic natural body developed as a result of pedogenic processes occurring during and after weathering of rocks, consisting of mineral and organic constituents, possessing definite chemical, physical, mineralogical and biological properties, having a variable depth over the surface of earth and providing a medium for plant growth. Soil provides anchorage to roots enabling plants to stand erect, act as a storehouse of water and nutrients for plant growth, act as an abode of flora and fauna which suitably transform nutrients for uptake by plants roots, provides space for air and aeration which create a healthy environment for the biological activity of soil organisms.

Soils are formed as a result of weathering of rocks and minerals. Weathering is the disintegration and decomposition of rock and minerals by physical and chemical processes. The former involves mainly physical breaking down into smaller particles, whereas the latter is responsible for chemical decomposition leading in course of time to the formation of new products. Soil is composed of partly weathered, unweathered, and transformed products of rocks and rock minerals, and organic matter.

Collectiou of soil samples

In the present study, soil samples were collected from 12 selected sites (Figure 1) of Dubna-Sakradihi Iron and Manganese Ore Mines area. One surface (0-15 cm) and sub-surface (15-30 cm) soil sample from each quadrat was collected and hence, a total of 24 soil samples were collected for analyzing the physico-chemical properties of soil and additionally, a soil sample from each site (12 total) was also collected by using core sampler to determine bulk density of the soil.

Processing of samples

The collected soil samples were brought to TFRI laboratory and air dried in shade, grounded and screened through 2mm sieve and used for analysis. Care was taken to maintain the identity of each sample at all stages of processing and analysis. The soil samples were analyzed by following the standard methods.

Physico-chemical characteristics of soil samples

Table 5 represents physico-chemical characteristics of soil samples collected from 12 quadrats laid out for vegetation survey.

Bulk denslty is defined as the mass of a unit volume of oven-dry soil. Bulk density was determined by core sampler method which is widely used being quick, accurate and relatively easy method. The bulk density of samples varied from of 1.10 g/cm^3 to 1.58 g/cm^3.

Texture of soil is basic physical property depends upon particle size distribution in the soil. It was determined by using International Pipette method and found that the soils having Clay to Silty clay loam texture.

The pH (soil reaction) value is a measure of hydrogen ion concentration of the soil water system and expresses the acidity and alkalinity of soil. pH is very important property of soil as it determines the nutrient availability, microbial activity and physical condition of the soil. pH was measured by using glass electrode pH meter in 1:2.5 ratio of soil water suspension (Jackson, 1973). The pH of the surface and sub-surface soil samples was ranged from 4.3 to 6.4 indicating a very strongly acidic to slightly acidic nature of the soil.

Soil electrical couductivity (EC) denotes the total amount of soluble salts present in the soil. It is a measurement that correlates with soil properties affecting crop productivity, including soil texture, cation exchange capacity (CEC), drainage conditions, organic matter level, and sub-soil characteristics. Excess salts hinder plant growth by affecting the soil-water balance. Salt levels can increase as a result of cropping, irrigation, and land management. Electrical conductivity was measured by using an electrical conductivity meter in supernatant liquid of 1:2.5 ratio of soil water suspension (Jackson, 1973). The electrical conductivity of the surface soil samples ranged from 0.046 to 0.138 dS m^{-1} whereas sub-surface soil samples ranged from 0.023 to 0.089 dS m^{-1}.

Soil organic carbon (SOC) plays a very important role in the maintenance and improvement of soil properties. Organic carbon is an integrative property of soil and it is generally assumed that higher the level of organic carbon, higher the soil fertility. The decomposition of organic matter and production of organic acid have in general effect on soil pH. The organic carbon also influences the availability of nitrogen and phosphorus to the plants. Organic carbon was

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determined using the Wet digestion method (Walkley and Black, 1934). The soil samples from the study sites was overall found to have low to high in organic carbon (0.41%-2.52%). Organic carbon content in soils decreased with depth because of the ground cover generally consists of grasses, herbs, ferns etc., and more organic matter decomposition at surface hence the higher value of all nutrients occurs in the surface soil and then it gradually decreases to lower horizons.

Nitrogen is an essential constituent of metabolically active compounds like amino acids, proteins, enzymes and some non-proteinous compounds. When nitrogen is a limiting factor, the rate and extent of protein synthesis are depressed and as a result plant growth is affected, the plant gets stunted and develops chlorosis, stems or shoots are dwarfed. The nitrogen-deficient plants are light green in color. The lower leaves turn yellow and in some plants they quickly start drying up if suffering from shortage of water. Available N content of the soil was estimated by using alkaline permanganate method outlined by Alkaline permanganate method (Subbiah and Asija, 1956). The available nitrogen in the surface soil samples ranged from 100.35 to 332.42 kg ha^{-1} whereas sub-surface soil samples ranged from 137.98 to 326.14 kg ha^{-1}. The available nitrogen was observed low to medium throughout all sites.

Phosphorns is a structural component of cell membranes, chloroplasts and mitochondria and a constituent of sugar phosphates, viz., ADP, ATP and nucleic acid, phospholipids and phosphatides. Phosphorus plays an important role in energy transformations and metabolic processes in plants. It stimulates root growth. It is a constituent of the cell nucleus, essential for cell division and the development of tissues at the growing points. It makes 0.1 to 0.5% of dry weight of the plant. Therefore, plants which cannot absorb adequate quantities of phosphorus from the soil have small root system and leaves, and their growth is stunted. Optimum quantity of phosphorus available to the crop in combination with nitrogen balances their shoot and root growth. Available phosphorus was determined by using Bray's No.1 method (Bray and Kurtz, 1945). The available phosphorus in the surface soil samples ranged from 0.44 to 1.27 kg ha^{-1} whereas sub-surface soil samples ranged from 0.68 to 1.33 kg ha^{-1}. Low available phosphorus content was detected in all the collected soil samples from surface and sub-surface soils of Dubna Sakradihi mine areas. This was evident as phosphorus is never readily soluble in the soil but is most available in soil with a pH range centered around 6.5 and the soil of the study area was acidic as discussed previously.

Table 5: Physico-chemical characteristics of soil samples collected from quadrats laid out for vegetation survey Dubna-Sakradihi, Odisha

Site No.	Bulk density (g cm^{-3})	Surface/ Sub-Surface	pH	EC (dS m^{-1})	OC (%)	Available nutrients				Exchangeable cations (meq/100 g of soil)			Available nutrients (ppm)				Mechanical analysis (%)			Texture
						N (kg/ha)	P (kg/ha)	K (kg/ha)	S (ppm)	Ca	Mg	K	Mn	Fe	Cu	Zn	Sand	Silt	Clay	
1	1.12	S	5.45	0.084	1.94	213.25	1.22	449.01	4.043	7.20	11.40	0.113	36.21	5.98	2.34	0.40	16.80	54.4	28.8	Silty clay loam
		SS	5.21	0.055	1.80	238.34	1.19	695.63	3.441	6.80	8.80	0.064	45.77	7.13	2.54	0.31	15.00	44.8	40.2	Silty clay
2	1.37	S	4.59	0.059	0.80	200.70	0.81	925.57	3.957	2.80	3.60	0.040	32.75	20.93	0.86	0.17	2.60	57.2	40.2	Silty clay
		SS	4.30	0.047	0.48	175.62	0.89	1004.98	4.904	3.20	2.80	0.025	16.55	9.48	0.53	0.05	20.60	47.6	31.8	Clay loam
3	1.24	S	5.50	0.138	2.34	332.42	1.21	685.33	4.732	12.00	12.40	0.041	-	-	-	-	25.20	42.2	32.6	Clay loam
		SS	5.34	0.083	2.27	225.79	1.14	642.88	3.699	9.20	10.40	0.089	21.64	18.21	1.24	0.18	22.80	51.4	25.8	Silt loam
4	1.17	S	5.47	0.070	1.04	225.79	0.76	529.65	3.871	6.40	7.20	0.023	32.27	4.10	0.99	0.11	29.40	41.0	29.6	Clay loam
		SS	5.58	0.069	0.87	137.98	0.75	378.56	3.871	8.00	7.60	0.025	26.92	3.12	0.89	0.07	20.60	28.6	50.8	Clay
5	1.53	S	5.70	0.046	2.52	163.07	0.92	923.55	3.355	6.80	8.00	0.023	10.65	10.94	0.56	0.16	34.00	23.2	42.8	Clay
		SS	5.60	0.047	2.13	225.79	0.91	810.54	2.581	7.60	10.80	0.019	9.24	7.72	0.61	0.08	27.40	28.8	43.8	Clay
6	1.51	S	4.46	0.072	1.32	150.53	0.70	1121.9	4.215	11.60	3.60	0.031	36.02	33.66	0.37	0.18	22.00	41.0	37.0	Clay loam
		SS	4.37	0.061	0.98	163.07	0.68	803.71	4.301	12.80	2.40	0.028	19.79	28.31	0.31	0.14	21.80	43.2	35.0	Clay loam
7	1.28	S	5.51	0.100	2.39	288.51	0.44	962.30	4.818	10.40	8.40	0.036	24.82	20.35	1.90	0.44	23.60	51.0	25.4	Silt loam
		SS	4.84	0.053	1.41	301.06	0.78	817.38	3.613	7.60	5.60	0.022	40.93	31.28	2.57	0.21	9.20	54.8	36.0	Silt Clay loam
8	1.58	S	5.38	0.062	1.20	250.88	1.27	336.78	4.215	18.00	6.80	0.030	22.84	6.97	1.70	0.27	26.60	46.6	26.8	Loam
		SS	4.94	0.041	0.92	238.34	1.30	479.81	5.420	16.40	6.00	0.025	28.83	8.70	1.72	0.23	31.60	36.2	32.2	Clay loam
9	1.15	S	5.11	0.091	1.20	301.06	1.02	707.06	3.527	7.20	9.20	0.030	38.16	9.35	1.10	0.15	20.40	29.0	50.6	Clay
		SS	4.89	0.087	0.84	326.14	1.13	817.38	3.269	12.00	8.40	0.031	32.75	4.84	0.91	0.10	21.40	78.4	0.2	Silt loam
10	1.10	S	5.39	0.145	2.01	263.42	0.70	479.81	3.613	10.40	12.80	0.057	26.04	13.59	1.19	0.22	11.60	61.4	27.0	Silt Clay loam
		SS	5.56	0.089	1.85	275.97	0.95	876.62	4.387	7.20	8.80	0.051	16.81	9.83	1.26	0.15	1.00	44.8	54.2	Silt clay
11	1.23	S	4.88	0.053	1.43	238.34	0.49	145.82	2.753	6.40	6.80	0.029	26.33	15.28	0.51	0.14	19.40	56.2	24.4	Silt loam
		SS	5.11	0.023	1.35	263.42	1.11	533.34	2.753	4.80	7.60	0.026	32.32	13.06	0.48	0.11	30.80	45.4	23.8	Loam
12	1.23	S	6.40	0.064	0.41	100.35	0.79	462.11	4.043	9.20	10.00	0.015	1.36	1.24	0.98	0.36	31.20	39.2	29.6	Clay loam
		SS	5.83	0.063	0.80	225.79	1.33	823.31	4.215	8.00	11.60	0.030	12.90	11.43	3.34	0.36	34.60	28.4	37.0	Clay loam
Average	**1.29**	**S**	**5.32**	**0.082**	**1.55**	**227.36**	**0.86**	**644.07**	**3.929**	**9.03**	**8.35**	**0.015**	**26.13**	**12.94**	**1.14**	**0.24**				
		SS	**5.13**	**0.060**	**1.31**	**233.11**	**1.01**	**723.68**	**3.871**	**8.63**	**7.57**	**0.113**	**25.37**	**12.76**	**1.37**	**0.16**				
		Total	**5.23**	**0.071**	**1.43**	**230.23**	**0.94**	**683.88**	**3.900**	**8.83**	**7.96**	**0.039**	**25.73**	**12.85**	**1.26**	**0.20**				

Potassinm plays an important role in the maintenance of cellular organizations by regulating permeability of cell membranes and keeping the protoplasm in a proper degree of hydration. It activates the enzyme in protein and carbohydrates metabolism and translocation of carbohydrates and impart diseases resistance to plants. Unlike nitrogen and phosphorus, potassium is not a constituent of the carbohydrates, oils, fats and proteins, the substances which form the fabric of the plants. But it plays a vital role in the formation or synthesis of amino acids and proteins from ammonium ions which are absorbed from the soil. It is also considered essential in the photosynthetic activity of the leaves. When potassium is in short supply, the carbon dioxide is synthesized into sugars more slowly than when it is available in optimum quantity. The relative concentration of sodium and calcium also influences the activity of potassium in the plant. Available potassium was estimated by using Neutral Normal Ammonium Acetate method (Stanford and English, 1949). The available potassium in the sampled soil samples was mostly high (336.78-1121.90 kg ha^{-1}) i.e., >280 kg ha^{-1} besides that in surface soil of site 11 having 145.82 kg ha^{-1} medium range of available potassium.

Sulphur (S) is an essential element in forming proteins, enzymes, vitamins, and chlorophyll in plants. It is crucial in nodule development and efficient nitrogen fixation in legumes. Protein synthesis requires large amounts of sulphur, especially in the formation of oils within the seed, and sulphur is a constituent of several amino acids and vitamins found in both plants and animals. Thus, sulphur is an important factor in determining the nutritional quality of foods. Sulphur was estimated to be low (2.581-5.420 ppm) in all the samples collected from sites of Dubna Sakradihi mine area. Organic sulphur, which is mineralised into plant-available sulphate sulphur, is more prevalent in soils with high clay and gravel content. Sandier soils from higher rainfall areas do not have any ability to restrict the leaching of water-soluble sulphate sulphur.

