### **REPORT ON**

# FLORA AND FAUNA, WILDLIFE CONSERVATION AND MANAGEMENT PLAN, FOR DURGAPUR II/SARIYA COAL BLOCK

## **1. INTRODUCTION**

Conservation of Biodiversity has become the most important requirement of the present day world. This is because survival of the man depends upon the biodiversity. Biodiversity consists of two components: richness, or taxonomic diversity, and evenness, or the distribution of individuals among taxa. Anthropogenic factors are eroding both the richness as well as evenness components of the biodiversity, jeopardizing the survival of human race itself. This realization has initiated serious efforts towards conservation of both the components of biodiversity. One of the causes for the erosion of biodiversity has been recognized to be the mining activity. Some of the important minerals of our country are lying below the forests. Opencast mining of such areas are bound to result in the destruction or fragmentation of the habitat. If the area under mining is not having any endemic species then the mining will result only in the reduction in the gene pool, i.e. the evenness component of the biodiversity. However, mining an area with endemic species will have more drastic effect on biodiversity. Similarly, if the area falls under crucial migratory route of a species then also the mining may have some impact on such migratory species. Thus, it is required to evaluate the area, going to be mined, for any endemic and endangered species and any direct or indirect impact on biodiversity.

Mining is required for development. Then, is the mining antithesis of development? No, it cannot be, provided sufficient measures are taken to offset the impact on biodiversity. Present account is, thus, an evaluation of the status of the biodiversity of the proposed mining lease area, and proposed offset measures to any negative impact on biodiversity.

Chhattisgarh state has almost sub-tropical humid climate, a climate good to support a rich biodiversity. The state has teak, sal and mixed forests as climax communities. Further, more than 40% of its land area is covered with forests. However, only a fragmentary knowledge of biodiversity of the state is there. In the animal kingdom, richness component of almost all the mammals is known. Some listing of amphibia and fishes are also available, but for other groups of animals, very little or almost no record is available. Similarly among

plants Botanical Survey of India has published Flora for some of the districts of the state. There are several publications on the medicinal plants and some publications on the edible mushrooms of the state, but, for other groups of plants, although, some research work has been done in the universities but there are no published records of their wealth.

Points of special consideration for Biodiversity conservation are:-

- Conservation of an area should be to the extent that it develops in to an ecosystem, which is climatic climax to the area. Ultimate aim of conservation is a sustainable ecosystem.
- 2. Emphasis should not be given to the conservation of a single species. This may require altered maintenance of an ecosystem, which may lead, ultimately, to the destruction of the ecosystem.
- 3. With the shrinking of habitat, development and maintenance of extensive corridor is essential for the conservation of species, which require a large home range. This is essential because a single, reduced habitat may not be able to sustain species, requiring a large home range, for a longer period.
- 4. Conservation of forests is never antithesis to exploitation, utilization or extraction. Most important is to know the productivity of the ecosystem. Exploitation of the ecosystem up to or below the level of its productivity will maintain it at **sustainable** level. Exploitation equal to its productivity is also called the **carrying capacity** of the system. Exploitation of the system, more than its productivity will lead to the disorganization of the system. It is necessary also to know the resilience ability of the system, so that, in case of any large **natural perturbation**, its ability to return to its normal condition may be evaluated.
- 5. However, basic to any conservation plan is to know the status and required optimum biodiversity of the area. Serious efforts must be made to evaluate these two parameters: the status and required optimum biodiversity of the area, planned for conservation.
- 6. It is now the role of the policy makers to frame policy and to allocate appropriate funds to evaluate the status and required optimum biodiversity of the area, marked for conservation.

## 2. ECOLOGY OF THE AREA

Climate of the area is on the boundary of tropical to sub-tropical and dry to subhumid. Summer months are hot and dry, rainy months are very few and within four months of rainy season more than 80% of the annual rainfall is received, winter months are moderately cool. Average climatic conditions for 1996 to 2005, recorded at IMD station, Raigarh, are as follows:

Month	Temper	ature ⁰C	Rainfall	Relative	e humidity
	Max	Min	(mm)	8.30 hrs	17.30 hrs
Jan	27.96	12.04	14.17	71	52
Feb	29.97	16.20	9.30	64	45
Mar	35.72	19.64	9.05	49	34
Apr	39.93	24.71	37.90	49	29
May	42.08	27.57	23.47	42	27
Jun	37.08	26.02	202.49	64	54
Jul	31.94	25.11	324.29 82	76	
Aug	31.39	24.58	371.58	86	82
Sep	32.13	24.31	220.02	81	78
Oct	32.11	21.42	35.65	72	66
Nov	31.21	16.67	7.35 70		55
Dec	28.25	12.63	13.72	71	54
Mean/Total	33.20	20.96	1268.99	66.75	54.33

The area comes under broad category of sub-humid to dry deciduous, mixed and sal forests. Sal forest is considered to be the sub-climax leading to mixed forest as the climax formation. Natural vegetation of the area is a forest. Due to anthropogenic factors, including the cattle grazing, savanna like structures have developed. These factors are causing also rapid degradation of forest both in the plains and more importantly in the hills as well. First to disappear from the forests of the area are the timber trees like Bija (*Pterocarpus marsupium*) and Sal (*Shorea robusta*). This is then followed by the extraction of fuel wood, leading to the conversion of forests to scrub land and then to a grazing (grass) land. Soil in the area is mostly sandy loam locally called as "matasi". The area is under sub-tropical and dry to sub-humid climate. Winter is mild to cool with lowest temperature occasionally going down below 10<sup>o</sup>C in winter while the peak summer temperature may reach up to 50<sup>o</sup>C. Although occasional rains are received, but, most testing to the life is the, post monsoon, long dry

spell of about eight months. The dryness becomes more testing during the dry and hot summer months, particularly the months of March to mid June, with scorching sun. Relative humidity may go as low as 20% during this period. Typical climax vegetation of the area is sal forest. According to Champion and Seth two types of forests are visible in the area 1.  $3C/C_2e$ . The Moist Peninsular sal forest and 2. The  $3C/C_3$  Moist mixed deciduous Forest.

Sal, under best protection and lesser disturbance grows to a height of 15 to 20 m. with 0.14 to 0.18 percent basal cover. Forests in the area range from heavily degraded condition to relatively in good condition. The ground is covered with herbaceous and shrub vegetation during the rainy months up to about middle of the winter months (January), after which most of the herbaceous vegetation is dead and most of the shrubs start sheding leacves. Leaf fall of the trees start from late winter month (February) which continues to about early summer (March). Actually some plants start shedding their leaves as early as in the month of November (eg. Terminalia tomentosa) while some species may continue shedding leaves till the Month of April. However, new leaves start appearing from the middle of March and is almost complete till about the end of the month of May. April and up to about middle of the month of May are the months when the lower strata of the forest is almost totally leafless, increasing the visibility to long distances. These are the best months to observe the wildlife making them vulnerable to the poachers, also. To take a better view of the wild life, it is best to seat near a water hole, which remain very few during theses months. Dominant tree, sal, is leafless for a shorter time ranging from a few days to about a month, depending upon the sites. At moist places leafless condition of the species is for a very short time. May is the month when the maximum thickness of leaf litter is observed which continues up to the rainfall, when the disappearance of the litter starts. However, fire may cause burning of the litter from a small to large areas. Fire in the forests is very common in the area. The fire, however, does not cause much damage. Herbaceous plants have already shed their seeds, most of which survive the light surface fire. Similarly the tubers are already buried deep in the soil going unhurt due to surface fire. Trees are either leafless or have leaves very high from thr ground, hence, there is no damage to the foliage.

Disappearance of the litter, with the onset of rains, is very fast, due to hot and humid condition. Almost all the litter has disappeared till about the month of October. Teak litter is first to disappear while the sal litter may persist up to the month of December and even later. Tuberous, corm and rhizomatous forms like the members of Liliaceae and Araceae are first to appear immediately after the onset of rains, followed by the growth of other herbaceous species. Surface of the forest gets clothed well with herbaceous vegetation within only 15-20 days. Insects, mollusks and reptiles are at their peak, in the area, during this time.

Mushroom start growing after about fifteen days to a month after the onset of rains. However, *Astreus* species is special to be mentioned. This is believed to have mycorrhizal association with the sal. It starts coming up within about a week of the rainfall in the area. However, only trained persons are able to locate the mushroom because its fruiting body remains below the soil, coming up only after the fruiting body has developed to non-edible stage. Similarly, coming little later than the *Astreus* sp. is the *Termitomyces* sp. It grows on termite mounds. Both the species of mushrooms are considered to be a delicacy in the area fetching a good price in the market. Forest floor is replete with a large variety of other edible and non-edible, mycorrhizal, saprophytic, parasitic and termitomycetes fungi, more prominently the mushrooms.

The core and buffer zones include the village settlements with their cultivated fields, forest areas as well as vast areas reduced to grasslands due to heavy, anthropogenic disturbances. The disturbance includes cattle grazing and other illegal operations including collection of fire wood. The flora and fauna are similar both in core and buffer zones. The protected and reserve forest areas range from heavily disturbed to much disturbed. Chhote Jhad ka Jungle support shrubby growth of mostly the species with good coppicing ability (Lagerstroemia parviflora, Shorea robusta) or less important species (Chloroxylon swietenia). In more disturbed and open forest land Holarrhaena antidysenterica dominates with its coppices. Some open places are dominated by the small, shrub stage plants of Diospyros melanoxylon and Butea monosperma. Teak (Tectona grandis) is not a natural species of the area but has been planted at a few patches. Eucalyptus plantation is not much common in the area. Village areas are heavily infested with weeds like Hyptis suaveolens, Xanthium strumarium, Calatropis gigantea, Pennisetum pedicillatum and Ageratum conyzoides, but the notorius weed Parthenium hysterophorus has not become much problematic and has, so far not invaded the forest areas. Cultivated field bunds support good growth of Hyptis suaveolens, Themeda quadrivalvis, Iselema laxum, Heteropogon contortus, Bothriochloa pertusa and Pennisetum pedicillatum. Forest openings have grasses like Andropogon aciculatus, Andropogon fulvus, Eragrostis tenella, Aristida setacea and herbs like Hemigraphis indica, The shade support the growth of psyophyte, Oplismanus burmannii. The forests lack the Aonla (Emblica officinalis) trees mainly due to lopping and cutting of the tree for fruit collection. Village outskirts are identifiable from a distance due to presence of large Mahua (Madhuca latifolia) trees in abundance. Also common are the mango (Mangifera indica) groves near to the villages. Timber trees of larger girth, particularly Bija and Sal are almost absent. Sal being a good coppicer is able to maintain its density but the Bija is progressing rapidly towards disappearance from the forests.

The cultivated fields are generally plain areas under single crop cultivation, lying fallow for almost eight months in a year. Rice is the major crop raised in the area as kharif crop during the rainy season. The area has no irrigation facility hence Rabi crop during dry season is not possible. The waste lands are used mostly as grazing grounds. Some important features observed on these wastelands are that Aristida adscecionis is the most common species, growing abundantly on the wastelands. The species is not grazed by the cattle. At some other places coppicing of senha (Lagerstroemia parviflora) with multiple shoots is observed. At some other places wastelands are covered by the scattered, bushy growth of tendu (Diospyros melanoxylon) and Palas (Butea monosperma). These two plant species have proved to be the only plant species able to survive in these highly disturbed areas. The remaining soil surface, not covered by these bushes, are covered by the annual and perennial grasses, sedges and forbs. The village settlements are small villages. Outside the village houses, Palas (Butea monosperma) and Mahua (Madhuca latifolia) are seen commonly growing outside the village areas. These are the trees which have been left uncut during the clearing of the forest for settlement. These trees have very little fuel or timber values and are useful only when they are standing. Leaves of both the trees are used for the preparation of "Dona" and "Pattal". The Butea tree is used for Lac cultivation also. Mahua tree is the source of mahua flower used in the preparation of local alcoholic drink the "Daru or the Tharra" while its fruit yields an oil. Some mango trees are also observed outside the village areas, but are not so common in the presently applied mining lease area, as could be observed outside the village areas in other parts of Chhattisgarh.

### Water bodies are

- 1. Natural streams
- 2. Man made ponds, dug wells and tube wells

Most of the streams are of seasonal type and are restricted mainly to the forest area. The only perennial stream is the river Kelo. The river flows a long way down to the soutgh to join the river Mahanadi. The river forms also the eastern boundary of the applied mining lease area. Man made or excavated ponds are quite common in the area. In earlier days ponds and dug wells were the major source of water to the villages. A peculiar feature of the excavated ponds is that their water remains silty for a long time may be 10 to 12 years. During this period water is yellow in colour due to suspended silt. Fishes and other aquatic life is rare including the hydrophytes. The water, even then, supports a good number of frogs. The water becomes clear only after thick growth of hydrophytes. Now-a-days the

culture of excavated ponds is declining. Their places are being taken over by the tube wells. Fast increase in the number of tube wells is causing lowering down of the water table, rapidly. So far no any serious pollution has been recorded in any type of water or water bodies.

Basically the area comes under sal forest region with interspersed mixed forests. There are patches of teak (*Tectona grandis*), and kaju (*Anacardiun occidentale*) plantations within the lease area.

# 3. METHODOLOGIES

## 3.1. Data Collection

The core and buffer zones, both the areas, include revenue forests including reserve and protected forests, orange areas, *chhote jhad ka jungle, bade jhad ka jungle*, grazing lands and cultivated lands. Hence, the flora and fauna are similar in core and buffer zones and have been shown also, together. However, data were collected more rigorously for the core zone as compared to the data collection in the buffer zone.

### 3.2. Period of survey

The area was visited in the month of April 2011 and August 2011. In data collection the support and help of local forest officials were also taken. Data on the density and frequency of the tree layer were collected mainly for the reserve and protected forests and the orange areas. Information on wildlife was obtained mainly through interviews of the local people.

## 3.3. Methodology for Primary Data Collection and Analysis

The reserve, protected and orange forests were studied with the help of square and rectangular quadrants. Plants with a girth of 20cm or more in girth were taken as trees, while sapling and seedlings of trees and shrubs below 20 cm. in girth were taken as shrubs. The tree layer was sampled with 30 x 30 m square quadrats. Shrub layer was studied with the help of 20x10 m quadrants while herb layer is studied with 1x1 m quadrats. Number and girth of trees were recorded species wise in each sampling plot while for shrubs and herbs only the number was recorded in each sampling plot.

Basal area, Abundance, Frequency and density, their relative values and Importance value index (IVI) of individual specie were calculated using the following formulae:

Racal area	_	(Circumference at breast height) <sup>2</sup>				
Dasal alea	=	12.56				
Frequency (%)	_	No. of sampling plots in which the species is present				
Frequency (76)	_	Total No. of plots sampled				
Doncity $(Ho^{-1})$	_	No. of individuals of the species				
	=	Total area sampled (ha)				
Abundanco (Ha)		No. of individuals of the species				
		No. of sampling plots in which the species is present				
Relative basal area	=	Basal area of the species				
		Basal area of all the species				
Polotivo froguenov	_	Frequency of the species				
Relative frequency	=	Frequency of all the species				
Deletive Deneity		Density of the species				
Relative Density	=	Density of all the species				
Polotivo obundanco	_	Abundance of the species				
Relative abundance	=	Abundance of all the species				
IVI (of trees) =	Relativ	ve basal area + Relative frequency + Relative density				
<b>VI (Shrubs &amp; Herbs</b> ) = Relative abundance + Relative frequency + Relative density						

# 3.4. Shanon index of diversity:

A diversity index is a mathematical measure of species diversity in a community. Diversity indices provide more information about community composition than simply species richness (i.e., the number of species present); they also take the relative abundances of different species into account. Diversity indices provide important information about rarity and commonness of species in a community. Shannon diversity index (*H*) is another index that is commonly used to characterize species diversity in a community. Like <u>Simpson's</u> index, Shannon's index accounts for both abundance and evenness of the species present. The proportion of species *i* relative to the total number of species ( $p_i$ ) is calculated, and then multiplied by the natural logarithm of this proportion ( $\ln p_i$ ). The resulting product is summed across species, and multiplied by -1:

 $H = -\sum_{i=1}^{s} \operatorname{pi} \ln \operatorname{pi} = H = -\sum_{i=1}^{s} (\operatorname{Ni}/\operatorname{N} \ln \operatorname{Ni}/\operatorname{N})$ 

Shannon's equitability ( $E_H$ ) also called evenness can be calculated by dividing H by  $H_{max}$  (here  $H_{max} = \ln S$ ). Equitability assumes a value between 0 and 1 with 1 being complete evenness.

EH = H/In S

# Where:

- H = Shanon index of general diversity
- Pi = Ni = Fraction of the entire population made up of species i (IVI of ith species)
- N = Entire population (IVI of all the species)
- *EH* = Equitability or evenness index
- S = Total No. of species

Note: The power to which the base e (e = 2.7183) must be raised to obtain a number is called the **natural logarithm** (In) of the number.