Excbangeable calcium is essential for the formation of cell walls, as calcium forms part of the middle layer of the cell wall. The middle lamella regulates the entry of only those nutrients which are not toxic to the plant. In root tips calcium is very essential for the meristematic activity or formation of new tissues. It also helps to keep up sustained activity of the nodule bacteria in legumes. Besides its direct nutrient value, calcium when applied to acid soils increases the availability of other nutrients, like phosphorus, nitrogen and molybdenum. Excess of calcium in the calcareous soils depresses the uptake of potassium and magnesium. In the present study,

exchangeable Ca varied from 2.80 meq/100g of soil to 18meq/100g of soil in all the soil samples collected from the quadrats. Average Ca content in surface samples was observed more (9.03 meq/100g of soil) than sub-surface samples (8.63 meq /100g of soil).

Exchaugeable Magnesium is a constituent of chlorophyll and chromosomes. It is known to play a catalytic role as an activator of a number of enzymes, most of which are concerned with carbohydrate metabolism. The chlorophyll development is much reduced when magnesium uptake is restricted because it is an integral part of the pigment. It maintains the dark-green color of leaves and regulates the uptake of other materials, particularly nitrogen and phosphorus. It appears to play an important role in the transport of phosphorus, particularly into the seeds. It is also said to promote formation of oils and fats, possibly by increasing photosynthetic activity in the leaves. The average exchangeable Mg content in sub surface soil samples was found more (12.80 meq/100g of soil) in comparison to surface samples (2.40meq/100g of soil).

Exchangeable Potassium is the third most likely element to limit plant productivity after nitrogen and phosphorus as it plays significant role as an activator of the various enzymes responsible for various processes (e.g., nitrate reduction, protein synthesis, breakdown of carbohydrates, photosynthesis). Only 1-2 % of the total potassium in the soil is available as either exchangeable potassium adsorbed on soil colloidal surfaces (i.e., clay particles and organic colloids) and/or in soil solution. Exchangeable potassium content in the collected soil samples was found in low amounts varying from 0.015meq/100g to 0.0113meq/100g. Average exchange K was found more in surface samples (0.039meq/100g) than sub-surface samples (0.036meq/100g).

Based on the results of soil physico-chemical analysis, it was observed that the sites of Dubna Sakradihi mine area are acidic in nature, low to high in organic carbon content, low to medium in available nitrogen, low in available phosphorus & sulphur and high in potassium content.

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5. Plantation sites and Suggested species

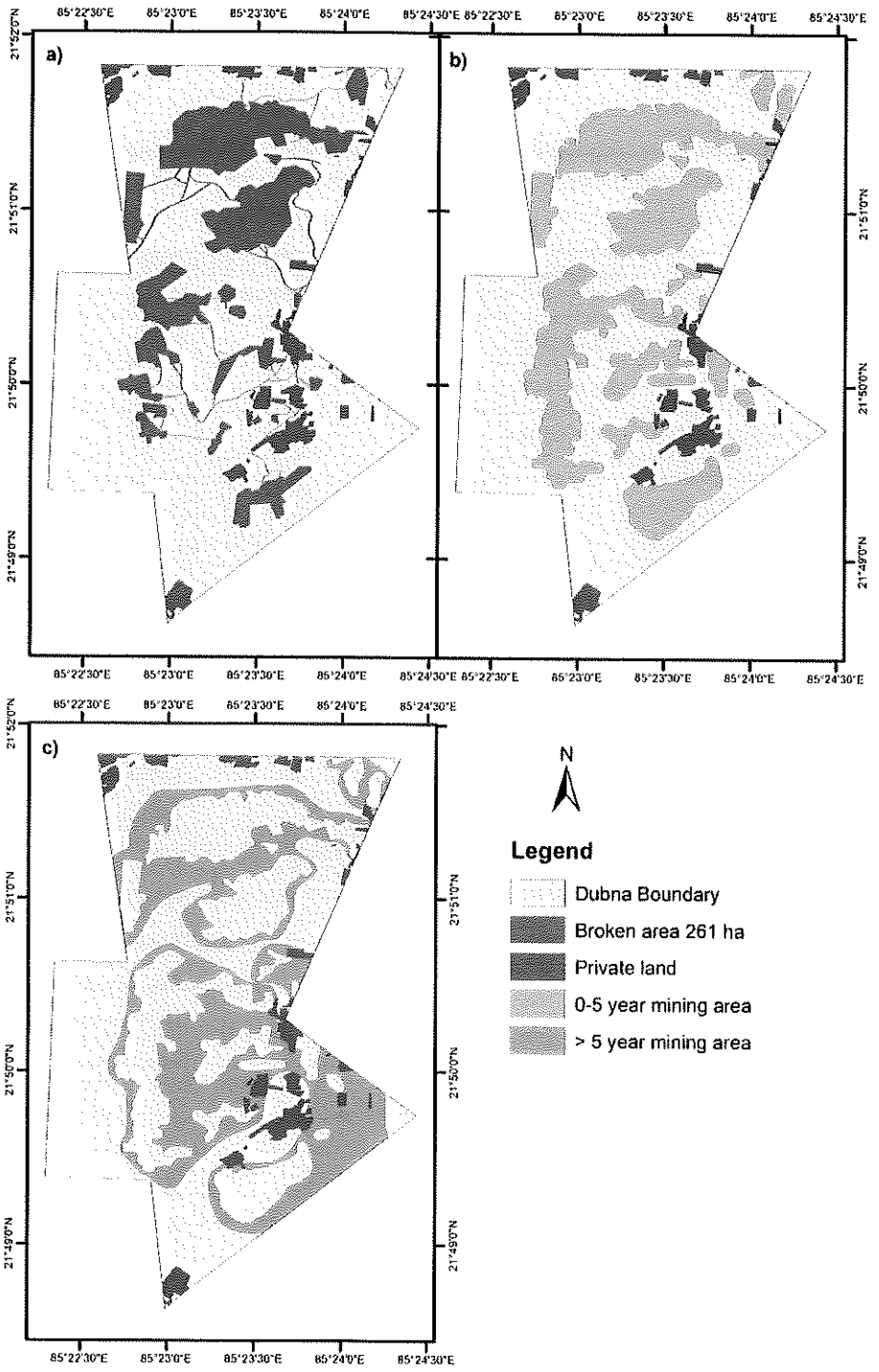
The land use details as provided by the Odisha Mining Cooperation Limited (Table 6) and the representative map (Figure 5) is given below: -

Table 6: Land nse details of Dnbna-Sakradihi iron and manganese ore mines in Keonjhar district of Odisha

Si. No.	Land Use	Category	Area (ha)	Total area (ha)	Remarks
1.	Total lease area			1332.019	
2.	Broken area	Forest land	258.599	261.919*	• Verified broken prior to 25.10.1980 • More minerals will be extracted after getting forest clearance
		Non-forest land	3.320		
3.	Area to be taken up in next 5 years	Mining and ancillary activities	326.9818	358.7282	• Includes already broken area of 261.919 ha • Area for safety zone and green belt shall be utilized for raising plantation by OMC as per the scheme approved by the State Forest Department. • Area for public purpose will be used for construction of pond, cremation ground, grazing land, road, market place etc. It has been excluded from the diversion proposal and shall be used by villagers.
		Safety zone	24.8200		
		Green belt	1.3478		
		Public purpose	5.5786		
4.	Area to be used after 5 years	6-10 years	500.00	914.7028	App. 500 ha area may be used during 6-10 years for mining activities
		> 10 years	414.7028		The remaining 414.7028 ha area may be used after 10 years for mining activities.
6.	Private land inside lease area			58.588	Not proposed for any activity related to mining.

Source: OMCL

* Included within 358.7282 ha area for mining and ancillary activities.



Fignre 5: Land nse details of Dubna-Sakradihi iron and manganese ore mines in Keonjhar district of Odisha.

On the basis of the studies conducted studies and details provided by OMCL (Table 6), tentative plantation plan recommended for Dubna Sakradhi mine area with short-rotation forestry crops is given below in Table 7.

Table 7: Selected tree species for raising plantation at Dubna-Sakradihi iron and manganese ore mines in Keonjhar district of Odisha

Land Use		Total area ha)	Area (ha) for plantation in (% of respective total areas)	Tree species
1.	Total lease area	1332.019	343.07 (25.76%)	--
2.	Broken area	261.919	--	--
3.	Area to be taken up in next 5 years for mining and ancillary activities (Excluding safety zone and green belt) plus public purpose	332.5604	--	--
4.	Area to be taken up for mining and ancillary activities between 6 and 10 years	500.00	197.77 (39.55%)	*Bamboo spp.* *Eucalyptus hybrid* *Populus deltoids* *Gmelina arborea* *Leucaena leucocephala*
5.	Area to be taken up for mining and ancillary activities after 10 years	414.70	119.13 (28.73%)	*Gmelina arborea* *Acacia auriculiformis* *Leucaena leucocephala* *Melia azedarach* *Dalbergia sissoo* *Dalbergia latifolia*
6.	Safety zone and green belt	26.17	26.17 (100%)	*Tectona grandis* *Azadirachta indica* *Haldina cordifolia* *Madhuca longifolia*
7.	Private land inside lease area	58.588	--	--

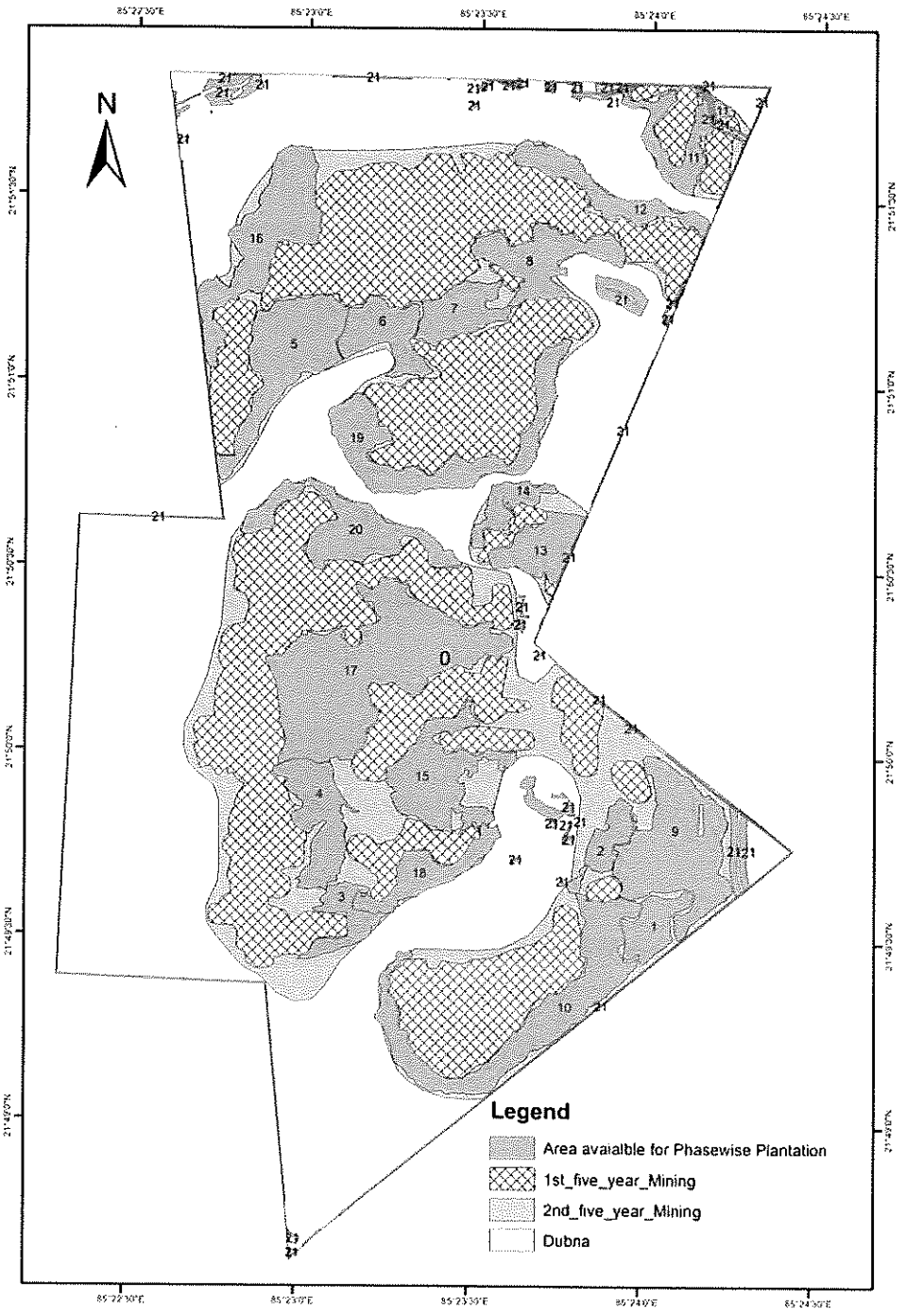


Figure 6: Map depicting mining plan and assigned area for plantation of forestry crops at Dubna-Sakradihi iron and mangauese ore mines in Keonjhar district of Odisha

Table 8: Site-wise selected tree species for raising plantation at Dubna-Sakradihi iron and manganese ore mines in Keonjhar district of Odisha

S. No.	Plot No.	Suggested tree species	Rotation age (years)	Area (ha)
1	**1**	*Bamboo spp., Eucalyptus spp., Populus deltoids, Gmelina arborea* and *Leucaena leucocephala*	<10years	6.61
2	**2**			5.31
3	**3**			6.34
4	**4**			13.38
5	**9**			27.72
6	**10**			29.13
7	**13**			9.41
8	**14**			5.15
9	**15**			18.01
10	**17**			50.72
11	**18**			8.96
12	**20**			17.04
Area under plantation with rotation age <10 years				**197.77**
13	**5**	*Gmelina arborea, Acacia auriculiformis, Leucaena leucocephala, Melia azedarach, Dalbergia sissoo* and *Dalbergia latifolia*	>10years	21.56
14	**6**			10.26
15	**7**			8.9
16	**8**			13.95
17	**11**			9.26
18	**12**			10.38
19	**16**			23.05
20	**19**			21.78
Area under plantation with rotation age >10 years				**119.13**
21	**21**	*Tectona grandis, Azadirachta indica, Haldina cordifolia and Madhuca longifolia.*	Long rotation	**26.17**
Total plantation area				**343.07**

Hence, following are evident from Table 6, 7 & 8 and Figure No. 6 that -

- Foremost mining and ancillary activities in the first 5 years will be carried out in 332.56 ha and hence this area will not be considered for any plantation.
- Second phase of mining during 6 -10 years is proposed in area of 500 ha. Out of it, 39.55% i.e., 197.77 ha will undergo plantation with forestry crops having rotation age <10 years like *Bamboo spp., Eucalyptus spp., Populus deltoids, Gmelina arborea* and *Leucaena leucocephala* (Table 7). This included plantation on Plot no. 1 2, 3, 4, 9, 10, 13, 14, 15, 17, 18 and 20 as depicted in Figure 6.
- Plantation of species like *Gmelina arborea, Acacia auriculiformis, Leucaena leucocephala, Melia azedarach, Dalbergia sissoo, Dalbergia latifolia* having rotation age >10years will be undertaken in Plot no. 5, 6, 7, 8, 11, 12, 16 and 19 covering 119.13 ha i.e., 28.73% of 414.70 ha area that is expected to undergo mining only after 10 years.
- A permanent area of 26.17 ha is dedicated for developing safety zone and green belt. This entire area will be used for plantation with long term forestry crops like *Tectona grandis, Azadirachta indica, Haldina cordifolia and Madhuca longifolia,* selected on the basis of vegetation survey and ecological importance as derived by IVI.
- Hence, a total area of 343.07 ha i.e., 25.76% of the leased area of Dubna-Sakradihi iron and manganese ore mines in Keonjhar district, Odisha will be undertaken for plantation with forestry crops.

Justification for selection of the above mentioned 12 species for raising plantation in Dubna Sakradihi Iron Manganese Ore Mines is given below: -

1. ***Dendrocalamus strictus (Bamboo)***

It is drought resistant and frost hardy bamboo species which grows on well drained soils and stony soils on hill slopes. The average life of a culm is 7 years. The following table gives a model for harvest management in bamboo and the potential culm yield of bamboo.

Year after planting	No. of culms harvested
4	4
7	8
10	12
13	15
16	18
19	20
22	21
25	25
28	30
30	150 and above

2. ***Eucalyptus sp. (Nilgiri)***

Eucalyptus camaldulensis is an exotic fast-growing species which is best suitable for areas which receive mean annual rainfall of 250-600 mm. In plantations, the crop has a clear bole of 20 m with an erect, lightly branched crown. The success of Eucalyptus is attributed to its superiority to other trees in production of wood on non-fertile dry lands, its tolerance of drought and high temperature. This species thrives on a variety of soil types, ranging from red soils to sandy alluvial soils. It can also grow well in salt affected areas. In Tamil Nadu, yield of about 25-30 t/ha at a rotation of 6-7 years was realized through seed raised plantations during early 1990's. Introduction of clones increased the yield up to 60-70 t/ha in six years rotation. The species *Eucalyptus teriticornis* is reported to have a rotation of Four years (For clonal varieties), with an average yield of 40 tons per acre in places where water is available (CABI, 2022).

3. ***Populus deltoides (Poplar)***

Poplar is a large tree with a clear bole and an open spreading crown. Assured irrigation facility is a perquisite for Poplar plantation. Areas with high water table are best suited for the

growth of *Populus deltoides*. It has very high growth rate (mean annual increment of 20 to 25 m^3 /ha/year) in India. Farmers in the foothills of the northwestern and central Himalaya commonly plant *Populus deltoides* with rotations of 8 to 12 years. The rotation for irrigated *Populus deltoides* on agricultural lands in Indo-Gangetic plains is 4 to 8 years (Christersson and Verma, 2006; Palanisamy et al.,2010; Nayak et al., 2011; Kumar and Singh, 2012;).

4. ***Gmelina arborea* (Ghamhar)**

Gmelina arborea is a fast-growing deciduous tree. It usually prefers moist fertile soils with an average rainfall of 750-4500 mm per annum. The tree attains grows to an average height of 25-30 m, with girth of 1.2 to 4.5 m with a clear bole of 9-15 m. The wood has a specific gravity is 0.42-0.64. The trees can be harvested 4-5 years after planting for pulp wood, and fire wood, and at 10-12 years after planting for timber. Under good management regime, each trees yield about 1.5 to 2 tonnes. The total yield per hectare is around 250-300 tonnes/ha (Nayak et al, 2011).

5. ***Leucaena leucocephala* (Subabul)**

Leucaena leucocephala is a leguminous tree belonging to the family fabaceae. The species prefers mean annual rainfall of 650-3000 mm. The tree grows extensively and can even be planted in wastelands or lands unsuitable for crop cultivation. With an aggressive root system, subabul is an excellent soil binder and moisture retainer. It is known to tolerate salinity and alkalinity up to pH 8.3. Subabul is a high yielding short rotation tree with an average yield of 100 tonnes per hectare in 3 to 4 years. Rotation period varies from 4 to 6 years depending on location of planting (TNAU, 2022).

6. ***Acacia auriculiformis* (Australian Babul)**

Acacia auriculiformis is an exotic evergreen tree belonging to the family Fabaceae. This fast-growing species is known to grow over 15-20 meters tall, with a trunk up to 12 m long and 50 cm in diameter. The species grows well in all types of soil and climate, and is used especially for afforestation of grasslands, reforestation of degraded forests and avenue planting. The rotation period is 10 years, when the species attains a height of about 12 m and a girth of about 60 cm (at breast height). It is also reported that in humid tropical areas of north eastern

India, *A. auriculiformis* can be harvested four years after planting, with excellent biomass yields (Christersson and Verma, 2006; Shukla et al., 2007)

7. *Melia azedarach* (Bakain)

Melia azedarach, commonly called as chinaberry tree is a fast-growing deciduous tree is known to grow over 35 meters tall, the crop prefers subtropical climatic zone with mean annual temperature of 23-27^{0}C, and mean annual rainfall of 350-2000 mm. Deep, fertile, sandy loam soils favor the optimum growth of the crop. *M. azedarach* wood has a density of 510-660 kg/cubic meters (Orwa et al., 2009).

8. *Dalbergia sissoo* (Shisham)

Dalbergia sissoo is a deciduous medium-sized tree growing up to 30 meters tall. It is adapted to a seasonal monsoon climate and a dry season of up to 6 months. It has been planted successfully in regions with 600-900 mm annual rainfall. However, for optimal growth more than 1,000 mm of annual rainfall is required and it can succeed in areas with 4,500mm. Young trees may grow fast and reach up to 3.7 meters in 1 year.

9. *Dalbergia latifolia* (Kala Shisham)

It is commonly called as Black Rosewood and is a predominantly single-stemmed deciduous tree that can grow up to 20-40m tall. The diameter of the trunk can be up to 1.5 to 2 m. *D. latifolia* prefers a tropical to subtropical climate and moderate to well-drained soil. It is propagated mainly through seeds and germination takes up to 7-25 days. In 5-7 years, the trees can grow to a height of 5-6m and the diameter of trunk can reach 13-14cm. The trees are harvested through clear felling and will be used for timber to firewood purposes depending upon the grade of the wood.

10. *Tectona grandis* (Teak)

Tectona grandis is a large deciduous tree species that can reach up to 30-40 m height and 2 m in diameter. The crop prefers well drained sandy loam soil with pH not exceeding 8.5 for optimum growth and is a light demanding species. With mean annual rainfall requirement of over 750 mm, teak yields a volume of 1.58 cum of timber per year per tree (increment). In natural forests, rotation period is 100-120 years, while in artificial regeneration, it is 70-80 years and in coppice regeneration, teak has a reduced rotation period of 40-60 years. In

response to recent commercial plantation activity in central and southern India, there is also renewed interest in growing teak on short rotations (Christersson and Verma 2006; TNAU, 2022).

11. *Azadirachta indica* (Neem)

Azadirachta indica is a large evergreen tree belonging to the family Meliaceae. The tree grows to an average height of 12 to 18 meters with 1.8 to 2.4 meters in girth, and usually has a straight bole and long spreading branches forming a broad crown. It can grow on a wide range of soils upto pH 10. Neem thrives in all kinds of soil types including clayey, saline, alkaline and acidic soils. It grows better than many other species on dry stony saline soils with a waterless sub-soil. The rate of growth of Neem in plantation varies with the quality of soil. It is reported that neem grows rapidly upto the age of 5 years after which it slows down. The plant attains a height of 4 m at 5 years and 10 m at 25 years. The mean annual girth increment is 2.3-3.0 cm (TNAU, 2022).

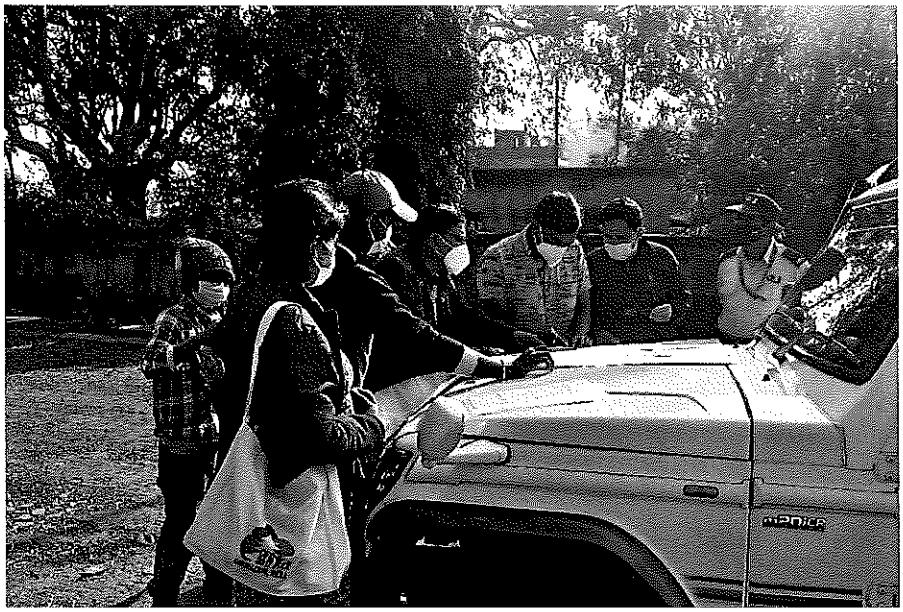
12. *Haldina cordifolia* (Haldu)

Haldina cordifolia is a deciduous tree which grows to an average height of 20-25 meters, however it is known to grow over 35 meters tall in freely drained soil. A light-demanding tree, Adina also establishes well in lower slopes of hills among boulders. It grows on a wide range of soils and tolerates pH up to 8.3 (ENVIS, 2011).

13. *Madhuca longifolia* (Mahua)

It is a deciduous, medium sized tree, attaining an average height of 12-18 m, usually with a short bole and a girth of 2-4 m. Mahua thrives on a wide variety of soils, but prefers sandy soils and alluvial soils of the Indo-Gangetic plains. It is a tree of dry tropical and subtropical climate and requires mean annual rainfall of 750-1875 mm (TNAU, 2022).