Diversity has been determined only for the tree layer..

## 3.5. Secondary data

Secondary data were collected from:

- 1. Forest working Plan of the area
- 2. Information from the local people

# 4. THE CORE ZONE

# 4.1. Details of applied lease area

The core zone or the area applied for mining lease is characterized by undulating topography with elevation varying from 302 m to 330 m above MSL. The block has distinct topographic highs roughly aligned in E-W direction in the southern part. In general the slope of the ground is towards north and south.

The core zone or the area applied for mining lease consists of private land, chhote jhad ka jungle and bade jhad ka jungle as follows:

SN	Land type	Area (Ha)	Percent
1.	Revenue Private land	393.963	56.82
2.	Revenue Govt. land	29.537	4.26
3	Chhote Jhad ka Jungle on Revenue land	56.731	8.18
4.	Bade Jhad ka Jungle	134.975	19.47
5.	Protected forest land	78.120	11.27
	Total	693.326	100

The area thus consists of mostly of the revenue land mainly in the form of cultivated land with only about 11 ha of protected forest.

There are no perennial water bodies, lentic or lotic, within the ML area. There are only a few first order drains within the ML area.

# 4.2. The Revenue land:

The revenue land consists of mostly the cultivated land. The cultivated lands are of two types:

- i. Upland
- ii. Low land

# i. Upland cultivated land:

Up lands are cultivated only during the rainy months thus have only one crop. These area are generally near the village settlements. Crops cultivated on uplands as kharif crop include:

## A. Cereals

S.No.	Local Name	English Name	Botanical Name
1.	Dhan	Paddy	Oryza sativa
2.	Makka	Maize	Zea mays
	B. Pulses and oil		
1.	Arhar	Pigeon pea	Cajanus cajan
2.	Til	Sesamum	Sesamum inicum
3.	Kulthi	Horse-gram	Dolochos biflorus
4.	Kusum	Safflower	Carthemus tinctorius
5.	Urd	Black gram	Phaeolus mungo
6.	Mungphali	Ground nut	Arachis hypogea
	D. Vegetables		

1.	Tamatar	Tomato	Lycopersicum esculantum
2.	Baigan	Brinjal	Solanum melongena
3.	Bhindi	Lady's finger	Abelmoschus esculentus
4.	Barbatti	Cowpea	Vignainensis/unguiculatoo
5.	Karela	Bitter gourd	Momordica charantia
6.	Torai	Ridge gourd	Luffa acutangula
7.	Kaddu	Pumpkin	Cucurbita moschata
8.	Gilki	Sponge gourd	Luffa cylindrica
9.	Palak	Beet	Beta vulgaris
10.	Lalbhaji	Amaranth	Amaranthus spp.
11.	Rakhia Kaddu	White Gourd	Benincasa hispida
12.	Kundru		Coccinia grandis
13.	Khira	Cucumber	Cucumis sativus

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14.	Lauki	Bottle gourd	Lagenaria siceraria
15.	Chichinda	Snake gourd	Trichosanthes anguina
16	Ghuiyan	Pichigi	Colocasia esculenta
17.	Dhaniya	Coriander	Coriandrum sativum

After rainy months these area generally, lie fallow, exposed to some level of wind erosion. At some of the places with irrigation facility some rabi crops, mostly as vegetables, are raised on these uplands.

## ii. The low land cultivated land

Low lands in the ML area are all un-irrigated land. Only a single crop of rice is raised on these lands as a raifed crop. For almost eight nonths in a year these area lie fallow. Movement of cattle is a common feature in these area, scrapping any growing edible plants on these areas. In addition to the cultivated crop many species of herbaceous weeds make their appearance from late monsoon months to the end of winter months. However, all the plants die with the approach of summer months and these areas are totally devoid of any plant life during the summer months.

## 4.3. Chhote Jhad ka Jungle (Forest with smaller plants):

This is area categorised as forest only because it is in the possession of Forest department. It includes an area of 56.731 ha constituting 8.18 percent of ML area. The area is open grazing land. Some scattered bushes of tenu (*Diuospyros melanoxylon*) are present here and there. Some isolated trees of Mahua may also be observed in the area as the sole representative of forest trees. Barring the perennial tendu bushes, vegetation in the form of herbs, is present in the area only during rainy months.

## 4.4. Bade Jhad ka Jungle (Forest with larger trees):

An area of 134.975 ha is inculed under Bade Jhad ka Jungle constituting 19.47 percent of th ML area. The area of Bade Jhad ka Jungle is under two forest compartments: comaprtment No. 275 and compartment No 295 of Dharanjaigarh Forest Divisin. Both the compartments are Reserve Forest Compartments, means are the areas where all the rights of its share holders are protected. The area is free for grazing and fuel wood collection with illegal

cutting of timber wood. These activities of people have converted the area in to highly degraded forests with very diversity and density of trees. Larger trees have mostly been removed from the area hence, percent basal cover in the area is also very low. Only 7 to 8 species of trees are present in these compartments.

# 4.5. Phytosociology of trees in the Bade Jhad ka Jungle area

# IVI of Tree species of Compartment No. 275. Values are in

SN	Species	BA.	Den/	Fre	RBA	RD	RF	IVI
		cm²/ha	ha					
1.	Shorea robusta	12.194	111.21	100	52.44	47.72	62.50	162.66
2.	Terminalia tomentosa	7.493	14.66	3	32.22	6.29	1.88	40.39
3.	Madhuca latifolia	3.164	48.29	25	13.61	20.72	15.63	49.95
4.	Diospyros melanoxylon	0.12	32.54	16	0.52	13.96	10.00	24.48
5.	Anogeissus latifolia	0.062	1.27	1	0.27	0.54	0.63	1.44
6.	Wrightia tinctoria	0.153	24.15	14	0.66	10.36	8.75	19.76
7.	Carea arborea	0.067	0.95	1	0.29	0.41	0.63	1.32
Total		23.253	233.07	160	100	100	100	300

## Abbreviations:

- Fre. = Frequency
- Den. = Dendity
- BA = Basal area

- RF = Relative frequency
- RD = Relative density
- RBA = Relative basal area
- IVI = Importance value index

Shannon's index of diversity (H) = 0.0654

Evenness index (EH) = 0.0285

## **IVI of Trees species of Compartment 295**

SN	Species	BA.	Den/	Fre	RBA	RD	RF	IVI
		cm²/ha	ha					
1.	Shorea robusta	9.143	113.58	100	91.74	54.96	53.48	200.18
2.	Pterocarpus marsupium	0.175	9.33	2	1.76	4.51	1.07	7.34
3.	Terminalia tomentosa	0.073	10.03	1	0.73	4.85	0.53	6.12

4.	Madhuca latifolia	0.35	8.12	31	3.51	3.93	16.58	24.02
5.	Diospyros melanoxylon	0.125	34.37	26	1.25	16.63	13.90	31.79
6.	Anogeissus latifolia	0.016	0.94	1	0.16	0.45	0.53	1.15
7.	Mitragyna parviflora	0.039	0.86	1	0.39	0.42	0.53	1.34
8.	Wrightia tinctoria	0.045	29.44	25	0.45	14.24	13.37	28.07
Total		9.966	206.67	187	100	100	100	300

# Abbreviations:

Fre.	= Frequency	RF = Relative frequency
Den.	= Dendity	RD = Relative density
BA	= Basal area	RBA = Relative basal area

IVI = Importance value index

RBA = Relative basal area

Shannon's index of diversity (H) = 0.0480

Evenness index (EH) = 0.0198

Tree layers in both the protected forests have very low diversity as well as evenness.

# 4.6. Phytosociology of shrubs in the applied lease area

SN	Secies	Den	Fre	Abun	RD	RF	RA	IVI
1.	Acacia catechu	40	16	2.5	0.48	1.82	1.41	3.71
2.	Adina cordifolia	4	4	1	0.05	0.45	0.56	1.07
3.	Aegle marmelos	140	32	4.38	1.69	3.64	2.47	7.80
4.	Anogiessus latifolia	8	8	1	0.10	0.91	0.56	1.57
5.	Boswellia serrata	4	4	1	0.05	0.45	0.56	1.07
6.	Bridelia retusa	4	4	1	0.05	0.45	0.56	1.07
7.	Buchanania lanzan	28	16	1.75	0.34	1.82	0.99	3.14
8.	Carissa spinarum	1180	84	14.05	14.28	9.55	7.91	31.74
9.	Chloxylon swietenia	12	4	3	0.15	0.45	1.69	2.29
10.	Desmodium pulchellum	16	8	2	0.19	0.91	1.13	2.23
11.	Diospyros melanoxylon	1528	92	16.61	18.49	10.45	9.35	38.30
12.	Elaeodendron glaucum	8	4	2	0.10	0.45	1.13	1.68
13.	Embelia ribes	4	4	1	0.05	0.45	0.56	1.07

14.	Emblica officinalis	12	4	3	0.15	0.45	1.69	2.29
15.	Flacaurtia ramontchii	192	52	3.75	2.32	5.91	2.11	10.34
16.	Gardenia gummifera	124	32	3.9	1.50	3.64	2.20	7.33
17.	Gardenia sp.	252	52	4.85	3.05	5.91	2.73	11.69
18.	Gardnia turgida	172	24	7.17	2.08	2.73	4.04	8.85
19.	Grewia tiliaefolia	16	4	4	0.19	0.45	2.25	2.90
20.	Helicteres isora	4	4	1	0.05	0.45	0.56	1.07
21.	Holarrhaena antidysenterica	988	68	15.71	11.96	7.73	8.85	28.53
22.	Kydia calycina	4	4	1	0.05	0.45	0.56	1.07
23.	Lagerstroemia parviflora	432	40	10.8	5.23	4.55	6.08	15.86
24.	Lannea grandis	4	4	1	0.05	0.45	0.56	1.07
25.	Lantana camara	1724	84	20.52	20.86	9.55	11.56	41.96
26.	Madhuca latifolia	124	16	7.75	1.50	1.82	4.36	7.68
27.	Meytenus emarginatus	4	4	1	0.05	0.45	0.56	1.07
28.	Miliusa velutina	112	12	9.33	1.36	1.36	5.25	7.97
29.	Mitragyna parviflora	4	4	1	0.05	0.45	0.56	1.07
30.	Ougeinia oojeinensis	4	12	3	0.05	1.36	1.69	3.10
31.	Phoenix acaulis	4	4	1	0.05	0.45	0.56	1.07
32.	Phyllanthus emblica	28	12	2.33	0.34	1.36	1.31	3.01
33.	Soymida febrifuga	4	4	1	0.05	0.45	0.56	1.07
34.	Tectona grandis	360	48	7.5	4.36	5.45	4.22	14.03
35.	Terminalia bellerica	12	8	1.5	0.15	0.91	0.84	1.90
36.	Terminalia tomentosa	16	8	2	0.19	0.91	1.13	2.23
37.	Zyziphus oenoplea	92	24	3.83	1.11	2.73	2.16	6.00
38.	Zyziphus xylopara	600	72	8.33	7.26	8.18	4.69	20.13
	TOTAL	8264	880	177.56	100	100	100	300

# Abbreviations:

- Den = Density/ha RF = Relative frequency Fre = Frequency
  - RA = Relative abundance
- Abun = Abundance
- IVI = Importance value index
- RD = Relative density

#### SN Species Fre Abu RD RF RA IVI Den Acacia pinnata 400 0.03 0.32 0.27 1. 4 1 0.61 1 2. Acanthospermum 400 4 0.03 0.32 0.27 0.61 hispidum Ageratum conyzoides 1200 8 1.5 0.08 0.63 0.40 1.12 3. Alysicarpus vaginalis 800 4 2 0.06 0.32 0.54 0.91 4. Aristida sp. 12800 16 8 0.90 1.27 2.14 4.31 5. 400 4 1 0.27 6. Atylosia scarabaeoides 0.03 0.32 0.61 7. 2400 4 6 0.17 0.32 1.61 2.09 Blumea oxyodonta 16 3.75 1.27 1.00 2.69 Borreria hispida1 6000 0.42 8. 100400 7.05 6.01 3 54 16 60 ۵ Borreria stricta 76 13 21 Т

# 4.7. Phytosociology of herbs in the applied lease area

9.	Borrena siricia	100400	70	13.21	7.05	0.01	3.54	10.00
10.	Bothriochloa pertusa	2400	4	6	0.17	0.32	1.61	2.09
11.	Cassia mimosoides	6000	28	2.14	0.42	2.22	0.57	3.21
12.	Cassia tora	194800	60	32.47	13.68	4.75	8.69	27.12
13.	Chorcorus olitorius	45600	36	12.66	3.20	2.85	3.39	9.44
14.	Chrysopogon fulvus	11600	24	4.83	0.81	1.90	1.29	4.01
15.	Cissampelos pariera	400	4	1	0.03	0.32	0.27	0.61
16.	Crotalaria Montana	4800	20	2.4	0.34	1.58	0.64	2.56
17.	Curculigo orchioides	7600	16	4.75	0.53	1.27	1.27	3.07
18.	Cynodon dactylon	28800	44	6.55	2.02	3.48	1.75	7.26
19.	Cyperus sp.	4800	20	2.4	0.34	1.58	0.64	2.56
20.	Dactyloctenium aegyptium	1600	8	2	0.11	0.63	0.54	1.28
21.	Desmodium gangeticum	800	4	2	0.06	0.32	0.54	0.91
22.	Desmodium triflorum	144000	76	18.95	10.11	6.01	5.07	21.20
23.	Digitaria sp.	8400	20	4.2	0.59	1.58	1.12	3.30
24.	Dolichos sp	400	4	1	0.03	0.32	0.27	0.61
25.	Elephantopus scaber	18000	20	9	1.26	1.58	2.41	5.26
26.	Emilia sonchifolia	4000	20	2	0.28	1.58	0.54	2.40
27.	Eragrostis nutans	26400	28	9.43	1.85	2.22	2.52	6.59
28.	Eragrostis unioloides	5200	24	2.17	0.37	1.90	0.58	2.84
29.	Eragrostis viscosa	237600	64	37.13	16.69	5.06	9.94	31.69
30.	Eulaliopsis sp.	400	4	1	0.03	0.32	0.27	0.61
31.	Euphorbia hirta	6400	20	3.2	0.45	1.58	0.86	2.89
32.	Evolvulus alsinoides	9200	20	4.6	0.65	1.58	1.23	3.46
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33.	Evolvulus nummularius	34000	32	10.63	2.39	2.53	2.85	7.76
34.	Hemidesmus indicus	2000	20	1	0.14	1.58	0.27	1.99
35.	Heteropogon contortus	400	4	1	0.03	0.32	0.27	0.61
36.	Ionidium suffruticosum	400	4	1	0.03	0.32	0.27	0.61
37.	Iselima laxum	400	4	1	0.03	0.32	0.27	0.61
38.	Justicia simplex	800	4	2	0.06	0.32	0.54	0.91
39.	Oldenlandia corymbosa	14400	16	9	1.01	1.27	2.41	4.69
40.	Oldenlandia sp.	400	4	1	0.03	0.32	0.27	0.61
41.	Oplismanus burmanii	152000	40	38	10.67	3.16	10.17	24.01
42.	Paspalidium flavidum	6400	20	3.2	0.45	1.58	0.86	2.89
43.	Phyllanthus amarus	400	4	1	0.03	0.32	0.27	0.61
44.	Phyllanthus madaraspatana	24800	64	3.88	1.74	5.06	1.04	7.84
45.	Phyllodium sp.	400	4	1	0.03	0.32	0.27	0.61
46.	Plectranthus incanus	400	4	1	0.03	0.32	0.27	0.61
47.	Rungia repens	27600	56	4.93	1.94	4.43	1.32	7.69
48.	Salvia sp.	400	4	1	0.03	0.32	0.27	0.61
49.	Setaria glauca	3200	16	2	0.22	1.27	0.54	2.03
50.	Sida acuta	400	4	1	0.03	0.32	0.27	0.61
51.	Sida cordata	8800	8	11	0.62	0.63	2.94	4.20
52.	Sida cordifolia	107200	68	15.76	7.53	5.38	4.22	17.13
53.	Sida rhomboidea	3200	16	2	0.22	1.27	0.54	2.03
54.	Sporobolus diander	96000	56	17.1	6.74	4.43	4.58	15.75
55.	Thunbergia sp.	2400	16	1.5	0.17	1.27	0.40	1.84
56.	Tridax procumbens	1200	4	3	0.08	0.32	0.80	1.20
57.	Triumphetta annua	2000	16	1.25	0.14	1.27	0.33	1.74
58.	Vandelia brachteata	6000	12	5	0.42	0.95	1.34	2.71
59.	Vandelia crustacia	15200	16	9.5	1.07	1.27	2.54	4.88
60.	Ventilago calyculata	1200	4	3	0.08	0.32	0.80	1.20
61.	Vernonia cineria	3600	12	3	0.25	0.95	0.80	2.01
62.	Zornia gibbosa	13200	24	5.5	0.93	1.90	1.47	4.30
63.	Zyziphus xylopara	1200	4	3	0.08	0.32	0.80	1.20
TOTAL		1424000	1264	373.59	100	100	100	300

## Abbreviations:

Den = Density/ha	RF = Relative frequency
Fre = Frequency	RA = Relative abundance
Abun = Abundance	IVI = Importance value index
RD = Relative density	

# 5. FAUNA IN THE CORE ZONE

The terrestrial fauna includes common invertebrates and vertebrates. Wild faunal species like Bear, Fox and Jackal were reported to be more common than other animal species in the area. The major aquatic fauna are fishes, amphibians and water snakes. The list of faunal species is given below:

5.N.L0		a Name English Name Zoological Name Status		Act, 1972 Schedule	Part
1.	Siyar	Jackal	Canis aureus	П	П
2.	Bhalu	Sloth bear	Melursus ursinus	I	I
3.	Kharaha	Indian hare	Lepus ruficaudatus	IV	-
4.	Gilhari	squirrel	Funambulus pennant	i IV	-
5.	Chamgadad	fruit bat	Cynopterus sphinx	V	-
6.	Chooha	Field rat	Bandicota benghalen	sis V	-
7.	Lomadi	Indian fox	Vulpus benghalensis	II	II
8.	Bandar	Monkey	Macaca mulatta	III	-
9.	Neola	Mangoose	Herpetes edwardsi	IV	-
10.	Hurra	Hyaena	Hyaena hyaena	III	-
11.	Langoor	Common langur	Semnopithecus entel	lus II	I
12.	Chital	Spotted dear	Axis axis	III	-
13	Jangali billi	Jungle cat	Felis chaus	II	II
14.	Jangalisuar	Wid boar	Sus scrofa	III	-
15.	Sahi	Porcupine	Hystrix indica	IV	-

### 5.1. Mammals

# 5.2. Birds

1.	House crow	Corvrus splendens	V
2.	Comman myna	Acridotheris tristis	IV
3.	Brahminy myna	Sturnus pagodrum	IV
4.	Pied myna	Sturnus contra	IV
5.	Black drongo	Dicrurus adsimilis	IV
7.	Spotted dove	Streptopelia chinensis	IV
8.	Blue jay	Coracias benghalensis	IV
9.	Parakeet	Psittacutla krameri	IV
10.	Little Green Bee-Eater	Merops orientalis	IV
11.	Koel, Cuckoo	Eudynamys scolopaicea	IV
12.	Phakhta	Streptopelia chinensis	IV
*13.	Jangali Kaua	Corvus macrorhynchos	V
14.	Jangali Tota	Taccocua leschenaultia	IV
15.	Tania Tota	Psittacula cyanocephala	IV
16.	Tota	Psittacula krameri	IV
17.	Neelkanth	Coracias benghalensis	IV
18	Bater (Grey Quail)	Coturnix coturnix	IV
19.	Basanti (Indian cuckoo)	Cuculus micropterus	IV
20.	Kite	Milvus migrans	IV
21.	Peafowl	Pavo cristatus	Ι
22.	Redwhiskered bulbul	Pycnonotus jocosus	IV
23.	Besra Sparrow-Hawk	Accipiter vigratus	IV
24.	Paddy Bird/Pond Bird	Ardeola grayii	IV
25.	Small Blue Kingfisher	Alcido atthis	IV
26.	Scaup Duck	Aythya marila	IV
27.	Common Hoopoe	Epupa epops	IV

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# 5.3. Reptiles

1.	Dhaman/Indian Rat snake	Ptyas mucosus	II	
2.	Dhondwa/Water sanke	Enhydris enhydris	IV	
3.	Nag/Cobra	Naja naja	П	П
4.	Common Karait	Bungarus caeruleus	IV	
5.	Russel viper	Vipera ruselli	П	Ш

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6.	Sita Ki Latl	n ,	Amphiesma stolata	-	-
7.	Girgit (Ga	arden lizard)	Calotes versicolor	-	-

### 5.4. Amphibia

2	Mendhak	Bull frog	Hoplobatrachus tigerinus	IV	_
3	Mendhak	Common toads	Duttaphrvnus melanostictus	IV	_
4.	Mendhak	Skipper frog	Euphlyctis cyanophlyctis	IV	_
5.	Mendkak	Small frog	Microhyla ornata	IV	-
6.	Mendhak	Tree frog	Polypedates maculatus	IV	_
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### 5.5. Spiders and insects

#### \_\_\_\_\_ \_\_\_\_\_ 1. Hunting spider Pisarua mirabills 2. House spider Tegenaria domestica 3. Hair Dragonfly Brachytron pratense 4. Emperor Dragonfly Anax imperator 5. Grasshoppers Tettigonia viridissima (i) Common Green (ii) Rice grasshopper Hieroglyphus. Banian (iii) Common painted Pecilocerus pictus Grasshopper 6. Paddy Jassids Nephotettix apicalis 7. Skeletonizers Hyblea purea mechaerales 8. Defoliators Hepalia mauritia 9. Swarming caterpillar Spodoptera mauritia 10. Ant lion Myrmeleo sp. 11. Scolopender Scolopendra morsitans 12. Praying mantid Sphoromantis lineola 13. Common stick insect Carausius morosus 14. Cockroach Blatta orientalis 15. American cockroach Periplanata americana 16. Firefly Aracnocampa sp. \_\_\_\_\_

### 5.6. Butterfly

More than 20 species of butterfly have been recorded from the applied mining lease area. Thierteen of them have been identified clearly as given below:

- 1. Acraea violae
- 2. Eurema andersoni
- 3. Eurema brigitta
- 4. Eurema laeta
- 5. Euthalia nais
- 6. Gandeca harina
- 7. Hypolimnas bolina
- 8. Hypolimnos misippus
- 9. Junonia lemonias
- 10. Junonia orithiya
- 11. Neptis hylas
- 12. Phalanta phalantha
- 13. Tanaecia lepidea

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## 5. BUFFER ZONE

Buffer zone within 10 km radius from the applied lease area, on the basis of satellite imagery interpretation consists of more than 55% of agriculture land while forest land constitute only about 38% of the area. On the basis of census data, 2001, forest within revenue land constitute 28.76% of the area while protected forest occupy 22.92% of the area. Irrigated agriculture land is only 1.19% while un-irrigated agriculture land constitute 21.74% of the area. Generally a single crop, mostly the rice, is grown in the cultivated land in the rainy season. Then the cultivated lands generally lie fallow for almost 8 months in a year. Dense forest area is dominated by sal. The forests are at different stages of growth depending upon the period after the area has been extracted. Selective removal of trees of timber value like sal (*Shorea robusta*), bija (*Pterocarpus marsupium*), gamhar (*Gmelina arborea*) etc. has converted the areas in to open forest. Further removal of other trees like dhawra (Anogeissus latifolia) saja (*Terminalia tomentosa*) tendu (*Diospyros melanoxylon*) etc. converts the area in to scrub land. These areas are dominated by species with good coppicing ability or species multiplying with root suckers like Senha (Lagerstroemia

parviflora), tendu (*Diospyros melanoxylon*) and dudhi (*Wrightia tinctoria*). Out of these destructions mahua (*Madhuca latifolia*) is the only tree saved from scathing. Trees of mahua, left uncut, grow in to large trees with bulbos crown. Scattered presence of the tree gives savanna like appearance to the totally denuded, revenue forest areas, particularly surrounding the village settlements. Due to this and also due to the ponds, generally surrounded by large trees of bargad (*Ficus benghalensis*) and peepal (*Ficus religiosa*), occasionally with mango trees, village settlements can be recognized from great distances. Elephant is emerging as one of the causes for the destruction of crops. However, the hanuman langur, neola and parrot have also been repoted to be even more important in recent year to be a great nucence and has become a vermin not only due to destruction of the crop, but because it causes damages to the houses by moving on the earthen tiled roofs. There are some refugee settlements of migrants from Bangladesh (East Pakistan). These people cultivate tadi palm (*Borassus flabellifer*) and Chhind (*Phoenix sylvestris*) for extracting tadi (the stem sap flow), for which these Bengali migrants have special liking.

Land use	Area (Ha)	Percent
Irrigated agricultural land	575.00	1.19
Un-irrigated agricultural land	10475.00	21.74
Cultivable waste land	5343.00	11.09
Area not available for cultivation	6884.74	14.29
Forest within revenue land	13853.00	28.76
Protected forest	11041.71	22.92
Total	48172.45	100

### Land use pattern of buffer zone (As per census 2001)

### Land use details of buffer zone based on satellite imagery interpretation

Land type	Area (Sq. km)	Percent
Forests	168.24	37.77
Built-up area	14.16	3.16
Waste land	3.83	0.86
Mining area	3.99	0.90
Water body	2.78	0.62
Road/Rail	5.76	1.29
Agriculture land	242.62	55.38
Total	445.38	100

SN	Forest	Distance	Direction	Area (sq. km)
		(rm)		
1.	Semipali PF	4.21	NNE	3.96
2.	Jabga RF	5.28	NNW	6.48
3.	Marpahar RF	7.99	S	4.66
4.	Dahidang RF	4.52	ENE	15.12
5.	Sherband RF	0.08	S	18.86
6.	Fatehpur RF	4.72	W	2.70
7.	Sajapali RF	4.75	ENE	11.49
8.	Karmitikra PF	8.57	W	0.61
9.	Koilar PF	7.78	WSW	2.09
10.	Jaldega RF	9.96	NNE	0.03
11.	Semipali RF	4.09	S	8.18
12.	Chainpur RF	9.21	S	0.45
13.	Sisringa RF	9.21	S	35.79

Protected (PF) and reserve forests (RF) in the buffer zone and their	distance from the
core zone	

# 7. LIST OF PLANT SPECIES RECORDED FROM THE LEASE AND BUFFER AREA

It is difficult to prepare an exhaustive list of all the species of plants, particularly the herbs, from any sizable area. It may run in to at least 200 to 300 species. However with the above mentioned species of trees, shrubs and herbs, some other trees shrubs and herbs were recorded from the mining lease area as well as from the buffer zone. A list of the same is being given below:

## 7.1. Trees

S. No. Botanical Name		Local Name	Family
1.	Acacia catechu	Khair	Mimosaceae
2.	Acacia leucoploea	Reunjha	Mimosaceae
3.	Acacia nilotica	Babool	Mimosaceae
4.	Adina cordifolia	Haldu	Rubiaceae
5.	Aegle marmelos	Bel	Rutaceae
6.	Ailanthus excelsa	Maharukh	Simarobiaceae
7.	Albizia lebbeck	Kala siris	Mimosaceae
8.	Albizia odoratissima	Chichwa	Mimosaceae

9.	Annona squamosa	Sitaphal	Annonaceae
10.	Anogeissus pendula	Kardhai	Combretaceae
11.	Anogeissus latifolia	Dhaora	Combretaceae
12.	Azadirachta indica	Neem	Meliaceae
13.	Bauhinia malabarica	Amta, Amti	Caesalpiniaceae
14.	Bauhinia racemosa	Asta	Caesalpiniaceae
15.	Bauhinia variegata	Kachnar	Caesalpiniaceae
16.	Bombax ceiba	Semal	Bambacaceae
17.	Boswellia serrata	Salai	Burseraceae
18.	Bridelia retusa	Kasai	Euphorbiaceae
19.	Butea monosperma	Palas, Cheola	Fabaceae
20.	Casearia tomentosa	Chilla	Samydaceae
21.	Cassia fistula	Amaltas	Caesalpiniaceae
22.	Catunaregam uliginosa	Kala phetra	Rubiaceae
23.	Catunaregam spinosa	Mainphal	Rubiaceae
24.	Chloroxylon swietenia	Bhirra	Meliaceae
25.	Cochlospermum religiosum	Galgal, Gongal,	Cochlospermaceae
26.	Cordia myxa	Lasora	Boraginaceae
27.	Dalbergia latifolia	Shisham	Fabaceae
28.	Dalbergia paniculata	Dhobin, Phansi	Fabaceae
29.	Dalbergia sissoo	Sissoo	Fabaceae
30.	Diospyros melanoxylon	Tendu	Ebenaceae
31.	Ehretia laevis	Datrangi	Ehretiaceae
32.	Elaeodendron glaucum	Jamrashi	Celastraceae
33.	Emblica officinalis	Aonla	Euphorbiaceae
34.	Feronia limonia	Kainth, Kawit	Rutaceae
35.	Ficus benghalensis	Bar, Bargad	Moraceae
36.	Ficus racemosa	Umar, Gular	Moraceae
37.	Ficus infectoria	Pakar	Moraceae
38.	Ficus religiosa	Pipal	Moraceae
39.	Flacourtia ramontchii	Kakai	Flacourtiaceae
40.	Gardenia gummifera	Dikamali	Rubiaceae
41.	Garuga pinnata	Kekad	Burseraceae
42.	Gmelina arborea	Siwan, Khamer	Verbenaceae
43.	Grewia tiliaefolia	Dhaman	Tiliaceae
44.	Hymenodictyon excelsum	Bhonrsal	Rubiaceae
45.	Kydia calycina	Baranga	Malvaceae

46.	Lagerstroemia parviflora	Lendia, Seja	Lythraceae
47.	Lannea coromandelica	Moyen, Gunja,	Anacardiaceae
48.	Madhuca indica	Mahua	Sapotaceae
49.	Mangifera indica	Aam	Anacarsiaceae
50.	Miliusa tomentosa	kari	Anonaceae
51.	Mitragyna parvifolia	Kaim, Kalam, Mundi	Rubiaceae
52.	Sapindus laurifolium	Ritha	Sapindaceae
53.	Schleichera oleosa	Kusum	Sapindaceae
54.	Schrebera swietenioides	Mokha	Oleaceae
55.	Soymida febrifuga	Rohan	Meliaceae
56.	Sterculia urens	Kullu	Sterculiaceae
57.	Syzgium cumini	Jamun	Myrtaceae
58.	Tectona grandis	Sagon, Teak	Verbenaceae
59.	Terminalia arjuna	Arjun, Kahua	Combretaceae
60.	Terminalia bellirica	Bahera	Combretaceae
61.	Terminalia chebula	Harra	Combretaceae
62.	Terminalia tomentosa	Saj, Saja	Combretaceae
63.	Wrightia tinctoria	Dudhi, Kalidudhi	Apocynaceae
64.	Ziziphus mauritiana	Ber	Rhamnaceae

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# 7.2. Shrubs

- 1. Acacia catechu
- 2. Adina cordifolia
- 3. Aegle marmelos
- 4. Anogiessus latifolia
- 5. Boswellia serrata
- 6. Bridelia retusa
- 7. Buchanania lanzan
- 8. Carissa spinarum
- 9. Chloxylon swietenia
- 10. Desmodium pulchellum
- 11. Diospyros melanoxylon
- 12. Elaeodendron glaucum
- 13. Embelia ribes
- 14. Emblica officinalis
- 15. Flacaurtia ramontchii

- 16. Gardenia gummifera
- 17. Gardenia sp.
- 18. Gardnia turgida
- 19. Grewia tiliaefolia
- 20. Helicteres isora
- 21. Holarrhaena antidysenterica
- 22. Kydia calycina
- 23. Lagerstroemia parviflora
- 24. Lannea grandis
- 25. Lantana camara
- 26. Madhuca latifolia
- 27. Meytenus emarginatus
- 28. Miliusa velutina
- 29. Mitragyna parviflora
- 30. Ougeinia oojeinensis
- 31. Phoenix acaulis
- 32. Phyllanthus emblica
- 33. Soymida febrifuga
- 34. Tectona grandis
- 35. Terminalia bellerica
- 36. Terminalia tomentosa
- 37. Zyziphus oenoplea
- 38. Zyziphus xylopara

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# 7.3. Herbs

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- 1. Acacia pinnata
- 2. Acanthospermum hispidum
- 3. Ageratum conyzoides
- 4. Alysicarpus vaginalis
- 5. Aristida sp.
- 6. Atylosia scarabaeoides
- 7. Blumea oxyodonta
- 8. Borreria hispida1
- 9. Borreria stricta
- 10. Bothriochloa pertusa
- 11. Cassia mimosoides

- 12. Cassia tora
- 13. Chorcorus olitorius
- 14. Chrysopogon fulvus
- 15. Cissampelos pariera
- 16. Crotalaria Montana
- 17. Curculigo orchioides
- 18. Cynodon dactylon
- 19. Cyperus sp.
- 20. Dactyloctenium aegyptium
- 21. Desmodium gangeticum
- 22. Desmodium triflorum
- 23. Digitaria sp.
- 24. Dolichos sp
- 25. Elephantopus scaber
- 26. Emilia sonchifolia
- 27. Eragrostis nutans
- 28. Eragrostis unioloides
- 29. Eragrostis viscosa
- 30. Eulaliopsis sp.
- 31. Euphorbia hirta
- 32. Evolvulus alsinoides
- 33. Evolvulus nummularius
- 34. Hemidesmus indicus
- 35. Heteropogon contortus
- 36. Ionidium suffruticosum
- 37. Iselima laxum
- 38. Justicia simplex
- 39. Oldenlandia corymbosa
- 40. Oldenlandia sp.
- 41. Oplismanus burmanii
- 42. Paspalidium flavidum
- 43. Phyllanthus amarus
- 44. Phyllanthus madaraspatana
- 45. Phyllodium sp.
- 46. Plectranthus incanus
- 47. Rungia repens
- 48. Salvia sp.