Photo Gallery

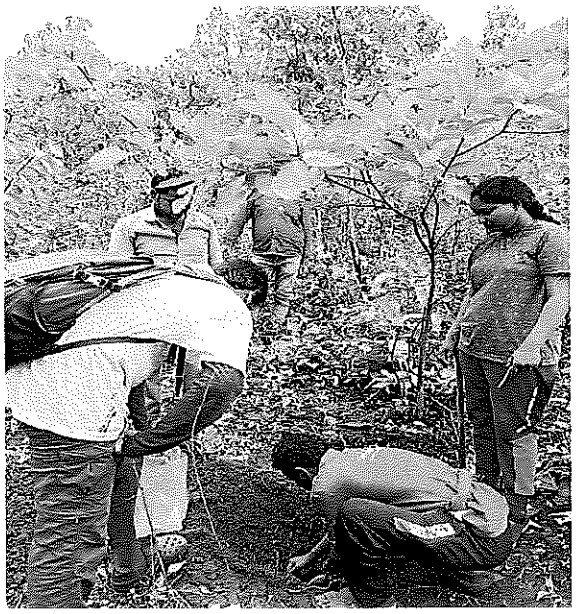


Detailed discussiou with the officials for selection of quadrats for conducting vegetation studies at Duhna-Sakradhi ore mine area

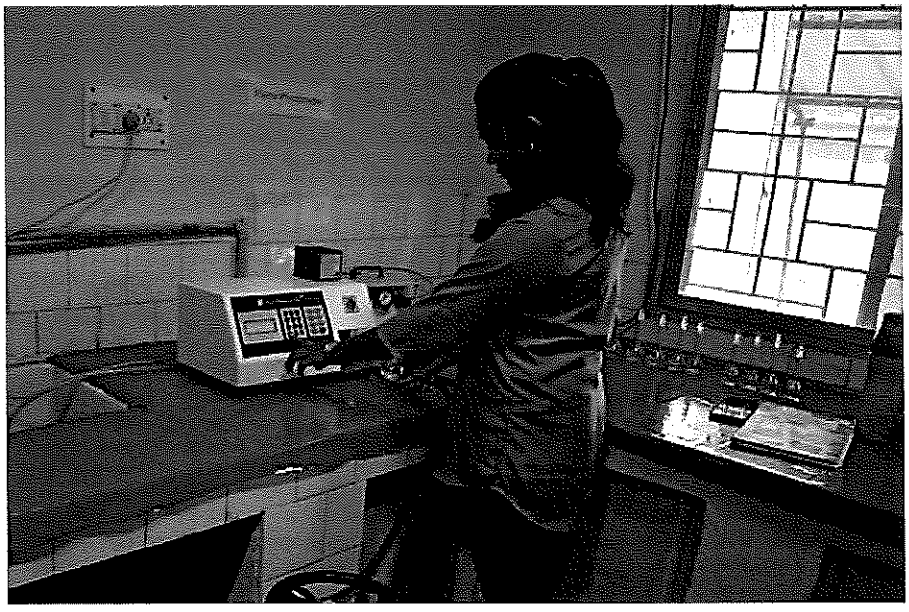
A view of the surveyed forest areas of Dubna-Sakradhi ore mine area

Layiug of tree transects/quadrats for vegetation survey at the study site

Measuring of growth parameters durlng vegetation survey at Dubna-Sakradhi vegetation study



Soll samples collection from Duhna Sakradihi mines



Analysls of soil samples in TFRI lahoratories

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OMC | ODISHA NEW OPPORTUNITIES

Annexure-IV

UNDERTAKINGS

I Dr. Suman Krishna Sit, General Manager (Geo), Authorized Signatory of OMC Ltd. for this project do hereby undertake to impiement the recommendations given by TFRI, ICFRE, Jabalpur in the ML area once the mine is put to operation and the outcome at reguiar interval shail be informed to the State Government for needful action against diversion proposai for use of 1243.27 ha of forest land for non-forestry purpose pertaining to Dubna-Sakradih Iron and Manganese Ore Mines of OMC Ltd in Keonjhar district, Odisha.

(Dr. Suman Krishna Sit)
General Manager (Geo)
Authorized Signatory

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ANNEXURE-V

OFFICE OF THE REGIONAL CHIEF CONSERVATOR OF FORESTS, ROURKELA CIRCLE, AT/P.O. PANPOSH, ROURKELA-769 004.

Memo No. 3938 /3F-1033 /2022. Date: 16.11.2022

To

The Divisional Forest Officer,
Keonjhar Division.

Sub: Proposal for non-forestry use of 1243.270 ha of forest land for mining of Iron and Manganese Ore in Dubuna-Sakradihi Iron and Manganese Ore Mines of M/s OMC Ltd. in Keonjhar District, Odisha.

Ref: Your Memo No.8604 Dtd.10.11.2022.

The scheme for afforestation of 1.5 times Safety Zone over 31.981 ha (21.3207 X 1.5) of degraded forest land identified in Chamakpur PRF under Champua Range prepared in compliance with Condition No. A.5(ii) stipulated in the Stage-I approval accorded vide F.No.8-26/2019-FC dtd.05.08.2022 of MoEF & CC, GoI in respect of the above diversion proposal with a financial outlay of Rs.1,70,86,100/- at the current wage rate of Rs.333.00/- per man day as per onetime cost norm provided by the PCCF, Odisha and submitted vide your Memo under reference is hereby technically approved.

The technically approved scheme is returned herewith for taking necessary action at your end.

Encl:- As above.

16/11/2022

Regional Chief Conservator of Forests,
Rourkela Circle

Memo No. Date:

Copy forwarded to the Principal Chief Conservator of Forests(Forest Diversion & Nodal Officer, FC Act),O/o the Pr.CCF, Odisha for favour of kind information and necessary action with reference to Memo No.8605 dtd.10.11.2022 of the DFO, Keonjhar Division.

Regional Chief Conservator of Forests,
Rourkela Circle

SCHEME FOR AFFORESTATION OF 1.5 TIMES SAFETY ZONE OVER 31.981 HA (21.3207 ha x 1.5) OF DEGRADED FOREST LAND @Rs. 333/- PER MANDAYS (AS PER ONETIME COST NORM) IDENTIFIED IN CHAMAKPUR PRF UNDER CHAMPUA RANGE OF KEONJHAR FOREST DIVISION

IN RESPECT OF

DUBUNA – SAKRADIHI IRON & MANGANESE MINES

OF

M/s ODISHA MINING CORPORATION LTD.

ELEMENTS OF THE SCHEME FOR AFFORESTATION OF 1.5 TIMES SAFETY ZONE

CHAPTER-I

BRIEF NOTE ON THE PROPOSED FOREST DIVERSION PROPOSAL

Government of India in the Ministry of Environment, Forest and Climate Change has granted Stage-I Forest Clearance vide their F. No. 8-26/2019-FC, Dt. 06.05.2021 for diversion of 1243.270 hectares of forest land pertaining to Dubna-Sakradih Iron and Manganese ore mines of M/s Odisha Mining Corporation Limited. Condition no. A.8 (iv) of Stage-I FC stipulates as given under:

"Afforestation on degraded forest land to be selected elsewhere, measuring one and half times the area under safety zone, shall also be done at the project cost under the supervisions of the State Forest Department. The degraded forest land (DFL) so selected will be informed to the MoEF&CC with shape files before Stage-II approval and afforestation will be done within three years from the date of Stage-II clearance and maintained thereafter in accordance with the approved Plan in consultation with the State Forest Department."

In order to comply the above condition a scheme over 31.981 ha (21.3207 ha x 1.5) of degraded forest land in Belda Reserved Forests near village Potal under Keonjhar Range of Keonjhar District was prepared which had been approved by the RCCF, Rourkela with a financial outlay of Rs. 1,38,53,900/-. User Agency M/s OMC Ltd. has transferred an amount of Rs. 20,91,08,458/- vide UTR No. UBINJ 22076649463 dt. 17.03.2022 which includes Rs. 1,38,53,900/-. The above scheme along with the payment details was recommended by State Forest Dept. vide letter no. 12390/9F (MG)-118/2018 dt. 22.06.2022. After scrutiny of the Stage-I compliance, MoEF&CC has sought certain information vide letter no. ,8-26/2019FC dt. 05.08.2022. Condition no. iii of the said letter is given as under:

"Examination of the degraded forest land using Google Satellite Imagery revealed that patch - I, involving degraded forest land of 28 ha, is completely planted while gap plantation seems to has been done in Patch-II. The State Government may, therefore, comment on the suitability of these areas for raising fresh afforestation as per the CA scheme approved by the CCF Rourkela".

In compliance to the above observation by MoEF&CC, an alternate land of 31.981 ha has been identified in Chamakpur PRF in Champua Range of Keonjhar Forest Division. Plantation will be taken up over 31.981 Ha. (1.5 x 21.3207 ha) of identified degraded forest area in AR mode @ 1000 plants/Ha.

The present scheme aims at preparation of a site-specific Afforestation 1.5 times Safety Zone scheme over 31.981 ha of degraded forest land identified in Chamakpur PRF under Champua Range of Keonjhar Division prepared at the prevailing wage rate @Rs. 333.00 per MD (as per onetime norm) with a maintenance period of ten years regarding Dubuna – Sakradihi Iron & Mn Mines of M/s OMC Ltd.

CHAPTER- II

DETAILS OF LAND IDENTIFIED FOR AFFORESTATION OF 1.5 TIMES SAFETY ZONE

IDENTIFICATION OF DEGRADED FOREST LAND

II(1)- Details of identified Forest land-

The identified Forest land for Afforestation of 1.5 times safety zone is situated in Chamakpur PRF under Champua Range over 31.981 ha in Keonjhar Forest Division.

II(2)- Character of existing vegetation of the identified site for Afforestation of 1.5 times Safety Zone -

The prevailing forest growth has been categorized under forest type- open jungle mainly sal in Sol Topo Sheet No. 73G5 & 73F8. The vegetation consists of Sal and its scattered associates like Jamu, Piasal, Asana, Sisoo, Kuruma, Karada, Dhaura, Khair, Sidha, Harida, Bahada and Ainla.

II(3)- Working Plan prescription for the identified site for Afforestation of 1.5 times Safety Zone-

The prescribed objectives of management for the identified forest block is depicted hereunder-

1. Regenerate of the degraded forest blocks including the areas once affected by shifting cultivation, by appropriate silvicultural inputs and protection measures with people's participation.
2. Improvement of the micro-climate and micro-edaphic conditions though soil and moisture conservation measures.
3. Encouragement of natural regeneration for increasing the biodiversity in forest crop.
4. Fulfillment of the bonafide needs of the local inhabitants for fuel wood, small timber, fodder and N.T.F.P. to the extent possible depending upon the productivity of the forests to ensure their participation.

II(4)- Suitability of the identified site for Afforestation of 1.5 times Safety Zone-

The identified site in Chamakpur PRF under Champua Range is a degraded patch with existing vegetation of Sal and Sal associates. Gaps are sporadically spread over the forest block. The topography of the area is mainly undulating hilly having good depth of red boulder mixed soil conducive for plantation under 1000 seedlings/ ha as per field situation for 31.981 ha. The average maximum temperature is 40^0 to 45^0C and minimum 5^0 to 10^0 C and annual rainfall varies from 1100 mm to 1800 mm. The maximum rainfall is received during the rainy season from July to September. The site has been demarcated with 4 feet RCC pillars with erection of durable signboard depicting Scheme, Year, User Agency, Area etc. on it.

CHAPTER-III

DELINEATION OF PROPOSED AREA ON SUITABLE MAP

III(1)- GPS COORDINATES AND GPS MAP OF THE AFFORESTATION OF 1.5 TIMES SAFETY ZONE

The area has been demarcated through GPS survey and GPS survey data showing latitude and longitude of each point and their chainage with bearing is also enclosed in the map prepared thereon (Maps enclosed).

III(2) DECISION SUPPORT SYSTEM- ANALYSIS OF FOREST COVER MAP

The map of the proposed afforestation of 1.5 times safety zone land was processed using DSS for analysis of Forest cover over the area. The result obtained are depicted in the **Annexure- I.**

Decision Support System of degraded Forest land identified in Chamakpur PRF under Champua Range

Name of the site	Area identified for plantation (in ha)	Non-Forest (in Sq. Miles)	Open Forest (in Sq. Miles)
Chamakpur PRF under Champua Range	32.00	0.26	0.06

CHAPTER- IV

AGENCY RESPONSIBLE FOR AFFORESTATION OF 1.5 TIMES SAFETY ZONE

IV(1)- AGENCY RESPONSIBLE FOR PLACEMENT OF FUNDS

The user agency shall provide funds for raising afforestation of 1.5 times safety zone as per approved scheme.

IV(2)- AGENCY RESPONSIBLE FOR EXECUTION OF AFFORESTATION OF 1.5 TIMES SAFETY ZONE

The Territorial Wing of the Forest Department i.e. Divisional Forest Officer, Keonjhar Division will be assigned with the task for execution of the afforestation of 1.5 times safety zone.

CHAPTER- V

DETAILS OF WORK SCHEDULE PROPOSED FOR AFFORESTATION OF 1.5 TIMES SAFETY ZONE

A. PLANTING PLAN

Planting Plan reflects the species-specific treatment of the identified site. Choice of species is based on the geo-morphology of the site, soil-texture, structure, fertility and depth, proneness of the site to water logging etc. Specific treatment of the site in terms of soil and moisture conservation intervention will be depicted in the treatment map. A treatment map will invariably be prepared for Species to be planted and treatments to be applied to the different patches shown in the treatment map and planting plan. This plan will be followed when actual planting is carried out.

Species to be planted: -

1. *Sizyzium cumini* (Jamu)
2. *Adina cardifolia* (Kuruma)
3. *Anogeissus latifolia* (Dhaura)
4. *Accacia catechu* (Khair)
5. *Dalbergia sissoo* (Sissoo)
6. *Azadirrachta indica* (Neem)
7. *Gmelina arborea* (Gambar)
8. *Terminalia belerica* (Bahada)
9. *Terminalia chebula* (Harida)
10. *Pongamia pinnata* (Karanja)
11. *Emblica officinalis* (Ainla)
12. *Shorea robusta* (Sal)

B.PRE-PLANTING OPERATION

B(I)-RAISING OF PLANTATION STOCK- NURSERY-

Nursery will be raised @1100 seedlings per ha including seedlings for 10% casualty replacement.

B(II)- SURVEY, DEMARCATION & PILLAR POSTING, GPS READING WITH MAPPING-

The planting area has been surveyed and demarcated with four feet height RCC pillars at inter visible distance (as per the direction of the Forest Range Officer, Champua Range) with GPS coordinates, forward and backward bearing, pillar No. and distance between pillars inscribed in it. A GPS map in the scale of 1:4000 has been prepared along with GPS co-ordinates, forward & backward bearing, pillar to pillar distance and pillar numbers reflected in the map. A sign board has been erected at a conspicuous location with name of the site, scheme, area etc. depicted on it.

B(III)- SITE PREPARATION AND SILVICULTURAL OPERATION INCLUDING CLEARANCE OF WEED, CLIMBER CUTTING, HIGH STUMP CUTTING, SINGLING OF SHOOTS-

The clearing of the site involving removal of invasive weeds, bushes, climbers, high stumps and singling of shoots will be taken up preferably by the end of February and latest by the end of March. Pits of the dimension 45 cm x 45 cm x 45 cm. will be dug @1000 seedlings for 31.981 ha in the preferably 2 months before or at least a month before planting of seedlings.

C. PLANTING OPERATION

Planting of seedlings will be taken up in the month of July. The polythene {(size 12 x 10) (300 gauge)} covering of the balls of earth will be carefully removed before planting. Care will be taken to see that the ball of earth is not broken while doing so. The seedling with the ball of earth will then be placed firmly in the pit and buried at such a depth that the root collar is well below the surface of the soil. The soil around the plant will be well compacted with the heal as a final step so that there is a proper bond between the ball and the surrounding soil. The earth close to the collar will be slightly elevated so that rain water does not accumulate very close to the plant.

D. POST PLANTING OPERATION

D(1)-CASUALTY REPLACEMENT

The entire area will be gone over in the same order as plantation was carried out and casualties, if any, will be replaced as soon as the main plantation operation is over.

D(2)-WEEDING AND SOIL WORKING

Regular and efficient weeding will start immediately after sprouting of the stumps is complete or after the seedlings have started throwing up new buds.

D(3)-MANURING AND INSECTICIDE APPLICATION

On degraded sites urban compost or farmyard manure, wherever available, will be added to the soil while refilling the pits. As regards artificial fertilizers, the minerals required and dosage @ 50 grammes of patent mixtures like 'Gromor' or N.P.K. (2:2:1) will be applied in two split doses one in August and the other in September.

D(4)-SOIL MOISTURE CONSERVATION MEASURES

Special Soil Moisture Conservation Measures will be taken up through construction of LBCD structures of dimension 10' x 10' x 5' to the tune of 32 nos.

D(5)-WATERING PROVISION

The entire plantation site and 5 nos. borewell will be dug for watering over the plantation site (one diesel pump set fitted with borewell for 5 ha plantation) with maintenance and recurring expenditure for 5 years.

D(6)-PROTECTION AGAINST FIRE AND BIOTIC INTERFERENCE

It is proposed to protect the plantation from grazing by domestic animals using Fencing Angle Iron & Chain Link wire mesh. The total length of such Fencing Angle Iron & Chain Link wire mesh for the patch which comes to 2.97 Km. Fire line tracing will be ensured to protect the plantation from fire and watch & ward will be provided as per the approved norm for protecting the plantation from grazing with involvement of Ramachandrapur VSS.

CHAPTER- VI

COST STRUCTURE OF PLANTATION, PROVISION OF FUNDS AND UTILIZATION

Base Cost Norm for AR Plantation @1000 seedlings per ha (18 months old seedlings) @ 333.00/- Mandays as per revised wage rate by Labour Commissioner, Odisha, Bhubaneswar vide Notification No. 6078/LC dated 19.10.2022 and onetime cost norm provided by the PCCF, Odisha, Bhubaneswar vide their O.O. No. 1109 dated 08.11.2021 (As per base norm of Matrix for the year 2022-23)

ANNEXURE-4

BASE COST NORM FOR COMPENSATORY AFFORESTATION (BLOCK PLANTATION)
@ 1000 PLANTS PER HECTARE (18 months old seedling)

WAGE RATE Rs- 311/- PER MANDAY

Sl. No	Items of work	Preferable Period of Execution	No of Mandays	Labour Cost (in Rs.)	Material Cost (In Rs.)	Total cost (In Rs.)
1	2	3	4	5	6	7
	0th Year (Advance work) Pre-Planting Operation					
1	Survey, Demarcation and Pillar posting	Nov/Dec	2	622	0	622
2	Preparation of Treatment Map (Digital Map)	Nov/Dec	1	311	100	411
3	Site preparation (Cleaning & removal of debrises)	Nov/Dec	12	3732	0	3732
4	Creation of 4.00 mt wide Inspection Path	Feb/Mar	1	311	0	311
5	Alignment and stacking of pits	Feb/Mar	1	311	0	311
6	Digging of pits (45 cm x 45 cm X 45 cm) in hard and gravelly soil	Feb/Mar	40	12440	0	12440
7	Construction of Temporary Labour Shed, Drinking water facility and First Aid etc	Jan/Mar	0	0	3500	3500
	Total		57	17727	3600	21327
	1st Year/Planting Year					
1	Refilling of pits by altering the dugout soil of the pits, application of organic compounds/ CDM/ FYM & mixing the same properly.	Jun/Jul	7.5	2332.50	5000	7332.50
2	Transportation of 18 months old polythene bag seedlings in hired truck /tractor from the Permanent/Mega nursery to planting site including loading & unloading (Average lead of 10 Rkm) & stacking the seedling @ Rs.6/- per Seedling (1100 nos.)	Jul/Aug	0	0	6600	6600
3	Watering polypot seedlings at planting site	Jul/Aug	2	622	0	622
4	Conveyance of polypot seedlings on head load from the stacking site to individual dugout pits within the planting site, applying insecticide, fertilizers & planting after scooping the soil with other applied materials & pressing the soil perfectely around the planted seedlings.	Jul/Aug	22.5	6997.50	0	6997.50
5	Cost of Fertilizer & Insecticide (a)NPK/Bio-fertilizer @ 50 gms/plant as basal dose = 50kg @ Rs 30/- per kg = Rs 1500.00 (b) Urea/Vermicompost/Mo Khata/any other fertilizer in two subsequent doses @ Rs 750.00 (c) Insecticide/ Bio-pesticide @ 5 gms/plant=5 kg @ Rs.150/- per kg = Rs. 750.00	Jul/Aug	0	0	3000	3000
6	Casualty Replacement @ 10% (100 nos.)	Jul/Aug	2.5	777.5	0	777.5
7	1st weeding & Manuring	Aug/Sept	12	3732	0	3732
8	2nd Weeding Soil working (1mt. diametre around the plants) & Manuring	Oct/Nov	15	4665	0	4665
9	Fire line tracing (2 m. wide fire line over 400 m long) including maintenance of inspection path	Feb/Mar	3	933	0	933
10	Watch & Ward including watering as per requirement	Aug-Mar	12	3732	0	3732
	Total		76.50	23791.50	14600.00	38391.50
	2nd Year Maintenance					
1	Transportation of 100 seedlings from Nursery to plantation site including loading, unloading & conveyance by Tractor @ Rs 6/- per seedling	Jul	0	0	600	600
2	Casualty replacement- 10%	Jul	2.5	777.5	0	777.5
3	Cost of Fertilizer & Insecticide: A) Cost of Insecticide/ Bio-pesticide @ 5 gms/plant = 0.5 Kg @ Rs 150/- per kg = Rs 75/- B) Urea/NPK/Bio-fertilizer/Vermicompost/Mo Khata/any other fertilizer @Rs. 2800/-	July/Aug	0	0	2875	2875
4	Weeding (Complete weeding), Manuring & Soil working (1mt. diametre around the plants)	Sep/Oct	15	4665	0	4665
5	Fire line tracing (2 m. wide fire line over 400 m long) including maintenance of inspection path	Feb/Mar	3	933	0	933
6	Watch & Ward including watering as per requirement	Apr-Mar	18	5598	0	5598
7	Maintenance of Temporary Labour Shed, Drinking water facility and First Aid etc	Apr-Mar		0	1000	1000
	Total		38.5	11973.5	4475	16448.5

Sl. No	Items of work	Preferable Period of Execution	No of Mandays	Labour Cost (In Rs.)	Matrial Cost (In Rs.)	Total cost (In Rs.)
1	2	3	4	5	6	7
	3rd Year Maintenance					
1	Cost of Fertilizer(Urea/NPK/Bio-fertilizer/Vermicompost/No Khata/any other fertilizer	July/Aug	0	0	2800	2800
2	Weeding (Complete weeding), Manuring & Soil working, 1 mt. diameter around the plants)	Sep/Oct	15	4665	0	4665
3	Fire line tracing (2 m. wide fire line over 400 m long) including maintenance of inspection path	Feb/Mar	3	933	0	933
4	Watch & Ward including watering as per requirement	Apr/Mar	18	5598	0	5598
5	Maintenance of Temporary Labour Shed, Drinking water facility and First Aid etc.	Apr/Mar	0	0	1000	1000
	Total		36.0	11196	3800	14996
	4th Year Maintenance					
1	Fire line tracing (2 m. wide fire line over 400 m long) including maintenance of inspection path	Feb/Mar	3	933	0	933
2	Watch & Ward including maintenece of vegetative fencing	Apr-Mar	18	5598	0	5598
	Total		21	6531	0	6531
	5th Year Maintenance					
1	Fire line tracing (2 m. wide fire line over 400 m length)	Feb/Mar	3	933.00	0	933
2	Watch & Ward	Apr/Mar	18	5598.00	0	5598
	Total		21	6531	0	6531
	6th Year Maintenance					
1	Fire line tracing (2 m. wide fire line over 400 m length)	Feb/Mar	3	933.00	0	933.0
2	Pruning of branches, Singling out of multiple shoots	Jan/Mar	3	933.00	0	933.0
3	Watch & Ward	Apr/Mar	18	5598.00	0	5598.0
	Total		24	7464	0	7464.0
	7th Year Maintenance					
1	Fire line tracing (2 m. wide fire line over 400 m length)	Feb/Mar	3	933.00	0	933
2	Watch & Ward	Apr/Mar	18	5598.00	0	5598
	Total		21	6531	0	6531
	8th Year Maintenance					
1	Fire line tracing (2 m. wide fire line over 400 m length)	Feb/Mar	3	933.00	0	933
2	Watch & Ward	Apr/Mar	18	5598.00	0	5598
	Total		21	6531	0	6531
	9th Year Maintenance					
1	Fire line tracing (2 m. wide fire line over 400 m length)	Feb/Mar	3	933.00	0	933
2	Watch & Ward	Apr/Mar	18	5598.00	0	5598
	Total		21	6531	0	6531
	10th Year Maintenance					
1	Fire line tracing (2 m. wide fire line over 400 m length)	Feb/Mar	3	933	0	933
3	Watch & Ward	Apr/Mar	18	5598.00	0	5598
	Total		21	6531	0	6531

Year wise Abstract of Cost Norm (showing seedling cost separately)

Sl. No	Items of work	Preferable Period of Execution	No of Mandays	Labour Cost (In Rs.)	Matrial Cost (In Rs.)	Total cost (In Rs.)	
1	2	3	4	5	6	7	
Sl. No	Year	No. of Mandays	Labour cost (In Rs)	Material Cost(In Rs.)	Monitoring, Evaluation, Learning, Documentation and Other Contingency (5%) of (4+5)	Cost of Seedlings @Rs.50.31 per seedlings	TOTAL COST(In Rs)
1	2	3	4	5	6	7	8
1	0th year	52.0	17727.0	3600.0	973.00	0.00	22300.00
2	1st year	76.5	23793.5	14600.0	1918.50	5534.00	95651.00
3	2nd year	38.5	11973.5	4475.0	821.50	5031.00	22301.00
4	3rd year	36.0	11196.0	3800.0	749.00	0.00	15745.00
5	4th year	21.0	6531.0	0.0	326.00	0.00	6857.00
6	5th year	21.0	6531.0	0.0	326.00	0.00	6857.00
7	6th year	24.0	7461.0	0.0	373.00	0.00	7037.00
8	7th year	21.0	6531.0	0.0	326.00	0.00	6857.00
9	8th year	21.0	6531.0	0.0	326.00	0.00	6857.00
10	9th year	21.0	6531.0	0.0	326.00	0.00	6857.00
11	10th year	21.0	6531.0	0.0	326.00	0.00	6857.00
	Total:	358.0	111330.0	26475.0	6791.0	60372.0	204976.0

Note:

1. Priority must be given to the Indigenous local species available nearby to the site of plantation.
2. 10 % indigenous fruit bearing trees must be preferred to Plantation
3. Site specific Soil conservation work like CBCD, Gully Plugging, Staggered Trench, Contour Trench, Graded Bund, etc. may be taken up
4. Chain link fencing can be adopted in the CA plantation taken up outside the forest area and Bamboo twigs fencing may be preferred
5. Watering facilites for procurement of water & watering may be adopted as per the availability of water
6. The Cost Norm of various items can be changed with the approval of the concerned RCCF's keeping the overall cost norm fixed for each Financial Year

APCCF (Forest Diversion & NO, FC Act)

Matrix for AR-1000 Plants / Ha

Matrix for Model-I A Conventional CA Plantation (AR) 1000 plants per Ha

In Rupees

Sl. NO.	Commencement Year	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	XIII	XIV	XV	XVI	XVII	XVIII	XIX	XX	XXI	Total Cost (10 Years)
Base Norm		22300	95651	22301	15745	5857	6857	7837	6857	6857	6857	5557											
1	2021-22	22300	100434	24585	18226	8335	8751	10502	9648	10131	10637	11169											234718
2	2022-23		25415	105456	25814	19137	8757	9189	11027	10130	10585	11169	11727										246454
3	2023-24			24585	110729	27105	20094	9190	9648	11578	10637	11170	11727	12313									258777
4	2024-25				25815	116265	28460	11099	9650	10130	11157	11169	11729	12313	12929								271716
5	2025-26					27106	122078	25583	11154	10133	10637	17765	11727	12315	12929	13575							285302
6	2026-27						28461	128182	31377	23767	10640	11169	13403	12313	12931	13575	14254						299567
7	2027-28							29884	134591	32546	24475	11172	11727	14073	12929	13578	14754	14967					314546
8	2028-29								31378	141371	34593	25645	11731	12313	14777	13575	14257	14967	15715				330273
9	2029-30									32947	[illegible]	36373	25928	12312	12979	15516	14354	14970	15714	15501			346788
10	2030-31										44594	155806	38139	28274	12934	13575	15292	14967	15719	15501	17376		364127

APCCF (Forest Diversion & NO, FC Act)

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Cost Norms for Creation of Afforestation of 1.5 time Safety Zone with Stabilization of Soil Moisture Conservation (SMC)

Annexure-11

Cost Norms for creation of Compensatory Afforestation with Stabilization of Soil & Conservation of Moisture (1000

WAGE RATE Rs. 311/- PER DAY

Sl.No	Item of Works	Preferable Period of Execution	Total Cost
	0th Year (Pre-Planting Operation)		
1	Nil		0
	1st Year		
2	Soil Conservation measure structures like Staggered Trench, Percolation pit, Contour trench, Graded earthen bund, LBCD, Wire mesh LBCD, Sub surface Dyke & WHS as per the slope & site requirment on LS	Apr/Sept.	20,215
	2nd Year		
3	Maintenance of SMC structures @ 15 % of initial year cost	Apr/Jul	3,032
	3rd Year		
4	Maintenance of SMC structures @ 15 % of initial year cost	Apr/Jul	3,032
	4th Year		
5	Maintenance of SMC structures @ 15 % of initial year cost	Apr/Jul	3,032
	5th Year		
6	Maintenance of SMC structures @ 15 % of initial year cost	Apr/Jul	3,032
	Total		32,343.0

Abstract

Sl. No	Year	No. person days	Labour cost @ Rs. 311/-per day	Material Cost	Total cost (Rs.)
1	0th year	0.0	0.0	0.0	0.0
2	1st year	0.0	0.0	20,215.0	20,215.00
3	2nd year	0.0	0.0	3,032.00	3,032.00
4	3rd year	0.0	0.0	3,032.00	3,032.00
5	4th year	0.0	0.0	3,032.00	3,032.00
6	5th year	0.0	0.0	3,032.00	3,032.00
	Total	0.00	0.00	32,343.0	32,343.0

Different types of SMC structures may be taken up as per the slope & requirements of the plantation site out of the design & specification of different structures annexed along this document.