- 49. Setaria glauca
- 50. Sida acuta
- 51. Sida cordata
- 52. Sida cordifolia
- 53. Sida rhomboidea
- 54. Sporobolus diander
- 55. Thunbergia sp.
- 56. Tridax procumbens
- 57. Triumphetta annua
- 58. Vandelia brachteata
- 59. Vandelia crustacia
- 60. Ventilago calyculata
- 61. Vernonia cineria
- 62. Zornia gibbosa
- 63. Zyziphus xylopara

# 7.4. Grasses & Bamboos (Family Poaceae)

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1.	Dicanthium annulatum	Kail
2.	Andropogon caricosus	Mothi marvel
3.	Heteropogon contrtus	Kusal, Sukal, Lampa
4.	Themeda quadrivalvis	Gunner
5.	Apluda varia	Phuli
6.	Apluda mutica	Kunda-phuli
7.	Thysanolaena maxima	Phool bahari
8.	Cynodon dactylon	Doob
9.	Dandrocalamus strictus	Bans
10.	Desmostachya bipinnata	Kush
11.	Eragrostis tenella	Bhurburi
12.	Eulaliopsis binata	Sabai, Bhabhar
13.	Iseilema laxum	Mushan
14.	Saccharum spontaneum	Kans
15.	Sorghum halepense	Berru

## 7.5. Climbers and creepers

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Abrus precatorius	Ghumchi	Fabaceae
Acacia caesia	Chilati, Gutar	Mimosaceae
Acacia pinnata	Raona, Chotichilati	Mimosaceae
Asparagus racemosus	Shataori	Liliaceae
Bauhinia vahlii	Mahul	Caesalpiniaceae
Butea superba	Palasbel	Fabaceae
Celestrus peniculata	Malkangni	Celastreceae
Cryptolepis buchanani	Nagbel	Asclepiadaceae
Dioscorea hispida	Biachandi	Dioscoreaceae
Gymnema sylvestre	Phulcat	Rhamnaceae
Ichnocarpus frutescens	Dhimarbel	Apocynaceae
Marsdenia tenacissdima	Dudhibel	Asclepiadaceae
Mucuna pruriens	Kewanch	Fabaceae
Smilax marcrophylla	Ramdaton	Liliaceae
Tinospora cordifolia	Dudhbel	Menispermaceae
Vallaris heynei	Keoti	Apocynaceae
Ventilago calyculata	Pararbel	Rhamnaceae
Ziziphus oenoplia	Makor	Rhamnaceae
	Abrus precatoriusAcacia caesiaAcacia pinnataAsparagus racemosusBauhinia vahliiButea superbaCelestrus peniculataCryptolepis buchananiDioscorea hispidaGymnema sylvestreIchnocarpus frutescensMarsdenia tenacissdimaMucuna pruriensSmilax marcrophyllaTinospora cordifoliaVallaris heyneiVentilago calyculataZiziphus oenoplia	Abrus precatoriusGhumchiAcacia caesiaChilati, GutarAcacia pinnataRaona, ChotichilatiAsparagus racemosusShataoriBauhinia vahliiMahulButea superbaPalasbelCelestrus peniculataMalkangniCryptolepis buchananiNagbelDioscorea hispidaBiachandiGymnema sylvestrePhulcatIchnocarpus frutescensDhimarbelMarsdenia tenacissdimaDudhibelSmilax marcrophyllaRamdatonTinospora cordifoliaDudhbelVallaris heyneiKeotiYentilago calyculataMakor

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## 7.6. Epiphyte

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1. Vanda tasellata

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# 7.7. Parasite

- \_\_\_\_\_
  - 1. Dendrophthoe falcata
  - 2. Viscum orientale
  - 3. Cuscuta reflexa
  - 4. Cuscuta chinensis

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# 7.8. Ferns

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- 6. Cheilanthus farinosa
- 7. Adiantum lunulatum

- 8. Marselia minuta
- 9. Lygodium flexuosum
- 10. Ceratopteris thalictroides
- 11. Cheilanthus tenuifolius

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### 7.9. Mushrooms

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- 1. Agaricus bitorquis
- 2. Agaricus campestris
- 3. Amanita caesarea
- 4. Astreaus hygrometricus
- 5. Calvatica cyathiformis
- 6. Cantharellus sp.
- 7. Clitocybe infundibuluform
- 8. Flammulina velutipes
- 9. Ganoderma lucidum
- 10. Lactarius controversus
- 11. Lentinus cladopus
- 12. Lycoperdon oblongosporum
- 13. Plerotus ostreatus
- 14. Plerotus sajor-kaju
- 15. Russla alba
- 16. Russula cyanoxantha
- 17. Russla emetica
- 18. Russla illota
- 19. Schizophylum commune
- 20. Termitomyces heimii
- 21. Termitomyces sp.
- 22. Trametes versicolor

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# 7.10. Medicinal plants

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  - 1. Abrus precatorius Ghumchi
  - 2. Achyranthes aspera Chirchira
  - 3. Aegle marmelos Bel
  - 4. Asparagus racemosus Shataori

5.	Azadirachta indica	Neem
6.	Barleria cristata	Karanta
7.	Butea monosperma	Palas, Cheola
8.	Calatropis procera	Oak
9.	Casearia tomentosa	Chilla
10.	Cassia fistula	Amaltas
11.	Celastrus paniculata	Peng
12.	Chlorophytum tuberosum	Safed musli
13.	Cochlospermum religiosum	Galgal, Gongal, Gabdu
14.	Curculigo orchioides	Kali-Musli
15.	Dioscorea bulbifera	Dang Kanda
16.	Dioscorea hispida	Biachandi
17.	Diplocyclos palmata	Sheolingi
18.	Elephantopus scaber	Hiran Khuri
19.	Embelia robusta	Baibirang
20.	Emblica officinalis	Aonla
21.	Evolvulus alsinoides	Sankhpushpi
22.	Gardenia lucida	Dikamali
23.	Grewia hirsuta	Gangerwa, Gursakri
24.	Gymnema sylvestre	Phulcat
25.	Helecteres isora	Marorphal
26.	Hemidesmus indicus	Anantmool
27.	Holarrhaena antidysenterica	Dudhi (Korea)
28.	Jatropha curcas	Ratanjot
29.	Mucuna pruriens	Kewanch
30.	Phyllanthus amarus	Bhui neem
31.	Scoparia dulce	Hazardana
32.	Smilax marcrophylla	Ramdaton
33.	Soymida febrifuga	Rohina
34.	Sphaeranthus indica	Gokhuru
35.	Spilanthus calva	Jangali akarkara
36.	Sterculia urens	Kullu
37.	Tephrosia purpurea	Sarphunka
38.	Terminalia arjuna	Arjun, Kahua
39.	Terminalia bellirica	Bahera
40.	Terminalia chebula	Harra
41.	Tinospora cordifolia	Dudhbel

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## 7.11. Hydrophytes

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- 1. Ammania baccifera
- 2. Caesulia axillaries
- 3. Canscora decurrens
- 4. Cyperus articulatus
- 5. Cyperus iria
- 6. Cyperus tegetum
- 7. Drocera burmanii
- 8. Eragrostiella nordoides
- 9. Eragrostis stenophylla
- 10. Eriocaulon quiquangulare
- 11. Gnaphalium indicum
- 12. Hydrilla verticillata
- 13. Limnophila chinensis
- 14. Melastoma malbathricum
- 15. Panicum humile
- 16. Periscaria (Polygonum) barbata
- 17. Potamogeton javanicus
- 18. Rotala indica
- 19. Utricularia exoleta
- 20. Vallisneria spiralis
- 21. Vernonia anagallis
- 22. Eragrostis gangeticum
- 23. Nitella globulifera
- 24. Chara sp.

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# 7.12. Cultivated Plants

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### A. Cereals

S.No.	Local Name	English Name	Botanical Name
1.	Dhan	Paddy	Oryza sativa
2.	Makka	Maize	Zea mays

3.	Gehu	Wheat	Triticum sp.
4.	Sawa	Millet	Panicum miliare
5.	Minjri, Madia	Millet	Eleucine coracana
	B. Pulses and oil		
1.	Arhar	Pigeon pea	Cajanus cajan
2.	Til	Sesamum	Sesamum inicum
3.	Kulthi	Horse-gram	Dolochos biflorus
4.	Kusum	Safflower	Carthemus tinctorius
5.	Urd	Black gram	Phaeolus mungo
6.	Mung	Mung gram	Phaseolus radiates
7.	Surajmukhi	Sunflower	Helianthus annus
8.	Sarson	Mustard Brass	sica campestris var. sarso
9.	Matar	Pea	Pisum sativum
10.	Mungphali	Ground nut	Arachis hypogea

# C. Fruit Crops

1.	Kela	Banana	Musa paradisiaca
2.	Aam	Mango	Mangifera indica
3.	Nibbu	Lime	Citrus aurantifolia
4.	Amrud	Guava	Psidium guajava
5.	Papita	Papaya	Carica papaya
6.	Kathal	Jack-fruit	Artocarpus heterophyllus
7.	Seetaphal	Custard-apple	Annona squamosa
8.	Ber	Jujube	Ziziphus mauritiana

# D. Vegetables

1.	Tamatar	Tomato	Lycopersicum esculantum
2.	Baigan	Brinjal	Solanum melongena
3.	Pattagovi	Cabbage	Brassica oleracea
4.	Phulgovi	Cauliflower	Brassica oleracea
5.	Ganthgovi	Knolkhol	Brassica oleracea
5.	Bhindi	Lady's finger	Abelmoschus esculentus
6.	Barbatti	Cowpea	Vignainensis/unguiculatoo

7.	Aloo	Potato	Solanum tuberosum
8.	Muli	Radish	Raphanus sativas,
9.	Karela	Bitter gourd	Momordica charantia
10.	Torai	Ridge gourd	Luffa acutangula
11.	Kaddu	Pumpkin	Cucurbita moschata
12.	Gilki	Sponge gourd	Luffa cylindrica
13.	Palak	Beet	Beta vulgaris
14.	Lalbhaji	Amaranth	Amaranthus spp.
15.	Rakhia Kaddu	White Gourd	Benincasa hispida
16.	Kundru		Coccinia grandis
17.	Khira	Cucumber	Cucumis sativus
18.	Lauki	Bottle gourd	Lagenaria siceraria
19.	Chichinda	Snake gourd	Trichosanthes anguina
20	Ghuiyan	Pichigi	Colocasia esculenta
21.	Lahson	Garlic	Allium sativum
22.	Dhaniya	Coriander	Coriandrum sativum

# 8. FUNA IN THE BUFFER ZONE

Wild faunal species like Bear, Fox and Jackal were reported to be more common than other animal species in the area. Elephant is rare but moves in the buffer area. The major aquatic fauna are fishes, amphibians and water snakes. The list of faunal species is given below:

# 8.1. Mammals

S.N.Lo	ocal Name	English Name	Zoological Name	Status WL(Pro Act, 1972) Schedule	otection Part
1.	Siyar	Jackal	Canis aureus	П	II
2.	Bhalu	Sloth bear	Melursus ursinus	I	I
3.	Kharaha	Indian hare	Lepus ruficaudatus	IV	-
4.	Gilhari	Squirrel	Funambulus pennant	ti IV	-

5.	Chamgadad	Fruit bat	Cynopterus sphinx	V	-
6.	Chooha	Field rat	Bandicota benghalensis	V	-
7.	Lomadi	Indian fox	Vulpus benghalensis	II	II
8.	Bandar	Monkey	Macaca mulatta	Ш	-
9.	Neola	Mangoose	Herpetes edwardsi	IV	-
10.	Hurra	Hyana	Hyaena hyaena	Ш	-
11.	Langoor	Common langur	Semnopithecus entellus	II	I
12.	Chital	Spotted dear	Axis axis	Ш	-
13.	Jangali billi	Jungle cat	Felis chaus	II	II
14.	Jangalisuar	Wid boar	Sus scrofa	Ш	-
15.	Chooha	Common house	Rattus rattus	V	-
16.	Hathi	Elephant	Elephas maximus	I	I
17.	Kotri	Indian muntjak	Muntiacus muntjak	Ш	
18.	Cheeta	Leopard	Panthera pardus fusca	I	I

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# 8.2. Birds

1.	House crow	Corvrus splendens	V
2.	Comman myna	Acridotheris tristis	IV
3.	Brahminy myna	Sturnus pagodarum	IV
4.	Pied myna	Sturnus contra	IV
5.	Black drongo	Dicrurus paradiseus	IV
7.	Spotted dove	Streptopelia chinensis	IV
8.	Blue jay	Coracias benghalensis	IV
9.	Parakeet	Psittacutla krameri	IV
10.	Little Green Bee-Eater	Merops orientalis	IV
11.	Koel, Cuckoo	Eudynamys scolopaicea	IV
12.	Phakhta	Streptopelia chinensis	IV
13.	Jangali Kaua	Corvus macrorhynchos	V

14.	Jangali Tota	Taccocua leschenaultia	IV	
15.	Tania Tota	Psittacula cyanocephala	IV	
16.	Tota	Psittacula krameri	IV	
17.	Neelkanth	Coracias benghalensis	IV	
18	Bater (Grey Quail)	Coturnix coturnix	IV	
19.	Basanti (Indian cuckoo)	Cuculus micropterus	IV	
20.	Kite	Milvus migrans	IV	
21.	Peafowl	Pavo cristatus	I	
22.	Redwhiskered bulbul	Pycnonotus cafer	IV	
23	Bater (Grey Quail)	Coturnix coturnix	IV	
24.	Red jungle fowl	Gallu gallus	IV	
25.	Grey jungle fowl	Gallus sonneratii	IV	
26.	Jungle myna	Acridotheres fuscus	IV	
27.	Grey heron	Aredea ceineria	IV	
28.	Golden backed woodpeacker	Brachypternus benghalensis	IV	
29.	Owl	Bubo bubo	IV	
30.	Cattle egret	Bubucus ibis	IV	
31.	Blue rock pigeon	Columba livia	IV	
32.	House crow	Corvus splendens	V	
33.	Common Hawk-cuckoo	Cuculus varius	IV	
34.	Grey patridge	Francolinus pondicerianus	IV	
35.	Grey waig tail	Motacilla cinerea	IV	
36.	House sparrow	Passer domesticus	V	
37.	Grey quail	Perdicula asiatica	IV	
38.	Roseringed parakeet	Psittacula krameri	IV	
39.	Spotted dove	Pycnonotus luteolus	IV	
40.	Common kingfisher	Alcedo atthis	IV	
41.	Pond heron	Ardeola grayii	IV	
42.	Large cormorant	Phalacrocorax carbo	IV	
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43.	Little cormorant	Phalacrocorax niger	IV	
44.	Little green heron	Ardeola striatus	IV	
45.	Little egret	Egretta garzetta	IV	
46.	Phakta	Streptopedia senegalensis	IV	
47.	Asian openbill	Anastomus oscitans	IV	
48.	Black ibis	Psedibis papillosa	IV	
49.	Greater caucal	Centropus sinensis	IV	
50.	Indian Robin	Saxicoloides fulicata	IV	
51.	Oriental Magpie Robin	Copsychus saularis	IV	

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# 8.3. Reptiles

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1.	Dhaman/Indian Rat snake	Ptyas mucosus	II	II
2.	Dhondwa/Water sanke	Enhydris enhydris	IV	
3.	Nag/Cobra	Naja naja	II	II
4.	Common Karait	Bungarus caeruleus	IV	
5.	Banded Krait	Bungarus fasciatus	IV	
6.	Russel viper	Vipera ruselli	II	II
7.	Sita Ki Lath	Amphiesma stolata	-	-
8.	Goh, Monitor lizard	Varanus benghalensis	I	II
9.	Python	Python molursus	I	II
.10.	Garden lizard	Calotes versicolor	-	-

# 8.4. Amphibia

1.	Mendhak	Bull frog	Hoplobatrachus tigerinus	IV	-
2.	Mendhak	Common toads	Duttaphrynus melanostictus	IV	-
3.	Mendhak	Skipper frog	Euphlyctis cyanophlyctis	IV	-

4.	Mendkak	Small frog	Microhyla ornata	IV	-
5.	Mendhak	Tree frog	Polypedates maculatus	IV	-
					-

# 8.5. Fishes

1.	Kotri/Karwadi	Puntius sophora
2.	Karwadi	Puntius ticto
3.	Tengna	Mystus cavasium
4.	Bam	Mastocembelus armatus
5.	Padhan	Wallago attu
6.	Magur	Clarius batrachus
7.	Singi	Heteropneustes fossilis
8.	Maral	Chana marulius
9.	Bhunda	Ophiocephalus striatus
10.	Bhanga	Labeo bata
11.	Dandai	Rasbora daniconius
12.	Karwadi	Barbus ticto
13.	Catla	Catla catla
14.	Mrigal	Cirrhina mrigala
15.	Mongri rou	Labeo fimbriatus
16.	Dingra	Mystus aor
17.	Fresh water cat fish	Mystus seenghala
18.	Singhara	Mystus vittatus

# 8.6. Spiders and insects

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Pisarua mirabills

- Tegenaria domestica 2. House spider
- 3. Hair Dragonfly Brachytron pratense
- Emperor Dragonfly Anax imperator 4.
- 5. Grasshoppers

Hunting spider

1.