ACF CF (Forest Diversion & NOL FC Act)

Matrix for (SMC)

In Rupees

Sl. NO.	Commencement Year	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	XIII	XIV	XV	XVI	Total Cost
Base Norm		0	20215	3032	3032	3032	3032											
1	2021-22	0	21276	3347	3510	3565	3870											35633
2	2022-23		0	22287	3509	3686	3884	4064										37415
3	2023-24			0	73401	3684	3870	4067	4267									39284
4	2024-25				0	34571	3854	4064	4265	4480								41248
5	2025-26					0	35803	4061	4267	4478	4704							43310
6	2026-27						0	37090	4264	4480	4701	4939						45475
7	2027-28							0	39443	4677	4704	4937	5186					47749
8	2028-29								0	79867	4701	4939	5184	5445				50136
9	2029-30									0	51360	4936	5186	5441	5717			52642
10	2030-31										0	3/9.8	5183	5446	5719	6005		55274

APCCF (Forest Diversion & NO, FC Act)

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Fencing Model F-II

Fencing for Compensatory Plantation raised outside the Forest Areas using Angle Iron & Chain Link wire mesh

Fencing Model-F-II

Fencing for Compensatory Plantation raised outside the Forest Areas using Angle Iron & Chain Link wire mesh (250 Rmt/ Ha.)

WAGE RATE Rs- 311/- PER DAY

Sl. No	Items of work	Preferable Period of Execution	Man days	Wages	Material cost (Rs)	Total Cost (Rs. per Ha.)
	0th Year (FPO)					
1	Earth work (Excavation of hole) in Hard soil at a distance 3 mt 0.40m x 0.40m x 0.40m = 0.064 x 84 = 5.376 cum @ Rs. 140/cum Rs. 754		2.12	252.62	0.0	252.6
2	Cement concrete (1:4:8) using 40 mm HBG metal 84 X 0.40m X 0.40m X 0.40m = 1.344 cum @ 3755.91/cum		0	0	5,047.4	5,047.4
3	Angle iron post of size 50 mm X 50 mm X 6 mm of height 2.40 m 84 x 2.40 = 201.60 Rmt (@4.50/kg/ Rmt = 907.20 kg @ 69.50 per kg				63,050.0	63,050.0
4	Cement concrete (1:2:4) for fixing the iron angel pole using 12 mm HBG chips 84 X 0.40m X 0.40m X 0.40m = 1.344 cum @ [illegible]/cum				22,123.0	22,123.0
5	Cost of Chain link mesh using 4 mm Dia GI wire having gap size 50 mm X 50 mm 250 Rmt X 2.10 mt = 525 Sq mt @ 331/Sqmt = Rs. 1,73,775				1,73,775.0	1,73,775.0
6	Double coat painting of iron angel pole over a coat of primer using good quality enamel paint 84 x 2.10 x 0.20 = 35.28 sqmt x Rs. 108.80/Sqmt				3,838.0	3,838.0
7	Painting of GI Chain link mesh 250 x 2.10 x 2 = 1050/10 = 105 Sqmt @ Rs. 108.80 Sqmt				11,424.0	11,424.0
8	Transportation of Chain link mesh, iron angle, Scaffolding & [illegible] chain link mess etc. @ 2% of the total cost				5,600.0	5,600.0
	TOTAL		2.12	252.62	2,84,857.4	2,85,610.0
	Rate per running mt. 2,85,610/ 250= Rs. 1142/Rmt					
	1st Year Maintenance					
1	No Maintenance is required	Sept/Oct	0	0	0	0
	2nd Year Maintenance					
1	Maintenance of wire mesh fence @ 1% per running mt. cost of installation in 1st yr (1142x 1% = 11.42 say Rs. 11)	Sept/Oct	0	0	11000	11000
	3rd Year Maintenance					
1	Maintenance of wire mesh fence @ 1% per running mt. cost of installation in 1st yr (1142x 1% = 11.42 say Rs. 11)	Sept/Oct	0	0	11000	11000
	4th Year Maintenance					
1	Maintenance of wire mesh fence @ 1% per running mt. cost of installation in 1st yr (1142x 1% = 11.42 say Rs. 11)	Sept/Oct	0	0	11000	11000
	5th Year Maintenance					
1	Maintenance of wire mesh fence @ 1% per running mt. cost of installation in 1st yr (1142x 1% = 11.42 say Rs. 11)	Sept/Oct	0	0	11000	11000
	6th Year Maintenance					
1	Maintenance of wire mesh fence @ 1% per running mt. cost of installation in 1st yr (1142x 1% = 11.42 say Rs. 11)	Sept/Oct	0	0	11000	11000
	7th Year Maintenance					
1	Maintenance of wire mesh fence @ 1% per running mt. cost of installation in 1st yr (1142x 1% = 11.42 say Rs. 11)	Sept/Oct	0	0	11000	11000
	8th Year Maintenance					
1	Maintenance of wire mesh fence @ 1% per running mt. cost of installation in 1st yr (1142x 1% = 11.42 say Rs. 11)	Sept/Oct	0	0	11000	11000
	9th Year Maintenance					
1	Maintenance of wire mesh fence @ 1% per running mt. cost of installation in 1st yr (1142x 1% = 11.42 say Rs. 11)	Sept/Oct	0	0	11000	11000
	10th Year Maintenance					

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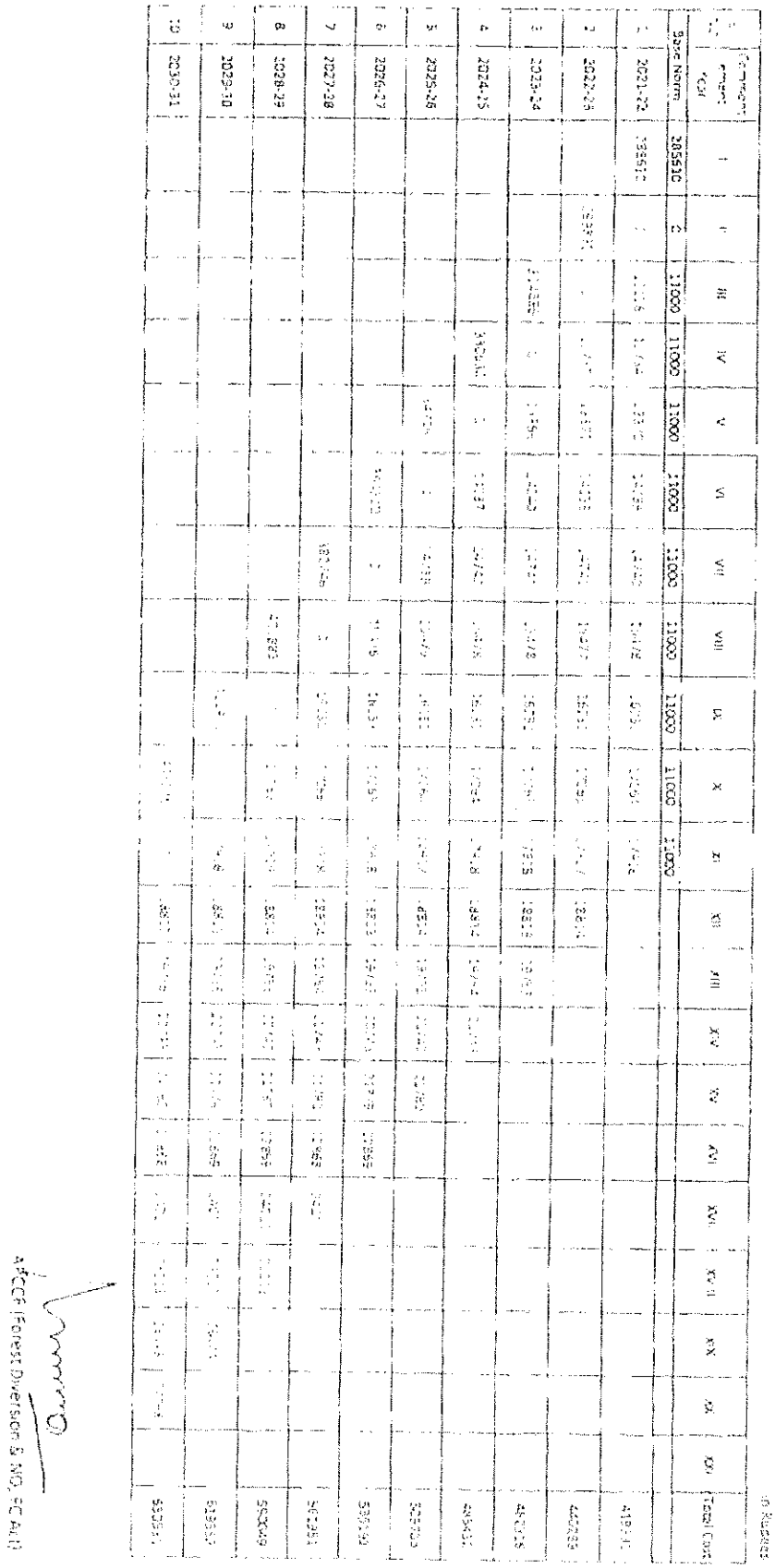
Sl. No	Items of work	Preferable Period of Execution	Man days	Wages	Material cost (Rs)	Total Cost (Rs. per Ha.)
1	Maintenance of wire fences once @ 1% per annum of cost of installation in 1st yr (1152x1 @ Rs. 11.42 say Rs.)	Sept./Oct	0	0	11000	11000

Abstract

Sl. No	Year	No. person days	Labour cost @ Rs. 311/- per day	Material Cost	Total cost (Rs.)
1	0th year	2.42	752.6	2840574	2856108.0
2	1st year	0.0	0.0	0.0	0.0
3	2nd year	0.0	0.0	11000.0	11000.0
4	3rd year	0.0	0.0	11000.0	11000.0
5	4th year	0.0	0.0	11000.0	11000.0
6	5th year	0.0	0.0	11000.0	11000.0
7	6th year	0.0	0.0	11000.0	11000.0
8	7th year	0.0	0.0	11000.0	11000.0
9	8th year	0.0	0.0	11000.0	11000.0
10	9th year	0.0	0.0	11000.0	11000.0
11	10th year	0.0	0.0	11000.0	11000.0
	Total:	2.42	752.62	3030574	3,84,610.0

APCCF (Forest Diversion & NO, FC Act)

Matrix for Model-F-II Fencing (Angle Iron & Chain Link wire mesh)



Watering Model – W-II

Watering Provision to CA Plantation

Watering Model-W-II			
Watering provision to CA Plantation			
Diesel pump set with Bore well (1 pump set + Bore well for 5 Ha Plantation), Wage rate @ Rs.311/-			
Year of Installation (0th Year)			
1	Cost of Borewell	1,50,000	
2	Cost of Diesel pump set 5HP	60,000	
3	Diesel pump set & assessories like commander, Pipes, etc.	30,000	
4	Water Storage Tanks/ Flexible pipes	15,000	
		2,55,000	
Cost of Water per Plant (2,55,000/ 5000)= Rs. 51/- Cost of Water per Ha. = Rs. 51,000/-			51,000
1st Year Watering			
1	Recurring expenditure i.e Diesel, Mobil, Engine Oil, etc. for pumping Water -21 x 1000		21,000
2	Watering 1000 Plants (Nov-Mar.) @ 200 plants/MD with 7 days rotation 20 MD x 5 months = 100 MD x 311 =		31,100
		Total	52,100
2nd Year Watering			
1	Recurring expenditure i.e Diesel, Mobil, Engine Oil, etc. for pumping Water -21 x 1000		21,000
	Maintenance Diesel pump set etc. @ 15 % of the installation cost.		7,650
2	Watering 1000 Plants (April- June & Nov-Mar. - 8 months) @ 200 plants/MD with 7 days rotation 20 MD x 8 months = 160 MD x 311 =		49,760
		Total	78,410
3rd Year Watering			
1	Recurring expenditure i.e Diesel, Mobil, Engine Oil, etc. for pumping Water -21 x 1000		21,000
	Maintenance Diesel pump set etc. @ 15 % of the installation cost.		7,650
2	Watering 1000 Plants (April- June & Nov-Mar. - 8 months) @ 200 plants/MD with 7 days rotation 20 MD x 8 months = 160 MD x 311 =		49,760
		Total	78,410
4th Year Watering			
1	Recurring expenditure i.e Diesel, Mobil, Engine Oil, etc. for pumping Water -21 x 1000		21,000
	Maintenance Diesel pump set etc. @ 15 % of the installation cost		7,650
2	Watering 1000 Plants (April- June & Nov-Mar. - 8 months) @ 200 plants/MD with 7 days rotation 20 MD x 8 months = 160 MD x 311 =		49,760
		Total	78,410
5th Year Watering			
1	Recurring expenditure i.e Diesel, Mobil, Engine Oil, etc. for pumping Water -21 x 1000=		21,000
	Maintenance Diesel pump set etc. @ 15 % of the installation cost		7,650
2	Watering 1000 Plants (April- June & Nov-Mar. - 8 months) @ 200 plants/MD with 7 days rotation 20 MD x 8 months = 160 MD x 311 =		49,760
		Total	78,410

Abstract					
Sl. No	Year	No. person days	Labour cost @ Rs. 311/-per day	Material Cost	Total cost (Rs.)
1	0th year	0	0.0	51000.0	51000.0
2	1st year	100.0	31100.0	21000.0	52100.0
3	2nd year	160	49760.0	28650.0	78410.0
4	3rd year	160	49760.0	28650.0	78410.0
5	4th year	160	49760.0	28650.0	78410.0
6	5th year	160	49760.0	28650.0	78410.0
	Total:	740	230140	186600	4,16,740

APCCF(Forest Diversion & NO, FC Act)

Matrix for Watering Model-W-II (Diesel Pumpset Fitted with Borewell) per Ha

In Rupees

Sl. NO.	Commencement Year	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	XIII	XIV	XV	XVI	Total Cost
Base Norm		5100	52100	78410	78410	78410	78410											
1	2021-22	51000	54705	86439	90771	95307	100073											478294
2	2022-23		53550	57440	90761	95210	100073	105076										502209
3	2023-24			56228	80312	95299	100076	105076	110330									527321
4	2024-25				59039	68325	100064	105080	110330	115847								553688
5	2025-26					61991	95494	105067	110334	115847	121639							581372
6	2026-27						45091	64819	110340	115851	121639	127721						610441
7	2027-28							68340	72310	115836	121644	127721	134107					640964
8	2028-29								71763	75976	121628	127706	134107	140812				573012
9	2029-30									75351	80925	127709	134113	140812	147853			706662
10	2030-31										79113	84568	134094	140813	147853	155245		741886

ARCCF (Forest Diversion & NO, FC Act)

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TOTAL COST OF PROJECT

S. No	Item of Work	Unit price	In Rupees
1	Cost of Base Norm for AR plantation @1000 plants/ ha (Year 2022-2023)	246454.00 x 31.981 ha	7881845.37
2	Cost of Soil Moisture Conservation (SMC) (2022-2023)	37415.00 x 31.981 ha	1196569.11
3	Cost of Angle Iron & Chain Link wire meshFencing with 10 years maintenance @4,40,289/- per 250 rmt/ha over 3.121 Km.	440289.00 / 250 rmt x 3121.02 rmt	5496603.10
4	Cost of 5 nos. borewell for watering (one diesel pump set fitted with borewell for 5 ha plantation)(2022-2023)	502209.00 x 5 Nos.	2511045.00
	Grand Total		**17086062.58 Or say 1,70,86,100.00**

(Rupees one crore seveuty lakh eighty-six thousaud one hundred) ouly

PROVISION OF FUNDS AND FUND UTILIZATION

Rs. 1,70,86,100/-(Rupees one crore seventy lakh eighty-six thousand one hundred) only shall be deposited by the User Agency i.e. M/s OMC Ltd on approval of the scheme to the Ad-hoc CAMPA Account and the funds will be utilized for raising of Compensatory Afforestationby the Divisional Forest Officer, Keonjhar Division on allotment by the Principal Chief Conservator of Forests, Odisha, Bhubaneswar.

Techinically Approved

Regional Chief Conservator of Forests
Rourkela Circle

Divisional Forest Officer,
Keonjhar Division

CHAPTER- VII

DETAILS OF PROPOSED MONITORING MECHANISM

Afforestation of 1.5 times Safety Zone will be taken up in the identified site by the Range Officer, Champua Range of Keonjhar Division. The Range Forest Officer, Champua Range will undertake field checks of the works undertaken at the identified site and will be cross checked by the Asst. Conservator of Forests, (Affn.) and Divisional Forest Officer, Keonjhar Division. GPS co-ordinates along with other required informations of Addl. Compensatory Afforestation will be uploaded in the e-Green watch Portal of NIC, MoEF, Govt. of India for the purpose of online monitoring. Annual progress of plantation involving growth of planted seedlings, survival percentage etc. will be monitored and recorded in the plantation journal by the field staffs of Champua and reported to the Divisional Forest Officer for necessary action. The same thing will be reported to the Regional Chief Conservator of Forests, Rourkela Circle and Chief Conservator of Forests (PP&A), O/o the Pr. Chief Conservator of Forests, Odisha, Bhubaneswar and necessary corrective measures will be followed if required so.

Divisional Forest Officer,
Keonjhar Division

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OFFICE OF THE DIVISIONAL FOREST OFFICER, KEONJHAR DIVISION
Phone No- 06766-254315, email ID- dfo.keonjhar@odisha.gov.in

No. 9002 /Mining-98/2021
Dated, Keonjhar, the 21-11- 2022

To

The Executive Director,
M/s OMC Ltd, OMC House,
Bhubaneswar- 751001

Sub: Proposal for non-forestry use of 1243.27 ha of forest land for mining of Iron and Manganese ore in Dubuna – Sakradihi Mines in favour of Odisha Mining Corporation Ltd in Keonjhar District of Odisha.

X-Sub: Demand of differential funds towards Afforestation of 1.5 times Safety Zone.

Ref: 1. F. No. 8-26/2019FC dt. 05.08.2022 of MoEF&CC, Govt. of India.
2. Memo No. 3938 dt. 16.11.2022 of Regional Chief Conservator of Forests, Rourkela Circle, Rourkela.
3. This office letter No. 8894 dt. 18.11.2022.

Sir,

With reference to the aforementioned memos on the captioned subject, you are requested to deposit the differential approved amount of **Rs. 32,32,200/-** (Rupees **thirty-two lakh thirty-two thousand two hundred**) only towards revised Afforestation of 1.5 times Safety Zone Scheme over 31.981 ha (21.3207 ha X 1.5 times) of degraded forest land identified in Chamakpur PRF under Champua Range for mining and ancillary activity in Dubuna – Sakradihi Mines in favour of Odisha Mining Corporation Ltd in Keonjhar District of Odisha as per current wage rate @Rs333.00 per MD as per onetime cost norm provided by the PCCF, Odisha, Bhubaneswar vide their O.O. No. 1109 dated 08.11.2021 (As per base norm of Matrix for the year 2022-23) with a maintenance period of ten years through e-portal of MoEF&CC as provided in the **https://parivesh.nic.in/** and the proof/evidence of the deposit of fund be submitted to this office for further necessary action at this end.

Particulars	Amount due as per revised wage rate of @Rs. 333.00 per MD as per onetime cost norm provided by the PCCF, Odisha, Bhubaneswar	Amount deposited earlier by the User Agency (Rs.)	Balance to be deposited (Rs.)
Scheme for revised Afforestation of 1.5 times Safety Zone Scheme over 31.981 ha (21.3207 ha X 1.5 times) of degraded forest land identified in Chamakpur PRF under Champua Range	1,70,86,100.00	1,38,53,900.00	32,32,200.00
Total			**32,32,200.00**

(Rnpees thirty-two lakh thirty-two thousand two hnndred) only

N.B: The demand letter issued earlier vide this office letter No. 8894 dt. 18.11.2022 is hereby cancelled.

Yours faithfully,

21/11/22

Divisional Forest Officer,
Keoujhar Division.

Address Line 2		Address Line 3	
Country			

TRI

Address Type		BIC	
Bank Code		Branch Code	
Locai Bank Code		A/c. ID	
Name		Address Line 1	
Address Line 2		Address Line 3	
Country			

Sender

BIC	UBIN0810592	Locai Bank Code	
Channel		MIRN	

UTR Number : [illegible]

OK

504

AGENCY COPY

यूनियन बैंक Union Bank of India

आन्ध्रा Andhra | कार्पोरेशन Corporation

NEFT / RTGS CHALLAN for CAMPA Funds

Date : 03-12-2022

Agency Name.	ODISHA MINING CORPORATION LTD
Application No.	5830349028
MoEF/SG File No.	8-26/2019-FC
Location.	ORRiSA
Address.	OMC HouseKhordha
Amount(in Rs)	3232200/-

Amount in Words :Thirty-Two Lakh Thirty-Two Thousand Two Hundred Rupees Only

NEFT/RTGS to be made as per following details;

Beneficiary Name:	ORRiSA CAMPA
IFSC Code:	UBIN0996335
Pay to Account No.	150825830349028 Valid only for this challan amount.
Bank Name & Address:	Union Bank Of India FCS Centre,21/1, III Floor, Jelitta Towers, Mission Road, Bengaluru-560027

- This Challan is strictly to be used for making payment to CAMPA by NEFT/RTGS only

BANK COPY

यूनियन बैंक Union Bank of India

आन्ध्रा Andhra | कार्पोरेशन Corporation

NEFT / RTGS CHALLAN for CAMPA Funds

Date : 03-12-2022

Agency Name.	ODISHA MINING CORPORATION LTD
Application No.	5830349028
MoEF/SG File No.	8-26/2019-FC
Location.	ORRISA
Address:	OMC House Khordha
Amount(in Rs)	3232200/-

Amount in Words :Thirty-Two Lakh Thirty-Two Thousand Two Hundred Rupees Only

NEFT/RTGS to be made as per following details;

Beneficiary Name:	ORRISA CAMPA
IFSC Code:	UBIN0998335
Pay to Account No.	150825830349028 Valid only for this challan amount.
Bank Name & Address:	Union Bank Of India FCS Centre, 21/1, III Floor, Jelitta Towers, Mission Road, Bengaluru-560027

- This Challan is strictly to be used for making payment to CAMPA by NEFT/RTGS only

Note:After making the required payment through challan, if the payment status has not been updated even after 7 working days, then kindly mail a copy of your challan with transaction date and reference Id to Email: fcsblr@unionbankofindia.bank , epurse@unionbankofindia.bank, ubin0903710@unionbankofindia.bank

CIS

DR. Sandhya Mishra
Addl. G.M.(F&E)
OMC Ltd.

3/12/2022

S. Mohapatra
Dy. General Manager (Fin)

UBINJ 22337708874

503

Finacle

Menu | Show Memo Pad | CCY Con

Universal Banking Solution from Infosys

03 December, 2022 | User SM622177 | 10591 | Menu Shortcut:

Maintain Payment Order

Function	I - Inquire	Payment Order ID :	000734583474
SOL ID :	10591	Transaction Type	Transfer
Payment Order Status	P - Processed	In/Out Indicator :	Outward

Payment Order | Reimbursement Details | Additional Details | Error Log | Memo | Outward Message

Help

Ordering Party

Document Type/No.			
Address Type		BIC	
Bank Code		Branch Code	
Local Bank Code		A/c. ID	
Name	ODISHA MINNING CORPORATION LTI	Address Line 1	OMC HOUSE UNIT 5 BHUBANESWAR
Address Line 2	ORISSA BHUBANESHWAR OR INDIA 7	Address Line 3	1
Country	IN	Party Code	

Ordering Institution

Address Type		BIC	UBIN0810592
Bank Code		Branch Code	
Local Bank Code		A/c. ID	
Name		Address Line 1	
Address Line 2		Address Line 3	
Country			

Sender's Correspondent

Address Type		BIC	
Bank Code		Branch Code	
Local Bank Code		A/c. ID	
Name		Address Line 1	
Address Line 2		Address Line 3	
Country			

Receiver's Correspondent

Address Type		BIC	
Bank Code		Branch Code	
Local Bank Code		A/c. ID	
Name		Address Line 1	

OFFICE OF THE PRINCIPAL CHIEF CONSERVATOR OF FORESTS
(WILDLIFE) & CHIEF WILDLIFE WARDEN, ODISHA,
BDA APARTMENT, 5TH FLOOR, PRAKRUTI BHAWAN, NILAKANTHA NAGAR, BBSR-12
Ph. No.0674-2564587, FAX No.0674-2565062
(Website:odishawildlife.org, E. mail: odishawildlife@gmail.com)

03 DEC 2016

RECEIVED F&E

No. 9432 /1WL-SSP-62/2016
Dated, Bhubaneswar the 30 Nov, 2016

7010
03-12-16

To

The Executive Director (F & E),
Odisha Mining Corporation Ltd.,
OMC House, Bhubaneswar

Sub: ***Approval of Site Specific Wildlife Conservation Plan in respect of Dubuna-Sakradihi Manganese and Iron Ore mines of M/s OMC Ltd. in Keonjhar District***

Sir,

It is to inform you that Dubuna-Sakradihi Manganese and Iron Ore mining iease area of M/s OMC Ltd. in Keonjhar district spreads over 1332.019 ha. which includes 1148.88 ha. of forest iand. Considering the presence of scheduie-I animals within the core/buffer zone of the ML area, M/s OMC Ltd. has to impiement a Site Specific Wildiife Conservation Pian to address adverse impact of mining and anciiiary activities on wiidlife in Keonjhar Division.