(i) Common Green Tettigonia viridissima

	(ii) Rice grasshopper		Hieroglyphus. Banian	
	(iii)	Common painted	Pecilocerus pictus	
		Grasshopper		
6.	Padd	y Jassids	Nephotettix apicalis	
7.	Skele	tonizers	Hyblea purea mechaerales	
8.	Defoli	iators	Hepalia mauritia	
9.	Swarı	ming caterpillar	Spodoptera mauritia	
10.	Aphids		Rhopalosiphum maidis	
11.	Scolopender		Scolopendra morsitans	
12.	Praying mantid		Sphoromantis lineola	
13.	Common stick insect		Carausius morosus	
14.	Cockroach		Blatta orientalis	
15.	American cockroach		Periplanata americana	
16.	Firefly	/	Aracnocampa sp.	
17.	Ant lic	on	Myrmeleo sp.	

# 8.7. Butterflies

1.	Fulvous pied flat	Pseudocoladenia dan dan	IV
2.	Lemon pansy	Precis lemonias lemonias	IV
3.	Peacock pansy	Precis almana almana	IV
4.	Yellow Pansy	Precis hierta hierta	IV
5.	Blue mormon	Papilio polymnestor	IV
6.	Common mormon	Papilio polytes	IV
7.	Common Sailer	Neptis hylas	IV
8.	Chocolate Grass Yellow	Eurema sari	IV
9.	Moth	Antheraea mylitta	IV

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# 9. Schedule i species recorded from the core and buffer zones

Mining Lease area (Core zone)	Buffer zone
1. Sloth bear ( <i>Melursus ursinus</i> )	<ol> <li>Monitor lizard (<i>Varanus benghalensis</i>)</li> <li>Python (<i>Python molursus</i>)</li> <li>Peafowl (<i>Pavo cristatus</i>)</li> <li>Sloth bear (<i>Melursus ursinus</i>)</li> <li>Elephant (<i>Elephas maximus</i>)</li> </ol>
	6. Indian Leopard ( <i>Panthera pardus fusca</i> )

10. Endemic animal species:	Nil
11. Migratory animal species:	Nil
12. Route of migratory animal species:	Elephant (occassionally)

# 13. GREEN BELT

Green belts, 10m in width will be developed along the boundary of the open cast mining area. The area for green belt plantation consists of undisturbed soil, hence, plantation could be made like gap filling in a forest area. Green belt is erected not from biodiversity conservation point of view but is basically developed as a screen to check the spread of fugitive dust.

- 1. A green belt, 100m in width will be developed around the open cast mining area.
- 2. Green belt plantation will be started with the beginning of the mining and will be completed within five years from the beginning.
- To raise seedlings for plantation in the green belt a nursery will be developed. Seedlings of only local species, suitable for green belt plantation will be raised in this nursery.
- 4. Green belt plantation will be protected properly. If need arises then the saplings will be protected with tree guards. Together with the trees green belt plantation will include shrubs, climbers and some herbaceous species also. However, only local species will be used in the plantation.
- 5. Green belt will help in reducing the spread of fugitive dust and noise from the mining area.

- 6. Selection of plants for green belt plantation will be made on following criteria:
- Having tolerance to dust pollution.
- Should maintain leaves for as longer a time as possible.
- Combination of plants should be such so that almost a screen of plants is formed to check the dust from escaping the area. Thus the green belt plants will consist of mainly the trees and shrubs with some herbs also.
- The trees should provide shade.
- Plants possessing economic and/or aesthetic value should be given preference.
- Trees less affected due to pruning should be given preference because pruning will yield fuel wood.
- Every plant species to be planted in the green belt should have some basis for its selection to be planted in the green belt.
- Only local species will be taken for plantation.

Green belt will be developed with the aim to form a curtain to check the spread of fugitive dust. Hence, the belt will consist of trees, shrubs and lianas and climbers. With these above considerations following, local plant species will be taken for green belt plantation.

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# 13.1. Trees

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- 1. Imli (*Tamarindus indica* seed)
- 2. Mahua (Madhuca latifolia- seed)
- 3. Saja (Terminalia tomentosa seed)
- 4. Aam (Mangifera indica seed, seedling transplantation)
- 5. Kumhi (Careya arborea seed)
- 6. Rohan (Soymida febrifuga seed)
- 7. Sidha (Lagerstroemia parviflora seed)
- 8. Bargad (Ficus benghalensis Transplantation)
- 9. Pipal (Ficus religiosa Transplantation)
- 10. Umar (Ficus racemosa Transplantation)
- 11. Pakar (Ficus infectoria Transplantation)
- 12. Neem (Azadirachta indica- seed)
- 13. Sal (Shorea robusta- seed)
- 14. Karanj (Pongamia pinnata seed)
- 15. Haldu (Adina cordifolia seed)

- 16. Bel (Aegle marmelos Seed)
- 17. Maharukh (Ailanthus excelsa Seed)
- 18. Kala sisris (Albizzia lebbeck seed)
- 19. Chichwa (Albizzia odoratissima seed)
- 20. Asta (Bauhinia racemosa seed)
- 21. Kasai (Bridelia retusa seed)
- 22. Amaltas (Cassia fistula seed)
- 23. Mainphal (Catunaregam spinosa seed)
- 24. Lasora (Cordia myxa seed)
- 25. Jamrashi (Elaeodendron glaucum seed)
- 26. Bhonrsal (Hymenodictyon excelsum seed)
- 27. Baranga (Kydia calycina seed)
- 28. Kari (Miliusa tomentosa seed)
- 29. Kusum (Schleichera oleosa seed)
- 30. Jamun (Syzgium cumini seed)

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# 13.2. Shrubs

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- 1. Chilhi (Casearia tomentosa seed)
- 2. Dikamali (Gardenia gummifera seed)
- 3. Adusa (Adhatoda vasica seed)
- 4. Akol (Alangium salvifolium seed)
- 5. Karonda (Carissa spinarum seed)
- 6. Chipti (*Desmodium pulchellum* seed)
- 7. Chapar (*Moghamia chapar* seed)
- 8. Baibirang (*Embelia ribes* seed)
- 9. Marodphali (Helecteres isora seed)
- 10. Dudhi (Holarrhena antidysentirica seed, transplantation)

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# 13.3. Climbers and Lianas

- -----
- 1. Satawar (Asparagus racemosus seed, tuber)
- 2. Mahul (Bauhinia vahlii seed)
- 3. Palasbel (Spatholobus roxburghii seed)
- 4. Malkangni (Celestrus peniculata seed)
- 5. Baichandi (Dioscorea hispida tuber, bulbil)

- 6. Dangkanda (Dioscorea bulbifera seed, tuber, bulbil)
- 7. Gudmar (Gymnema sylvestre cutting, seed)
- 8. Dhimarbel (Ichnocarpus frutescens seed)
- 9. Ramdaton (Smilax zeylanica seed)
- 10. Guruch (*Tinospora cordifolia* cutting, seed)
- 11. Keoti (Vallaris heynei seed)
- 12. Keoti (Ventilago calyculata seed)

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Green belt development will be started immediately after the sanction of permission for mining and will be completed within 5 years after starting the mining.

# 14. OVERBURDEN DUMP MANAGEMENT

The overburden soil will first be dumped, temporarily and then later on it will be used for filling the void. The overburden consists of two types of soil:

**I).** The top soil about 0.5 meter average in thickness. It is rich in nutrients and suitable for plant growth, and

**II).** The lower soil, which in true sense is not a soil but is earth, because in this soil organic matter is poor and is generally poor in nutrients required for plant growth.

#### 15. BACKFILL DUMP

#### 15.1. Top soil dump

Total top soil generated during the life of mine will be stacked separately in a soil stack pile. It will be used for growing plants along the fringes of the site roads and reclaimation of external dump and back filled area. Top soil stockpile will be of low height, maximum up to 3 m. To prevent unwanted washing down and erosion of this soil dump soil binding, grass and herbaceous species will be grown on this soil, till the time it is shifted again for back filling of the mine void. Some of the species included will be the species of *Andropogon, Chrysopogon, Saccharum, Iseilema* etc. To provide nitrogen to the non-nitrogen fixing plants, plants of a very good nitrogen fixing genus *Sesbania* will also be

planted through seeds. About 0.07 Mcum stock (loose max) of the top soil will be kept over an area of 2.0 ha. Extra generation of top soil will be utilized in two ways: part of the surplus top soil will be used for reclamation whereas the rest will be stacked at pit head temporarily for consecutive laying over backfilling.

# 15.2. Bio Reclaimation of backfilled area

The soil used for backfilling will be a better soil than the original soil because during dumping some leaf litter will be added to it and some grasses will be promoted to grow on it through seed sowing.

Biological reclamation will be done to transform the degraded land and waste dump into a self - sustaining ecologically stable land. This will prevent soil erosion, dust pollution and will create aesthetic beauty. Re-vegetation of waste dump through systematic means, increases the slope stability, enhances the infiltration of rain water and its availability, increases the soil fertility and promotes natural regeneration of native plant species.

With spreading of top soil layer the surface is ready for bio-reclamation it is recommended to plant saplings of selected species by pit plantation technique. A circularpit of 0.6 m dia and 1m depth will be at spacing of 2m x 2m on both sides. It will be filled with a mixture of top soil and organic fertilizer. Sapplings would be planted in the prepared pit. Plantation should be done at the onset of monsoon.

Up to year	Area mined	Backfilled area	Planted area (ha)
1	25.86	0.00	0.00
2	37.24	0.00	0.00
3	58.95	0.00	0.00
4	82.85	0.00	0.00
5	113.71	0.00	0.00
6-8	80.00	5.00	0.00
Conceptual (36)	540.75	299.43	299.43

#### Reclamation of excavated and backfilled area

# 15.3. Species Selection for Reclamation of the Area

Successful bio-reclamation would largely depend on the selection of appropriate species for re- vegetation. While selecting plant species following parameters will be considered.

- Local and native to the soil
- Nitrogen fixing leguminous species will form at least 30% of the total plantation.
- Shrubs, herbs and grasses to check soil erosion and development of fertile soil.

Apart from above top Soil management will be done to ensure the inoculation of Micro-organism, seed, organic matter etc.

# 15.4. The Plantation

Criteria for the selection of plants:

Plant species selected for plantation in the backfilled, overburden soil should possess any or more of the following properties.

- a. Have soil binding property.
- b. Be a nitrogen fixer.
- c. Be able to tolerate, at least to some extent, the crack formation in the soil.
- d. Have drought tolerance ability.
- e. Be able to grow in a slope.
- f. Be able to grow in nutrient and organic matter poor soil.
- g. Be a local species.

Plantation of the overburden soil will be taken up in two phases.

# Phase: I

The first phase will be aimed to establish plants, which will make the overburden soil suitable for plantation and/or natural growth of the local species.

# Phase: II

Second phase will then vagetate the area, introducing as much local biodiversity as possible with the aim to develop a natural ecosystem, prevalent in the area. The first phase of stabilization of the overburden soil is expected to take 3-4 years. After that, in the

overburden soil reclamation area, the local tree, shrub, herb, grasses and sedges and climber species, inhabiting the nearby forest area, will be introduced. This will lead, gradually, to the development of a natural forest and thus the natural ecosystem, in the area.

Some of the species, included in backfilled plantation are listed below. Seedlings of these species will be transplanted in pits mixed with organic manure.

#### Trees:

Kala siris (Albizzia lebbeck) Sisam (Dalbergia sissoo) Imli (Tamarindus indica) Mahua (Madhuca latifolia) Aam (Mangifera indica) Rohan (Soymida febrifuga) Sidha (Lagerstroemia parviflora) Bargad (Ficus benghalensis) Pipal (Ficus religiosa) Umar (Ficus racemosa) Pakar (Ficus infectoria) Neem (Azadirachta indica) Sal (Shorea robusta) Karanj (Pongamia pinnata) Bel (Aegle marmelos) Maharukh (Ailanthus excelsa) Chichwa (Albizzia odoratissima) Asta (Bauhinia racemosa) Kasai (Bridelia retusa) Amaltas (Cassia fistula) Mainphal (Catunaregam spinosa) Lasora (Cordia myxa) Jamrashi (*Elaeodendron glaucum*) Baranga (*Kydia calycina*) Kari (Miliusa tomentosa) Kusum (Schleichera oleosa) Bakain (Melia azadirach) Tendu (*Diospyros melanoxylon*) Char (Buchanania lanzan)

# Shrubs

Chilhi (*Casearia tomentosa*) Dikamali (*Gardenia gummifera*) Adusa (*Adhatoda vasica*) Akol (*Alangium salvifolium*) Karonda (*Carissa spinarum*) Chipti (*Desmodium pulchellum*) Chapar (*Moghamia chapar*) Baibirang (*Embelia ribes*) Marodphali (*Helecteres isora*) Dudhi (*Holarrhena antidysentirica*) *Flemingia nana Moghamia bracteata* 

# Herbs including legumes, grasses, sedges and forbs:

These species will be introduced through seeds. They will act as surface soil binder as well as will enrich the surface soil with organic matter and nitrogen. These species may require sowing of seeds for more than one year.

# i. Legumes:

Desmodium triflorum Zornia gibbosa Alysicarpus monilifer Alysicarpus vaginalis Uraria picta Crotalaria nana Crotalaria albida Crotalaria montana Indigofera anaephylla Indigofera linifolia Sesbania aegyptiaca

# ii. Grasses:

Desmostachya bipinnata

Pennisetum pedicillatum Pennisetum hohenackeri Bothriochloa pertusa Apluda mutica Themeda quadrivalvis Dichanthium annulatum Isilema laxum Eragrostis viscosa Eragrostis tenella Eragrostiella spp. Saccharum spontaneum

# iii. Sedges

Cyperus rotundus Cyperus flexuosus Cyperus platistylis Cyperus difformis Fimbristylis podocarpa

# iv. Forbes

Borreria stricta Borreria hispida Andrographis paniculata Barleria spp. Vernonia cineria Evolvulus alsinoides

# 15.5. Special consideration for animal food plants:

Plantation on the backfilled area will be done with the species of plants as mentionedearlier, however, emphasis will be given for the plants of food value to the wildlife like the species of Ficus. Ficus spp. are generally lesser in density in natural forests, so care will be taken to have higher density of suck species.

# 15.6. Restorstion of land to pre mining land use :

It is difficult to restore the area to pre mining land use conditions because:

- i. The presently existing forests are in much degraded condition while the forest which will develop after restoration will be in much better condition
- ii. All the areas which are presently without trees will be planted with trees.
- iii. Species of trees present in the area, presently, are those which are surviving after the removal of most of the useful species. The restored area will have much better combination of trees, approaching as similar as to the nearby, natural forests.
- iv. Care will be taken to have little more proportion of species preferred as food by the elephants and bear.

# 15.7. Development of a 4 tier vegetation in the restored area:

A four tier vegetation will be the ultimate aim of the restoration of the mined out area, consisting of

- i. Emergent tree layer: This will consist of tall growing trees like sal, Ficus, Schleichera etc.
- i. Canopy layer: This will consist of trees growing to little lesser height than the emergent trees. These will form a canopy below the emergent trees. This layer will consist of trees like Asta (*Bauhinia racemosa*), Kasai (*Bridelia*)

*retusa*), Amaltas (*Cassia fistula*), Mainphal (*Catunaregam spinosa*), Char (*Buchanania lanzan*) etc.

- ii. Shrub layer consisting of Chilhi (*Casearia tomentosa*), Dikamali (*Gardenia gummifera*), Adusa (*Adhatoda vasica*), Akol (*Alangium salvifolium*), Karonda (*Carissa spinarum*), Chipti (*Desmodium pulchellum*), Chapar (*Moghamia chapar*), Baibirang (*Embelia ribes*), Marodphali (*Helecteres isora*), Dudhi (*Holarrhena antidysentirica*) etc.
- iii. Herb layer consisting of grasses, legumes and forbs.

# 16. PLANTATION IN THE BUFFER ZONE

- Trees will be planted in the buffer zone also. This plantation will be done at selected places only and only local species will be used in the plantation. Some of the tree species included will be: Aonla (*Emblica officinalis*), Arjun (*Terminalia arjuna*) Saja (*Terminalia tomentosa*), Baheda (*Terminalia bellerica*) Bija (*Pterocarpus masupium*), Bargad (*Ficus benghalensis*), Peepal (*Ficus religiosa*), Mahua (*Madhuca latifolia*), Sal (*Shorea robusta*), Dhawda (*Anogeissus latifolia*) Tendu (*Diospyros melanoxylon*), Char (*Buchanania lanzan*), Khair (*Acacia catechu*), Lodh (*Symplocos racemosa*) etc.
- Care will be taken to include some fruit bearing trees like Gular (*Ficus glomerata*), Achar (*Buchanania lanzan*), Aonla (*Emblica officinalis*) Am (*Mangifera indica*) and such trees to provide food to the herbivores which in turn will be the food source of the carnivores.
- Water, particularly during drier seasons, becomes the most important factor to all types of wild animals including the mammals, birds and reptiles. If water is available safely, then all other factors become secondary for the presence and survival of the wild life in any forested area.
- Places suitable for mini watersheds will be identified in the core as well as in the buffer zone to store rainwater. Further, to make water available at all the times, throughout the year, some of these water holes will be recharged through artificial means. Proper slope will be given to approach these water sources so that the wild animals will be able to drink water without any difficulty.

- Proper cover through vegetation or any other type of even artificial cover will be developed near to these water sources so that the prey species will be able to hide themselves from the predators, at the time of approaching the water sources.
- To attract the birds, plants yielding food to the birds will be planted on priority basis. If water and food are available to the birds without any anthropogenic disturbances the area can become an ideal place for bird watching.

Execution of the above works is proposed to be taken by the Forest Department of Chhattisgarh State financed by the company.

Year	Area (Ha.)					No. of
	Green	Surface	Backfill	Facilities +	Total	trees @
	belt	dump		CHP + Stack		2500/Ha
				+ Pond		
1 <sup>st</sup> year	7.00	0.00	0.00	0.00	7.00	17500
2 <sup>nd</sup> year	7.00	9.80	0.00	0.00	16.80	42000
3 <sup>rd</sup> year	7.00	21.30	0.00	0.00	28.30	70750
4 <sup>th</sup> year	7.00	22.55	0.00	0.00	29.55	73875
5 <sup>th</sup> year	7.00	26.07	0.00	0.00	33.07	82675
6 <sup>th-</sup> 8 <sup>th</sup> year	0.00	4.28	0.00	0.00	40.28	100700
Conceptual	0.00	0.00	299.43	0.00	299.43	748575
(36 <sup>th</sup> year)						
Total	35.00	120.00	299.43	0.00	414.15	1136075

# Requirement of plants (Year/stage wise and location wise)

To fulfill the requirements of nursery plants, a nursery will be established at the site. During peak requirements, additional plants will be transported from Govt. / Forest nurseries, located around the area.

# 17. CONSERVATION PLAN FOR FAUNA

#### Conservation Plan for fauna requires knowledge on:

- 1. Home range of the animal
- 2. Territorial requirement of the animal
- 3. Deciding the number of animals to be conseved and accordingly evaluating the carrying capacity of the habitat
- 4. Conservation is aimed at single species or multiple species
- 5. Conservation is proposed in a managed ecosystem or an un-managed, natural ecosystem.

However, very little knowledge exists on the above parameters of most of the animals.

#### **Basis of the conservation Plan**

The proposed conservation plan has been prepared on the basis of the following:

- a. Field & Desk Study by M. L. Naik and Sanju Sinha
- b. Inputs from The Mine Plan Durgapur II/Sariya coal of block
- c. Working Plan of Raigarh Forest division
- d. FSI Report, 2009
- e. Some other references:

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Memon Vivek. 2009. Mammals of India, A Field Guide, Wildlife Trust of India.

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Several reasons for the decline of wild life and methods for their conservation are proposed. However the best method for the conservation of wild life is related directly to the maintenance of ecosystems in their natural condition, allowing their natural development and protection to the wildlife and their habitat. Both these phenomena (ecosystem development and habitat protection) are related to anthropogenic factors. Some of the important anthropogenic factors are listed below:

- 1. Habitat fragmentation and destruction
- 2. Man-animal conflict
- 3. Forest fire
- 4. Poaching
- 5. Stake holders dependence on forest resources
- 6. Creating awareness amongst forest stake holders

To the above mentioned factors may be added a non-anthropogenic but important factor:

7. Water scarcity

The plan for wild life conservation with respect to above situations is detailed as under:

**17.1. Habitat improvement:** Sal (*Shorea robusta*) is the most dominant tree species of the area. This should be one of the important species to be used in gap filling of the adjoining (degraded) forest area. Sal is a semi-evergreen tree species, providing shade to the wild life as well as to the ground flora, particularly during intense radiation and scorching summer months. There had been some debate over the regeneration of sal through natural regeneration as well as *dona* transplantation. However, I had observed successful natural regeneration as well as dona transplantation, provided it is done with care. Together with sal other local species, particularly some fruit yielding species should also be planted eg: Mango, Tendu and Gular etc. To this it is important to add the plantation of aonla, which has almost disappeared from the area. The area vegetated with the local species will provide natural environment, food and shelter to the wild life attracting them more to the area. Some hideouts, suitable to different species, should also be created at suitable places.

**17.2. Elimination of man-Animal conflict**: Man-animal conflict is a difficult problem to be eliminated. The conflict is both deliberate as well as inadvertent. However, conflict can be minimized through employing local persons to form anti-depredation team. The conflict can be minimized also through protecting the area, preventing the entry of human beings or the cattle in the area. First aid facilities should be provided in the villages to meet exigencies in case of any conflict.

**17.3. Prevention of forest fire:** Forest fire is caused both naturally as well as by the human beings. Anthropogenic causes will be minimized through forming a fire line around the forest area. To add to the prevention of fire local persons will be employed as fire guards, during the fire prone season. The team will be instructed to fight the fire as soon as it is detected. Watch towers will also be constructed to detect forest fire. Awareness program against forest fire will also be run in adjoining villages.

#### Management prescriptions for fire protection

The forest fires along-with unregulated grazing have been acknowledged as the main causes of degradations of forest eco-systems and wildlife habitat. It directly affects the fodder availability and also kills the helpless wild animals especially the micro-fauna, reptiles, etc. It also exposes the soil to erosion and, hence, causes habitat degradation in the process. Due to deciduous nature of the forests, the grasses, weeds and falling leaves and twigs forms a thick layer of undergrowth which is highly inflammable in nature. The availability of water also becomes scarce during summers causing further hardships in its timely check and control.

The Fire lines are classified into, the following, categories in order of priority.

- a) A -Class Fire lines: These Fire lines comprise of the external boundary These are the prominent Fire lines, which should be prescribed for clearing, burning and maintenance every year on priority basis.
- b) B -Class Fire lines: These Fire lines includes internal boundaries and roads. These Fire lines should also be prescribed for clearing, burning and maintenance, every year.
- c) C -Class Fire lines: It includes the remaining Fire lines including the internal boundaries of compartments and coupe lines.

**17.4. Prevention of poaching:** Poaching is undoubtedly a serious problem in the conservation of wild life. Several methods are employed by the poachers, to kill or trap the wild life, of which poisoning and traps of different types are more common. A proper

vigilance will be maintained to check such menace. Poaching menace will be eliminated seriously neither all the efforts to promote wild life survival in the area will go in to waste. This will be achieved through employing, properly equipped, two ex-army jawans to assist the forest officers.

**17.5. Reducing stake holder's dependence on forest produce**: People from adjoining villages have already exploited the forest to the extent that the forests have become a grazing land or a source of fuel wood. Timber and medicinal species have either disappeared or have become scarce. However, regenerating the forest will again attract the villagers towards the forest. To keep the people away from the forest their economic condition will be improved. This will be achieved through financial and technical help to develop Dairy, Poultry, Vegetable cultivation, Horticulture and Agro-forestry. Promotion of agro-forestry, in particular, will reduce their dependence on forests for timber as well as for fuel wood.

**17.6. Creating awareness amongst forest stake holders:** Awareness about the environment and wild life will be created amongst the adjoining villages. They will be informed about the importance of a good environment, a healthy ecosystem and more importantly about the wild life. Through slide and film shows they will be convinced about the sustenance of natural ecosystems. They will be convinced that their own survival depends upon the survival of a healthy ecosystem, to which a wide variety of wild life is an essential component. To develop affection of the people towards the wild life some of them will be taken to some zoos and wild life sanctuaries. Awareness programmes will be run with the help of Forest Officers and more importantly some national experts will be invited to deliver talks awareness, related to wildlife conservation.

**17.7. Water availability::** Rainfall in the area is about 1300 mm, sufficiently to be categorized as a wet zone. However, due to lack of proper storage, severe water scarcity develops during the summer months. To make the water available throughout the year it is essential to create water storage facility. Multiple water storage places will be created in the Buffer zone through improving the existing ponds, constructing stop dams in the water channels and through creating water holes. Also, camouflage and hiding places should be created. Some wildlife species fulfill their salt requirement through licking the soil. Salt deposits will be arranged for such species adjacent to the water holes. These water holes will also be helpful in recharging the ground water and thus will be supporting good growth of the vegetation.

**17.8. Restriction of grazing and creation of waterholes:** Waterholes will be constructed outside the plain area for exclusive use of wildlife. This will reduce direct conflict between the wild animals and cattle. Patrolling parties will check and stop the entry and illegal grazing of cattle in the area. Heavy grazing not only reduces the herbaceous cover but brings about compaction of the soil also. It also favours the growth of non-palatable, unwanted weeds like *Lantana camara, Hyptis suaveolens, Plectranthus incanus, ageratum conyzoides* and so on. Such weeds will be uprooted and eradicated, preferably before their flowering and fruiting, to promote the growth of fodder grasses.

**17.9. Providing salt licks:** Compensation of salt requirement through salt licks is one of the major requirements of the wildlife. Salt licks will be provided to them near the waterholes.

**17.10. Training and awareness programme:** This is the most important aspect of wild life conservation. People will be educated regarding the importance of wild life conservation through mass publicity by installing sign-boards, conducting audio visual classes and distributing literature in respective villages in the buffer zone. **Experts in the field** of wild life conservation will also be invited to deliver talks through slides.

17.11. Encourage local villagers to grow trees on their own on field bunds/court yards etc.: In consultation with Forest Department the company will provide some finance, to grow saplings of tree species, having importance for wood, small timber and fuel wood to distribute to the villagers. Bamboo will be another important species with a lot of environmental and economic value. This will, no doubt, will help reduce dependence of people on RF forest; as a result the ecological condition of the area will improve so the wild life will be attracted to this area.

**17.12. Creation of conservation awareness:** What if a few species of wildlife become endangered or extinct? How are we concerned if the Indian Cheetah has been lost forever or the Asiatic lion is precariously perched on the verge of extinction? Why should we spend crores of rupees to protect the tiger? The answers to these questions of "what", "how" and "why" should form the basis for creating conservation awareness among the public- an understanding of the importance of biological diversity of inter-relationships in nature, of the sustenance and stability of ecosystems and of man's impact on the natural world.

**17.13. Sign boards:** Wild life protection will be most effective if the young once like the school children are tought and involved in it. To begin with sign boards with images of wildlife will be placed near the village schools as well as at places of more occurrence or more conflicts of any particular species of the wildlife.

**17.14. Fencing and lighting:** A barbed wire fencing will be erected around the mining lease area, outside the green belt. Lighting will also be fixed around the mining lease area. Lights will be focused towards the inside, so that the animals outside the lease area will be disturbed least due to light.

Protected areas and threatened species could most effectively be safeguarded if local people considered it in their own interest to do so. Working with rather than against local people has become a major working principle for IUCN.

**17.15. Placement of funds:** Funds proposed for wildlife conservation should be made available in advance. The fund should be deposited in a separate account meant exclusively for wildlife conservation of Talaipalli Coal Block. The account should be requipped yearly with the amount marked for the year. Presently a corpus fund of Rs. 20 Lakhs will be deposited with the Forest department. This amount will be used for immediate rlief to the beneficiaries of animal abuses. The amount paid to the wildlife sufferers will be requiped by the Govt. Thus, amount in this corpus fund will be maintained at Rs. 20 lakhs.

# 18. CONSERVATION PLAN FOR WILDLIFE BELONGING TO SCHEDULE I

#### 18.1. Varanus bengalensis bengalensis (Bengal monitor lizard)

**Habit:** They are often found in agricultural areas. Bengal monitors shelter in burrows that they dig or crevices in rocks and abandoned termite mounds. It is mostly diurnal in habit.

**Habitat:** It is found in a wide range of habitats, *viz.* forest, river banks, by the side of nullah, and agricultural land. It occupies burrows, dense vegetation, hollows of trees, rock cracks and crevices.

**Behaviour**: Mainly ground dweller, but is a very good climber as well. Bengal Monitors are usually solitary and usually found on the ground although the young are often seen on trees. They shelter and spend nights in burrows or crevices in rocks, make use also of abandoned termite mounds. In the night their body temperature drops below ambient. In the morning they raise their body temperatures by basking before commencing activity and for this reason they are rarely active early in the morning and most active in the afternoons when temperatures are highest.

**Food:** Their normal prey consists of beetles, grubs, orthopterans, scorpions, crabs, snails, ants and other invertebrates. Vertebrate prey is comparatively rare and includes frogs, fish, other lizards, snakes birds and their eggs and rodents. They sometimes capture roosting bats.

**Threat:** Monitor lizards are hunted for skin and their body fat. Its eggs are considered a delicacy and the entire animal is also eaten. Unani, the Greco-Arabian system of medicine, recommends the use of various body parts of monitors to cure numerous ailments. The population of the Common Indian Monitor, *Varanus bengalensis* has alarmingly dwindled throughout the Indian sub-continent mainly due to excessive exploitation of the adults for their commercially valuable skins, as food and in traditional medicines. Habitat loss due to large-scale deforestation, urbanization, dams and hydroelecture projects and other biotic factors are also responsible for the population decline of the species.

**Conservation Status:** Status: Not Listed (IUCN 2000); Endangered (ESA). Schedule I Indian Wildlife (Conservation) Act, 1972. **Conservation:** measures: There is no scarcity of food or habitat to the animal. Preventing poaching will be the single most important factor in the conservation of the species, for which awareness programmes should be run frequently.

#### **18.2.** Python molursus (Indian Python)

**Habit:** It is a non-poisonous, lethargic and slow miving snake, exhibiting little if any timidity and rarely rousing itself seriously to escape, even when attacked. Diurnal and/or nocturnal habit depends upon the degree of disturbance from man in their environment. The snake hibernates in cold sason, in any convenient retreat. There are very few records of attack on human beings is also there in the area.

**Food:** Feeds on mammals, birds and reptiles, but prefers mammals. Stomach content has shown frogs, toads, monitor lizard, wild duck, peafowl, poultry, rat, hare, porcupine, langur, jackal, mousedeer, hogdeer, chital, smabar fawn, barking deer, chinkara and leopard. Thus has a very wide range of food items.

**Threats:** It is killed for flesh and skin. However, in the presently applied lease area it is not eaten. Killing for skin is also not reported in the area. However, it is killed only because it is a snake.

**Consevation:** The snake, although occurs in the area but is rare. Reports of its conflicts with human being is extremely rare. Public awareness is the most important method for its conservation.

**Conservation Status:** This species is classified as Lower Risk/Near Threatened (LR/nt) on the IUCN Red List of Threatened Species (v2.3, 1994). This means that it has been evaluated, but does not satisfy the criteria for any of the categories Critically Endangered, Endangered or Vulnerable. However, it is considered Near Threatened (nt), meaning that it does not qualify for Conservation Dependent, but is close to qualifying for Vulnerable. Year assessed: 1996.

#### **18.3.** Pavo cristatus (Common Peafowl, Indian Peafowl)

The Indian Peafowl (*Pavo cristatus*), is also known as the Common Peafowl or the Blue Peafowl, The peacock is the **national bird** of India.

**Habitat:** It is found in forests, but can live also in cultivated regions and around human habitations and is usually found where water is available.