2. The Site Specific Wiidiife Conservation Plan in respect of the above project has been approved by the undersigned with financial forecast of **₹1218.423 lakh** (Rupees twelve crore eighteen iakh forty-two thousand three hundred) oniy for the foiiowing activities.

a.	For activities to be impiemented by the user agency in project area	₹485.123 iakh
b.	For activities to be implemented by DFO, Keonjhar Division in project impact area	₹733.300 iakh
	Grand Total:	**₹1218.423 lakh**

3. Various activities in the lease hold area wili be executed by the user agency under the guidance of the Divisional Forest Officer, Keonjhar Division. A sum of ₹733.30 iakh only wiii be deposited by the user agency in the CAMPA fund for implementation of various activities within the project impact area by the Forest Deptt. as envisaged in the pian.

SM(F&E) 13/12/16

P.T.O.

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3. The User Agency may be advised to note the following conditions for future compliance.

- This Plan may be revisited after 5 years and the User Agency will give undertaking to contribute towards the revised cost of the conservation plan till the project period, if any.
- The project proponent has to prepare and submit the Conservation Plan for the next 10 years of their lease period (balance period for which forest land remains diverted) at least one year before the expiry of the present Conservation Plan and deposit the outlay amount upon its approval. In case of delay, it will be dealt as per law for violations of Forest Conservation Act, 1980 and Environment (Protection) Act, 1986.
- The project proponent has to give an undertaking to bear the differential cost in case of enhancement of wage rate at the time of implementation of this plan.

Yours faithfully

Encl: 2 copies of approved
site specific WL Conservation Plan

30/11/18

Principal Chief Conservator of Forests (WL)
& Chief Wildlife Warden, Odisha

Memo No. 9433 /date 30.11.2018

Copy forwarded for information and necessary action to –

1. Special Secretary to Govt. of Odisha, Forest & Environment Deptt.
2. Principal Chief Conservator of Forests, Odisha
3. Regional Chief Conservator of Forests, Rourkela Circle with reference to this office memo No.7181 dt 8.9.2016
4. Divisional Forest Officer, Keonjhar Division alongwith a copy of the approved site specific wildlife conservation plan with reference to this office memo No.7180 dt 8.9.2016

Principal Chief Conservator of Forests (WL)
& Chief Wildlife Warden, Odisha

ED(F&E)

Memo No. 5846 /date 04.07.17

Copy forwarded for information and necessary action to –

1. Special Secretary to Govt. of Odisha, F&E Deptt., Bhubaneswar with reference to that Deptt. memo No.10F(Cons)1/2017-8157/F&E dt 22.04.2017
2. Principal Chief Conservator of Forests, Odisha with reference to F&E Deptt. letter No.10F(Cons)1/2017-8156/F&E dt 22.04.2017
3. Regional Chief Conservator of Forests, Koraput Circle with reference to his memo No.2182 dt 03.06.2017 alongwith a copy of approved revised financial statements. It is requested that copies of the same may be provided to DFO, Koraput/ Rayagada Division. It is further requested to submit GPS co-ordinates of proposed site of interventions in respect of both Divisions immediately.
4. Divisional Forest Officer, Koraput Division
5. Divisional Forest Officer, Rayagada Division

Principal Chief Conservator of Forests (WL)
& Chief Wildlife Warden, Odisha

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OFFICE OF THE PRINCIPAL CHIEF CONSERVATOR OF FORESTS (WIL DLIF E) &

CHIEF WILDLIFE WARDEN, ODISHA

Government of Odisha, Forest, Environment & Climate Change Department
PRAKRUTI BHAWAN, PLOT NO.1459, SAHEED NAGAR, BHUBANESWAR- 751007
Phone: 0674-2602250, Website: www.wildlife.odisha.gov.in, Email: odishawildlife@gmail.com

No. 18876 / CWLW-FDWC-FD-0053-2021

Dated, Bhubaneswar the 20 December, 2021

To

The General Manager (Geo),

Power of Attorney Holder,

Odisha Mining Corporation Ltd., Bhubaneswar

Sub: Proposal for non-forestry use of 1243.27 ha of forest land for mining of Iron and Manganese Ore in Dubuna-Sakradihi Mines in favour of M/s Odisha Mining Corporation (OMC) Limited in District Keonjhar, Odisha - Approval of Site Specific Wildlife Conservation Plan

Sir,

It is to intimate that you have to implement a Site Specific Wildlife Conservation Plan for the above mining project in compliance to the Condition No.11 in Para-A i.e. conditions which need to be complied prior to handing over of forest land by the State Forest Department and compliance is to be submitted prior to Stage-II approval, stipulated in letter in File No.8-26/2019-FC dated 06.05.2021 of Government of India, MoEF&CC, FC Division while granting Stage-I approval under Section-2 of the Forest (Conservation) Act, 1980 to the above diversion proposal.

The Site Specific Wildlife Conservation Plan in respect of the above project is hereby approved with financial forecast of Rs.600.867 lakh (Rupees six crore eighty-six thousand seven hundred) only for implementation of the activities in project impact area in Keonjhar/ Bonai Division, as detailed in the approved plan.

The total cost of Rs.600.867 lakh (Rupees six crore eighty-six thousand seven thousand) only may be deposited in State CAMPA fund through e-portal (https://parivesh.nic.in) for implementation of activities in project impact area within the above forest divisions. it is further requested to take note of the following conditions for future compliance.

- The plan may be revisited after 5 years and the user agency will give undertaking to contribute towards the revised cost of the Conservation Plan till the project period, if any.
- Should there be need for Site Specific Wildlife Conservation Plan after expiry of the present plan period, the user agency shall submit another such plan at least one year before expiry of the present Conservation Plan and deposit the outlay amount upon its approval. In case of delay, it will be dealt as per law for violations of Forest (Conservation) Act, 1980 and Environment (Protection) Act, 1986.

P.T.O.

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- The user agency shall give an undertaking to bear the differential cost in case of enhancement of wage rate during implementation of the plan.

Yours faithfully

Encl: Copy of approved SSWLCP

PCCF (WL) & CWLW, Odisha

Memo No. 18877 /dt 20/12/2021

Copy forwarded for information and necessary action to the –

1. Special Secretary to Government of Odisha, F&E Department, Bhubaneswar with reference to that Deptt. Memo No.FE-DIV-FLD-0031-2021-9415/F&E dt 21.05.2021
2. Principal Chief Conservator of Forests, Odisha with reference to his memo No.11124 dt 07.07.2021
3. Regional Chief Conservator of Forests, Rourkela Circle with reference to his memo No.3066 dt 29.10.2021
4. Divisional Forest Officer, Keonjhar/ Boani Division alongwith a copy of the approved SSWLCP

PCCF (WL) & CWLW, Odisha

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ANNEXURE-XVI

OFFICE OF THE DIVISIONAL FOREST OFFICER, KEONJHAR DIVISION
Phone No- 06766-254315, email ID- dfo.keonjhar@odisha.gov.in

No. 9184 /Mining-98/2011
Dated, Keonjhar, the 21-12-2021

To

The Executive Director, F&E,
M/s OMC Ltd, OMC House,
Bhubaneswar- 751001

Sub: Proposal for non-forestry use of 1243.27 ha of forest land for mining of Iron and Manganese ore in Dubuna -Sakradihi Mines in favour of Odisha Mining Corporation Ltd in Keonjhar District of Odisha.

X-Sub: Demand of ... : funds towards approved Site Specific Conservation Plan.

Ref: Memo No. 13876 dt. 20.12.2021 of Principal Chief Conservator of Forests, (WL), CWLW, Odisha, Bhubaneswar.

Sir

With reference to the aforementioned memo on the captioned subject, the Principal Chief Conservator of Forests, (WL), CWLW, Odisha, Bhubaneswar has approved the Site Specific Conservation Plan in respect of Dubuna –Sakradihi Mines of M/s Odisha Mining Corporation Ltd with a financial outlay of Rs. 600.867 lakh. Hence, you are requested to deposit the said approved amount of Rs. 600.867 lakh (Rupees six crore eighty-six thousand seven hundred) only towards scheme for Site Specific Wildlife Conservation Plan through e-portal of MoEF&CC as provided in the https://parivesh.nic.in/ and the proof/evidence of the deposit of fund be submitted to this office for further necessary action at this end.

Yours faithfully,
21/12/21
Divisional Forest Officer,
Keonjhar Division.

Memo No. 9185 / Dated. 21-12-2021
Copy forwarded to the Regional Chief Conservator of Forests, Rourkela Circle for favour of kind information and necessary action.

21/12/21
Divisional Forest Officer,
Keonjhar Division.

Memo No. 9186 / Dated. 21-12-2021
Copy forwarded to the Principal Chief Conservator of Forests, Forest Diversion and Nodal Officer, FC Act, O/o the Principal Chief Conservator of Forests, Odisha, Bhubaneswar/ Principal Chief Conservator of Forests, (WL), CWLW, Odisha, Bhubaneswar for favour of kind information and necessary action.

21/12/21
Divisional Forest Officer,
Keonjhar Division.

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AGENCY COPY

यूनियन बैंक Union Bank of India

आन्ध्रा Andhra

NEFT / RTGS CHALLAN for CAMPA Funds

Date : 11-03-2022

Agency Name.	ODISHA MINING CORPORATION LTD
Application No.	5830349994
MoEF/SG File No.	8-26/2019-FC
Location.	ORRISA
Address.	OMC HouseKhordha
Amount(in Rs)	209108458/-

Amount in Words :Twenty Crore Ninety-One Lakh Eight Thousand Four Hundred and Fifty-Eight Rupees Only

NEFT/RTGS to be made as per following details;

Beneficiary Name:	ORRISA CAMPA
IFSC Code:	UBIN0903710
Pay to Account No.	150825830349994 Valid only for this challan amount.
Bank Name & Address:	Union Bank Of India Lodhi Complex Branch, Block 11,CGO Complex, Phase I, Lodhi Road, New Delhi -110003

- This Challan is strictly to be used for making payment to CAMPA by NEFT/RTGS only

BANK COPY

यूनियन बैंक Union Bank of India

आन्ध्रा Andhra

NEFT / RTGS CHALLAN for CAMPA Funds

Date : 11-03-2022

Agency Name.	ODISHA MINING CORPORATION LTD
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Bank Name & Address:	Union Bank Of India Lodhi Complex Branch, Block 11,CGO Complex, Phase I, Lodhi Road, New Delhi -110003

- This Challan is strictly to be used for making payment to CAMPA by NEFT/RTGS only

After making successful payment, User Agencies may send a line of confirmation through Email: helpdeskcampa@corpbank.co.in

Note:After making the required payment through challan, if the payment status has not been updated even after 7 working days, then kindly mail a copy of your challan with transaction date to Email: cb0371@unionbankofindia.com

Sl. No.	Particulars	Amount
1	Scheme for Gap Planting and Soil & moisture conservation activities within 100 m	25942300.00
2	Scheme for one and half time safety zone	13853900.00
3	RWMP	109225558
4	SSWLCP	600.867 Lakh
Total		209108458/-

17/03/2022
S. Mohapatra
Dy. General Manager (Fin)

UBINJ2207666494630

- Plantation of short rotation species on vacant / non mineralized areas – not likely to be broken up within the present lease period.
- Adequate Solar lighting arrangement around habitations to keep wild animals away for habitation within ML area.
- Cattle immunization Program in all core villages.
- Awareness camps for children / villagers on various Road safety measures and about animal behaviors and how to respond in case of animal intrusion to the Habitation.
- The above interventions are to be implemented within ML in addition to measures suggested in the approved Mining Plan.
- The forest department will take up / implement the following measures i.e. Habitat Improvement, Planting of Fruit Bearing Species / Bamboo, Providing Clean Drinking water to animals, Creation of Water holes / maintenance of old one, Deployment of "Gaja sathi", Construction of watch Towers, Construction of a Staff barrack, Integrated Fire management, Providing Logistic Support, Augmenting Flow of intelligence, Providing Trap Camera & Accessories, Providing machans, Providing Grain Bins (Metal), Provisions for Corpus Fund, Awareness Program, installation of early warning system and Monitoring & Evaluation.
- The total project cost is estimated to be Rs 600.867 Lakh (Keonjhar Division: 375.752 lakh and Bonai Division Rs225.115 Lakh.) **(Rupees Six Crore Eighty Six Thousand And Seven Hundred OnlyOnly)**
- This plan is valid for 10 years i.e. from 2021-22 to 2030-31(***In order to extroct the totol mineral reserve , OMC will final extension of the present leose period from 27.12.2029 to 26.12.2049, for a period of another 20years).*** Another plan will be prepared one year prior to expiry of this plan, if such necessity is felt by the Chief Wildlife Warden.
- The Plan may be reviewed periodically and effectiveness of plan prescription may be evaluated. If required it may be modified after 5 year of implementation.
- This Wildlife Conservation plan has been prepared in compliance to conditions Stipulated in the Stage-I order for Diversion of 1243.27ha & TOR granted for Environment Clearance. The OMC has prepared a SSWLCP in response of Environmental Clearance directives by the EAC in their 14th Meeting held on 25.04.2011, Govt. of India, New Delhi .
- The plan though approved in 2016 no work has been implemented by U/A. No work has also been executed by Forest Department as the User Agency has not deposited the demanded amount.
- This plan is prepared keeping in view of directives contained in the Stage-I approval order & TOR. On event of its approval it will supersede the previous approved plan.