**Food:** It is an omnivorous bird. It's diet consists of small mammals like: mice, reptiles like lizards and snakes, amphibians, arthropods like: insects, ticks, termites, ants, locusts and scorpions, seeds, fruit, vegetables, flowers, leaves, and minnows in shallow streams and so on. With its strong bill it is able to kill a snake, even a cobra. Around cultivated areas, peafowl feed on a wide range of crops such as groundnut, tomato, paddy, chilly, and even bananas. Around human habitations, they feed on a variety of food scraps and even human excreta.

**Threat:** Poaching of peacocks for their meat, feathers and accidental poisoning by feeding on pesticide treated seeds are known threats to wild birds. Methods to identify if feathers have been plucked or have been shed naturally have been developed as Indian law allows the collection of feathers that have been shed. However, presently, there is no severe threat to this species, primarily for its status as a National bird and secondarily due to religious belief this species is protected. But its train feathers are in great demand for commercial purposes and are the main threat to its survival. Their loud calls make them easy to detect, and in forest areas, often indicate the presence of a predator such as a tiger.

**Conservation:** They are generally protected by religious sentiment and will forage around villages for scraps. The people living in the surrounding area should be rewarded for timely information about disturbing and/or poaching of the bird. The bird has a wide range of food items, hence, improvement of and protection of the bird in the buffer zone will provide sufficient food to the animal.

**Conservation Status**: IUCN Red List, Least Concern species. Schedule I Indian Wildlife (Conservation) Act, 1972.

# 18.4. Melursus ursinus (Sloth bear) I Vulnerable A2 cd+4cd;C1

- 1. Introduction
- 2. Habitat
- 3. Home Range
- 4. Habit
- 6. Food
- 7. Threats
- 8. Conflicts
- 9. Conservation status
- 10. Conservation Measures

#### Some of the references consulted for the preparation of this report are:

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**Introduction:** Presently applied mining lease area has both the degraded, protected forest as well as cultivated area. Bear is a nocturnal animal. Generally it remains within the forest area, but ocassionally it intrudes within the village area. This is mainly due to the Mahua flower, because Mahua trees are most common around the village areas. Therefore approach of the bear near to the village area is more during the months of Mahua flowering: the Months of March and April. Approach of the animal near the village areas in other months is extremely rare. Their density is also very low. A good study on bear has been made in the central India by Bargali et al (2004).

**Habitat:** Sloth bears, in the area, occupy a wide range of habitats including forests, scrublands, and grasslands where boulders and scattered shrubs and trees provide shelter. The most common shelter is a den, a cavern like structure generally in rocks.

**Home range:** To date, there is no definitive research detailing the exact nature of the home range of the sloth bear. The size of the home range of an individual sloth bear will vary

with the concentration of high energy food sources. Thus, the more concentrated the food sources, the smaller the range necessary to maintain an animal.

**Habit:** The sloth bear is more inclined to attack man unprovoked than almost any other animal. Sloth bears avoid areas where human disturbance is high, however, the bear raid peanut, maize, and fruit crops. Sloth bears like to escape from the heat of the day and forage for food at night. They will start to become active as the sun starts to set. This is also the time when many insects such as termites are more active.

They are generally nocturnal, occasionally approaching near to the village area even during the day time. Locally they prefer isolated shelters below rocks and caverns to spend their day time hours. Occasionally, near to the village area, after consuming large amount of mahua (*Madhuca latifolia*) flower they remain sleeping below the tree late after sun rise.

Food: Sloth bears subsist primarily on termites, ants, and fruits. This is the only species of bear adapted specifically for myrmecophagy (ant and termite-eating; The ratio of insects to fruits in the diet varies seasonally and geographically. Most bears are opportunistic omnivores. As such, their activities are governed by the availability of food items and dietary components within their habitat. When trees are in fruit, usually during the monsoon season, sloth bears dine on mango, fig, ebony, and other fruits, and also on some flowers. However, ground dwelling ants and termites, dug out of their cement-hard nest mounds, are a year-round staple. They have special liking for the honey for which the animal can climb trees and knock down honeycombs, later collecting the sweet bounty on the forest floor. Beetles, grubs, ants, and other insects round out their diet. During food shortages, sloth bears will eat carrion. In March and April, they will eat the fallen petals of mowha trees and are partial to mangoes, sugar cane, the pods of the Amaltas and the fruit of the jacktree. Sloth bears are extremely fond of honey. Sloth bears will also climb and shake fruit trees to obtain food. They will also eat leafy plants, sugar-rich fruits, nuts, root, tubers, berries, vegetables, honey, eggs and small vertebrates like rodents. Will also eat virtually any carrion which they may discover. Seasonal availability and geographic location are the biggest factors determining the primary food sources of sloth bears.

Food items of bear are documented with the help of scat analysis and direct observation. However, percent occurrence of a particular food in scats may differ from actual consumption. It is possible that most easily digestible food may be observed less in the scat while less digested food may be more. Some studies have shown that sloth bears are mainly myrmecophagous but in another study of the scat it has been observed that Ficus species dominated in all seasons. expressed as percent dry-weight, plant matter dominated in all seasons. Similarly, a study on sloth bears in central India has found that fruits were eaten year round and were the mainstay of the diet from February to June, whereas termites, ants, and honey were the predominant foods in other months.

A study on the scat of bear, in the central India has revealed following to be present in the scat and hence forming the food item of the bear. Months of their local availability has been added with each of the food item.

- 1. Black ant and their egg: Available all round the year but more during winter and summer season.
- 2. Red ant and their eggs: Available all round the year but more during winter and summer season.
- 3. Termite and their egg: Available all round the year
- 4. Honey Bees: Available all round the year but more during late winter and summer season
- 5. Ficus benghalensis (Bargad), Ficus religiosa (Pipal): Summer season
- 6. Ficus virens: Winter, Summer
- 7. Ficus racemosa: Winter summer
- 8. Ficus glomerata (Gular): Summer
- 9. Ziziphus mauritiana (Ber), Ziziphus oenoplia (Makoy) and Ziziphus nummularia (Jharberi): Winter
- 10. Aegle marmelos (Bel): summer
- 11. Briedelia squamosa Kasihi): Late winter to early summer
- 12. Diospyros melanoxylon (tendu): Summer
- 13. Buchanania lanzan (Achar): Summer
- 14. Schleichera oleosa (Kusum): Summer
- 15. Syzygium cumini (Jamun): Summer
- 16. Cassia fistula( Amaltas) fruit: Rainy
- 17. Madhuca indica (Mahua) (flower): March-April
- 18. Madhuca indica (fruit): June-July
- 19. Arachis hypogeal (Groundnut): Late rainy season
- 20. Zea mays (Corn): rainy
- 21. Amarood (Psidium guajava): Winter
- 22. Aam (Mangifera indica): Summer

- 23. Kathal (Artocarpus heterophyllus): Summer
- 24. Bones, hair and animal tissue

Many of the non-timber forest produce, forming the food of the bear are collected like flowers and fruits of mahuwa (*Madhuca indica*) and fruits of bel (*Aegle marmelos*), char (*Buchanania lanzan*), jamun (*Syzygium cumini*), and tendu (*Diospyros melanoxylon*). Such collection may limit their availability for bears. *Ficus* spp. are not used by local people, so are readily available to the bears. Thus Ficus spp. play important roles by providing supply of food for most of the part of the year. This is particularly important during summer when there are no crops in fields to raid and fewer fruiting species, and bears find it difficult to dig for termite and ants.

**Threat:** Major threats to this species are habitat loss, poaching and conflict killings. Habitat loss is mainly due to overharvest of forest products, monoculture plantations (e.g., teak, eucalyptus), expansion of agricultural areas, human settlements, and roads. Poaching is mainly for the commercial trade in bear parts. Encounters resulting in conflicts between people and sloth bears occur mainly where the habitat has become severely degraded but still being used by both. The only natural threats to sloth bears are tigers (*Panthera tigris*) and possibly leopards (*P. pardus*). Dhole packs may also attack sloth bears. Asian elephants are reported not to tolerate sloth bears in their vicinity. The reason for this is unknown. Bear parts are valuable commodities in the trade for Asian medicines. Incentives for killing bears are therefore high. Although, bear is protected to varying degrees by national laws, however, they can be killed to protect life or property.

**Conflicts:** The sloth bear is more inclined to attack man unprovoked than almost any other animal. Major man-bear conflicts result during the mawha flowering season. Persons going early to collect the flower encounter the animal, frequently, some times the bear remain sleeping below the tree after consuming large amount of mahua flower and is one of the mjor causes of man-bear conflicts. Persons going to the forest for the collection of wood or other forest produce encounter the bear, inadvertently resulting in conflicts.

**Conservation Status:** *CITES APPENDIX*: I: *Indian Wildlife (Protection) Act (1972)* (*As amended up to 2002*): Sheduled I; Part I; *Indian Red Data Book (IUCN 1994*): Not Listed; *IUCN (1998)* (Proposed; Vulnerable (National) and Data Deficient (Global); *IUCN (2002)* (Proposed): Vulnerable (Global) based on Version 2.3 1994 (IUCN, 2003). According to Alfred et al considering the nature and degree of threats and treads reported, it is strongly recommended to include sloth bear in one of the endangered categories of IUCN. They are

particularly vulnerable to loss of habitat because of their reliance on lowland areas, which tend to be the places most readily used by people. Poaching and trade in sloth bears or their parts is also common in many parts of their range.

# **Conservation Measures**

- 1. Education will help to reduce bear-human conflicts and enhance a conservation ethic among locals,
- 2. Habitat improvements (government or community-based reforestation) would be helpful in alleviating conflicts.
- 3. Planting of fruit trees more particularly the spp. of Ficus, because Ficus spp. are not collected by man but form an important diet to the animal.
- 4. Promoting honey bee in the area will not only serve as food to the bear but will help also in warding off the elephant.
- 5. Red ant (*Oecophylla smaragdina*) can be promoted easily to form colonies in the trees. This will serve as important source of insect diet and may compensate for the termite.
- 6. Artificial method to promote termite colonies should be developed.
- 7. Den like structures should be developed in the area if such structures are lacking or less in number in the area.
- 8. It is unfortunate that the conservation of Elephant and Bear go contradictory to each other.
- 9. Villagers should avoid growing crops of liking to bear like ground nut and corn etc. particularly near their den sites.
- 10. Translocation of bears from isolated habitat patches to more suitable areas should be carried out.

# 18.5. Panthera pardus fusca (Indian Leopard)

**Habitat:** Indian leopard has high capability to adopt any type of habitat where it can get sufficient food and covers. Leopards avoid overlapping their territory or the home range with the tigers. Therefore they try to occupy the fringe areas of the forests, as well as dare more to enter the human inhabited areas.

Behaviour: Leopards are highly territorial.

**Food Habits:** The diet of these big cats is surprisingly varied which includes: wildebeest, impalas, reed-bucks, Thomson's gazelles, jackals, monkeys, fish and storks.

However, at times they seem to show a preference for canines, even attempting to snatch dogs right from the feet of their masters. They can also eat fish and domestic stock such as goats and cows. They will even eat carrion.

**Status**: The species has been assigned almost all the categories of IUCN Red List Categories including: Near threatened, Threatened, Endangered, Critically endangered to Vulnerable, by different workers and agencies. However these categories have been assigned mostly on regional basis. On global basis the species has been assigned Lower Risk Status. The species has been included in Shedule I in The Wildlife (Protection) Act, 1972. of our country.

Conservation Status: CITES APPENDIX: I; Indian wildlife (Protection) Act (1972) (As amended up to 2002); Sheduled-1; Part-1; Indian Red Data Book (IUCN, 1994); Vulnerable; (IUCN 1998) (Proposed); Vulnerable (National) and Data Deficient (Global).

**Man-leopard conflicts:** Major conflicts arise when leopards start preying on livestock. These conflicts have increased in recent years due to population growth among humans. The conflict becomes more severe when some leopards become man-eaters. They can prey on children and even enter homes at night to attack humans.

**Threats:** The Indian leopard (*Panthera pardus fusca*) is facing the crisis of adaptation. The species could soon qualify for Vulnerable under criterion A4 (30% decline over a period of 30 years = three generations, including both past and future). Despite being the most widespread cat, the Indian leopard faces several types of threat. The animal shares its habitat with other animals, which include tigers, bears, wolves, Asian elephants, hyenas, and wild dogs. These animals may kill leopard cubs if given a chance. Apart from its natural enemies, the leopard's main threat is people. For years, it has been threatened, due to loss of habitat and poaching. A rapidly increasing threat to Leopards is the poisoning of carcasses targeting carnivores as a form of retaliation as well as a means of predator control. An estimated 50% of the population lives outside Protected Areas and so it is vulnerable to habitat destruction.

**Conservation:** Capture and translocation to protected areas has been practiced more as a means of conservation. However, investigations have shown that the animal is highly territorial. Shifting causes inter and intra specific fighting to establish a territory in the translocated area. They are so much particular about their territory that they may make all the efforts to reach back to their original territory. However, Leopard are somewhat tolerant

of habitat conversion, and may persist close to large human populations provided they have suitable cover and prey. The MoEF has issued guidelines:

Guidelines for Dealing with Man-leopard Conflict, Press Note, Ministry of Environment and Forests, Govt. of India, moef.nic.in/downloads/public-informat. Accessed on, 01-08-2011.

The guidelines suggest a three pronged strategy to deal with man-leopard conflict as a means to their conservation:

- i. Awareness generation among local communities, media and officials of various departments.
- ii. Establish trained teams at two levels; the primary response team and the emergency response team, and
- iii. Use of latest technology and scientific know-how to improve efficacy of capture, handling, care and translocation of the animal.

A project has been run in Assam on Leopard. This project aims to encourage local communities to develop and refine their traditional means of mitigating human - leopard conflict by using non-lethal techniques. It will help to increase the level of awareness among local stakeholders besides acting as interface between villagers and other government agencies. This will be achieved through a series of meetings, consultations and the distribution of educational material. The project will further help to monitor the effectiveness of traditional conflict mitigation techniques. The ultimate goal will be to prepare the Assam Leopard Conservation Information Facility (ACLIF) from the project findings.

Conservation efforts will be more effective with awareness generation and participatory approach with support from local communities and other stakeholders. Also the farmers should be made aware that livestock sheds should be strong, robust and leopard proof.

# 18.6. Conservation Plan for additional Schedule I species not present earlier but enter the area later.

It is possible that some Schedule I species, not present presently in the core or the buffer zone of the presently applied mining lease area, may enter the buffer zone on some later date. Conservation plan will be submitted for such *Schedule I* species not mentioned earlier, but are found to have entered and becomes a part of the buffer zone, on any later date. The conservation plan will be prepared and then will be sent for approval by the Chief Wildlife Warden.

# 19. CONSERVATION PLAN FOR *ELEPHAS MAXIMUS* (ASIAN ELEPHANT) SSP. *INDICUS* (INDIAN ELEPHANT) THE NATIONAL HERITAGE ANIMAL

- 1. Introduction
- 2. Elephant in South Raigarh forest division
- 3. Important points in the conservation of elephant
- 4. Habitat
- 5. Food habits
- 6. Time-activity budget of elephants
- 7. Food plants
- 8. Threats
- 9. Conflicts
- 10. Conservation status
- 11. Elephant corridor
- 12. Conservation of the elephants in Durgapur II/Sariya Coal Block
- 13. Some suggestions to escape elephant damage.

The latest and most exhaustive reference on elephants in India is:

Rangarajan, M; Desai, A; Sukumar, R, Easa, PS; Menon, V; Vincent, S; Ganguly, S; Talukdar, BK; Singh, B; Mudappa, D; Chowdhary, Sushant and Prasad, AN. 2010. SECURING THE FUTURE FOR ELEPHANTS IN INDIA, The Report of the Elephant Task Force, Ministry of Environment and Forests, August 31, 2010.

# 19.1. Introduction

Durgapur II/Sariya coal block, mining lease area has either degraded forests or the cultivated land, with some human settlements. Durgapur II/Sariya coal block, the presently applied lease area has little to attract the elephants with no records of the animal entering the applied lease area. However, the animal is not so uncommon in the buffer zone. Forest department has prepared a map for the movement of elephants in the buffer zone of the presently applied lease area. According to the map elephant movement is there within buffer zone ie. within 10 km radius from the lease area. It is restricted, however to the southern and western region of the buffer zone. The southern boundary of the movement of the elephants extends to the Raigarh Forest Division also. The animal has reentered the area of the state of Chhattisgarh, after almost a gap of about 82 years. The animal left the area of

Chhattisgarh State somewhere around 1904 and reentered in 1986. This is not peculiar as the animal has re-entered the area of Andhra Pradesh state, after a gap of about 200 years.

# 19.2. Records of the elephants in Dharamjaigarh Forest Division

During 19<sup>th</sup> century and earlier elephants were, recorded only from the northern part (Raigarh district) of the state but for unknown reasons the species left the area in the beginning of the 20<sup>th</sup> century. During this time the species was recorded from Raigarh District. However, the species re-entered the area of Chhattisgarh state, in 1980s, around the year 1986. The elephants, then entered the area of Raigarh district, from Orissa state. In the beginning their entry was occasional, coming ang going in to and out of the area. However, in later years their entry as well as their residence time, within the area of the state, has increased. Elephants have entered the presently applied Durgapur II/Sariya coal mining lease area, only once, some 2 to 3 years ago.

# **19.3.** Important points in the conservation of elphants

Following are some key points in the conservation of elephants:

- 1. Require 150-250 kg of plant food every day, with preference for grasses.
- 2. Evolved to a large size, with black colour. The black colour absorbs more heat.
- 3. Lack sweat gland to dissipate the body heat, hence, require a shade in sunny days, or require frequent cooling through wallowing or spreading water over the body.
- 4. Have very poor visibility particularly during night. Their eyes do not shine in the night, because of reduced number of cones, unlike the canines like tiger, leopard and even bovid like the cow.
- 5. A good source of water is required also for drinking.
- 6. Frequent dusting of the body or mud cover over the body is required to protect the body from the biting insects.
- Change in cropping pattern by introducing crops disliked by elephant or the plants which act as elephant repellent (e.g. *Patchouli*, (Pachouli) *Helianthus annus* (Sunflower) *Capsicum annum* (Chilli) *Sesamum indicum* (Til) and *Citrus* should be promoted.

# 19.4. Habitat

Elephants are generalists, but use mainly scrub forest. They can be found in the jungle, but generally on the edge where open, grassy areas are accessible. They prefer areas that combine grass, low woody plants, and forest. Elephants rarely forage in one area for more than a few days in a row. In general, food, water and shade are the three basic resources that can be expected to influence the movement of the elephant (Sukumar *et al*, 2003). Their Home range ranges from 30-600 km<sup>2</sup>.

#### 19.5. Food

Elephants eat a wide variety of species of vegetation. They are herbivore, folivore and lignivore. More than 100-130 different species of plants may be eaten They prefer grasses, but they also consume bark, roots, leaves, wood, stems and leaves of trees, vines, shrubs, tubers, bamboo and barn, An average day's intake is 150-200kg of wet vegetation. The proportions of the different plant types in their diet vary depending upon the habitat and season. Annual diet has been found to be dominated by grass. Maximum straying distance covered by the raiding elephant has been recorded up to 5.5km.

#### 19.6. Time-activity budget of elephants

Generally they are active almost throughout the day during rainy and winter months, but during summer months they are active only in the morning and evening hours. They become active well before dawn and start their morning activities in the vicinity of the area where they spent night. Evening hour is the time for drinking and bathing especially during summers. In summer season percentage of movement is more due to lack of fodder species and shrinkage of natural water sources.

#### 19.7. Food plants

Following is a list of plants reported as food by different workers. However, only the names of plants, local to the area, have been taken and the local names have been changed. Part of the plant eaten may be different for the different species.

SN	Botanical Name	Local Name
1	Acacia catechu	Khair
2	Acacia nilotica	Babool
3	Aegle marmelos	Bel
4	Albizzia lebbek	Kala siris
5	Bambusa arundinacea	Bans
6	Albizzia procera	Safed siris
7	Bauhinia variegata	Kachnar
8	Bauhinia vahlii	Mahul

9	Bauhinia malabarica	Khatua
10	Bombax ceiba	Semal
11	Brachiaria sp.	Ghas
12	Bridelia retusa	Kasai
13	Careya arborea	Kumhi
14	Cordia myxa	Lassora
15	Cymbopogon flexuosus	Ghas
16	Cynodon dactylon	Doob Grass
17	Dalbergia sissoo	Shisham
18	Dendrocalamus strictus	Bans / Bamboo
19	Desmostachya bipinnata	Urai/Khus
20	Eleusine sp.	Ghas
21	Emblica officinalis	Amla
22	Eucalyptus spp	Nilgiri
23	Eulaliopsis binata	Bagai Ghas
24	Feronia elephantum	Kaith
25	Ficus bengalensis	Bargad/Bar
26	Ficus glomerata	Dumar/Gular
27	Ficus religiosa	Pipal
28	Ficus rumphii	Duranga-hesa
29	Ficus infectoria	Pakar
30	Flacourtia indica	Kandai
31	Garuga pinnata	Kekad
32	Grewia elastica	Dhaman
33	Helicteres isora	Ainthi
34	Holarrhena antidysenterica	Korea
35	Ipomoea spp.	Karmata
36	Imperata arundinacea	Ulu
37	Kydia calycina	Baranga/Pula
38	Lagerstroemia parviflora	Senha/Sidha
39	Limonia acidissima	Kaith
40	Mallotus philippinensis	Sinduri/Rohini
41	Mimosa pudica	Lajwanti
42	Mitragyna parvifolia	Mudhi
43	Musa paradisiaca	Banana

44	Neyraudia arundinacea	Bichhloo
45	Oryza sativa	Dhan
46	Ougeinia oojeinensis	Tinsa
47	Phoenix humilis	Buta Chhind
48	Pithecellobium dulce	Jangal Jalebi
49	Randia dumetorium	Mainphal
50	Saccharum munja	Kandi-khar
51	Saccharum officinarum	Ganna
52	Saccharum spontaneum	Kans
53	Sansevieria sp.	Sisal
54	Schleichera oleosa	Kosam/Kusum
55	Shorea robusta	Sarai/Sal
56	Syzygium cumini	Jamun
57	Tamarindus indica	Amli / Imli
58	Terminalia tomentosa	Saja
59	Tectona grandis	Sagaun / Teak
60	Tinospora cordifolia	Giloe / Gurch
61	Thysanolaena agrostis	Hathi ghas / Pirlu
62	Zizyphus mauritiana	Bhander
63	Zizyphus xylopyra	Ghont

Saccharum spontaneum, Thysanolaena maxima and fruit parts of Dillenia indica, are some of the other species recorded to be preferred by elephants. Some other food plants have been reported by the villagers of elephant moving areas of Chhattisgarh state. The list includes

Musa paradisica (Kela),

*Oryza sativa* (rice) eat very cleverly the fruiting part, only, in the barn yard they dismantle the heap of gathered rice.

Saccharum officinarum (Ganna) is one of the most preferred food item.

Dendrocalamus strictus (Bamboo):

Ficus benghalensis (Bargad)

Ficus religiosa (peepal)

Artocarpus heterophyllus (Kathal)

Miliusa velutina (Bhilwa)

Pterocarpus marsupium (Bija)

Zea mays (Maka)
Phoenix sylvestris (Chhind)
Phoenix acaulis (Buta chhind)
Buchanania lanzan (Char): The saplings are up-rooted, the root is thrashed clean of soil and is then eaten.
Goruga pinnata (Kekad)
Carica papya (Papita)
Some of the elephants develop fascination for country made alcoholic drinks called Handia.

## 19.8. Threats

The pre-eminent threats to the Asian elephant today are habitat loss, degradation, agriculture and farming, grazing, mining, human interference, trade, pollution, hunting for ivory, insurgency, corridor loss, anthropogenic pressures on the habitat, man-elephant conflict, forest fires, illegal captures of live animals etc. Poisoning and disease are some other threats to the animal.

## 19.9. Conflicts

There are a few reports of human-elephant conflict in the area, but so far no reports of human death.

## **19.10.** Conservation status

**CITES APPENDIX:** 1; Indian Wildlife (Protection) Act (1972) (As amended up to 2009); Sheduled-1; Part-1; Indian Red Data Book (IUCN, 1994); Vulnerable; (IUCN 1998) (Proposed); Vulnerable (National) and data deficient (Global); IUCN (2002) (Proposed); Endangered (Global) based on version 2.3 1994 (IUCN, 2003).

# 19.11. Conservation of the elephants in Durgapur II/Sariya coal block,

#### mining lease area

Habitat destruction by man has threatened the survival of the Asian Elephant Therefore, maintenance of the habitat is the first requirement in the conservation of the elephants. If proper habitat is absent or is below the desirable standard, then it may be developed. Elephants require, simultaneously, two types of habitats:

- a. Dense forest with tall trees and
- **b.** Scrub jungle and grasslands

Dense forest is required as refuge and protection from intense sun rays. While scrub and grasslands are required as a better feeding area. Tall trees are not a good source of food because their foliage and tender twigs are beyond the reach of elephant's trunk. It is only the fallen fruit and bark of such trees which can be eaten. It is generally difficult to peel off the bark from trees. In a scrub or a grassland, it is easy to feed. The food item may be foliage, tender shoot, entire plant or even the root, all are within their easy reach. With respect to the area, there are two options for the conservation of the elephants:

- Restrict the elephants in a defined area
- Develop a corridor for long, may be interstate, migration route.

Development of a corridor far beyond the Durgapur II/Sariya coal block mining lease area will be the best choice for the conservation of the species. The corridor, to be developed, must have both the dense forest with tall trees as well as shrubby areas. Now it depends upon the condition of the area to decide that the shrubby areas should be forming outer fringe to the tall tree area or should be in the middle or should be in patches in between the tall trees. The corridor belt should be of sufficient width and should be planned either away from the village settlements or the isolated houses near to their path should be shifted. Elephants require 150-200kg of food per head, per day. Habitat planning should include provisions to yield sufficient food. It is important now to decide about the plant species. The food plants should be of more liking type to the elephants. To keep the food plants within easy reach of the elephants, regular planting of new plants or pruning to stimulate coppicing, should be made. Some of the food plant species suggested to be planted in the area are:

Dendrocalamus strictus, (Bans) D. Rhedhii (Bans), Bambusa arundinacea (Bans), Ficus benghalensis (Bargad), F. religiosa (peepal), F. glomerata (Gular), F. rumphii (Jangali Bargad), F. infectoria (Pakar), Artocarpus heterophyllus (Kathal), Miliusa velutina (Bhilwa), Pterocarpus marsupium (Bija), Phoenix sylvestris (Chhind), Phoenix acaulis (Buta chhind), Buchanania lanzan (Char), Feronia elephantum (Kaith), Goruga pinnata (Kekad), Thysanolaena agrostis (Hathi ghas), Cymbopogon flexuosus (ghas), Themeda quadrivalvis (Ghas), Iseilema laxum (Ghas), Bothriochloa pertusa (Ghas), Apluda mutica (Ghas) etc.

Bamboos (*Dendrocalamus strictus*, *Bambusa arundinacea*) are one group of fast growing plants which can form a good proportion of diet to the elephants. Another bamboo species *Dendrocalamus rhedii* will be an exotic species to the area but is common in Western Ghats. It has a thin stem. Elephants have special liking for the bamboo plant and it is easy to grow the plant in sufficient quantity in short time. However, it is not a species which can create any problem. The villagers in Durgapur II/Sariya area have informed that the elephants have special liking for *Buchanania lanzan*. The saplings of the plant are uprooted and the root thrashed clean and eaten.

With the vegetation it is essential to develop perennial sources of water with some salt ponds, within the conservation area.

With the above following more steps should be taken for the conservation of this flagship species:

- i. Forest officers should be trained in Wildlife management.
- ii. Frequent use of fireworks should be avoided. This may lead to develop immunity in elephants against the fire works.
- iii. Conflict with human is a major conservation problem, hence, should be reduced to the lowest possible level.
  - . Anti poaching efforts should be strengthened. Awareness programmes should be run frequently.
- iv. Interstate committee of Madhya Pradesh, Chhattisgarh, Jharkhand and Orissa Govts. should be constituted for elephants.

# **20. ELEPHANT CORRIDOR**

There are news that Chhattisgarh Govt. is going to establish an elephant reserve, combining the Tamor-Pingla and Semarsoot wildlife sanctuaries in Sarguja district and Badalkhol wildlife sanctuary in Jashpur district. Corridor will be developed to join these three wildlife sanctuaries. However, still no notification has been issued, so far, to implement the policy. The concept is good but it depends upon the Govt. to make it a reality.

# 21. SOME SUGGESTIONS TO ESCAPE ELEPHANT DAMAGE

Methods adopted to escape elephant damage may be categorized as i) Active and ii) passive methods:

## i. Active methods

- a. Noise-making like shouting, drum beating, bursting fire crackers, firing gun shots into the air (by forest officials only),
- b. Using elephant torch light
- c. Pelting stones and lighted fuel-woods.
- d. Loudspeaker broadcasting of tiger roaring sound

However, the major drawback of using all these methods is that these may provoke the raiding elephants increasing the possibility of more damage to the crops and other properties as well as higher risk to the farmer's life. Further, If the active methods fail to be effective, singly, then combined effort should be made.

#### ii. Passive methods

- a. Change in cropping pattern by introducing some elephant repellent alternative cash crops (e.g. *Patchouli, Helianthus annus, Capsicum annum* and *Citrus*).
- b. Digging trenches around village area.
- c. Planting sisal (Agave americana) around village boundary.
- d. Solar fencing.
- e. Improvement of water sources.
- f. Raise/improve fodder resources.
- g. Fencing houses with GI wires. Elephants avoid shining objects. GI wires are cheapest, shining objects to distract the elephants. Barbed wire fencing is gradually proving ineffective in preventing the movement of elephants. In the buffer zone of the presently applied mining lease area also the elephant have broken a barbed wire fencing and entered a nursery.

Crops of elephant liking should be avoided, as far as possible. Some of the crops, listed above, should be used to replace the more traditional crops like the sugarcane and rice. In Karnataka elephant proof trenches are being dig around the village area, but I have observed in Raigarh district in Chhattisgarh state that the elephants can move down and up in trenches of good depth. Sisal has been found to be good to prevent the elephants to cross the sisal planted area. The plant yields a good quality fibre. Electric fencing has also been suggested as one of the methods but in Assam it has been found to be a failure as the elephant have discovered techniques to break such fences, safely. In areas like Kamakshyanagar in Dhenkanal division in Orissa improvement of fodder resources in the forest has shown promising result of restricting the elephants more in the forest area.

Passive methods are always better to avoid man-elephant conflicts. More important are the selection of plants as alternative crop as well as plants to check the entry of elephants in to the settlement areas.

A good amount of researches and suggestions on the conservation and reducing its conflicts with human being is going on, resulting in suggestions coming frequently on these aspects. Thus the presently prepared report is not the final. With the above, some more, methods are being suggested for Durgapur II/Sariya coal block region:

• **Two doors in a house:** Most of the houses in villages have only one door or exit. In case the elephant enters the house through the door, the occupants can escape through another door.

- **Timely information:** Timely information to the helping person about the approach of elephants can reduce the conflicts as well as loss of human life. For this a network should be formed with the villages and the forest officers.
- Elephant torch: The elephant torch should be provided to each of the vulnerable villages. Presently the torch is only with the forest officer, one torch for several villages.

# Some more suggestions to avoid conflicts:

- > Do not make crowd near elephant.
- > Maintain at least 300 meter distance from the elephant.
- > Do not wear red, white or colourful clothes.
- > Day time is their resting time, do not disturb them during day time.
- > Do not injure them neither they become more violent.
- > Do not allow children, ladies and aged persons to go near the elephants.
- Do not prepare liquor or "handia" (country liquor) in the elephant movement area, because elephants like it and can smell it from distance. Do not go near the elephant after taking alcoholic drink.
- > Elephants have good smelling power so keep in mind the direction of the wind.
- Elephant can run at a speed of 30-40km per hour, so do not run straight instead make zig-zag running.
- While running throw towel, handkerchief, cap or any other cloth so that they will get attracted to that and will get engaged with that.
- > In a hilly terrain run towards the slope.
- While running away from an elephant do not hide behind a tree nor climb up a tree in the evening.
- To prevent the entry of elephants in a village burn wood and "Masal". Collect in a group and make noise by beating drum, tin etc. Try to drive them towards noninhabitated area.
- > Make the payment for compensation of elephant loss, early.
- Inform loss of human life or property, within 24 hours to the Patwari or the nearest forest employee.

## Steps taken in Africa, to escape elephant damage

- Elephant area is fenced with ropes. Fencing ropes are smeared with a mixture of chilli + tobacco powder in engine oil. Disagreeable smell of the mixture, helps to some extent, to ward off the elephants
- Honey bee combs are promoted on the elephant corridor boundary. Honey bees ward off the elephants.
- Electronic tracking devices are attached to the elephants to track their movements. This helps in timely information to the villagers.

## 22. CONSERVATION PLAN FOR MEDICINAL PLANTS

Types and number of plant species, to be named as medicinal plants are rare in the core and buffer zone. However, conservation of medicinal plants will be done in the area proposed for aforestation. Medicinal plants recorded in the core and buffer zone, all of them are common plants of the area. Endangered species like Rauwolfia serpentina or as common a species of the area as Andrographis paniculata have not been recorded from the area. The medicinal plants recorded from the core and buffer zone are not difficult to be regenerated, however, they will be regenerated as follows:

- **A.** *Achyranthes aspera:* This annual plant grows abundantly on waste grounds but sporadically in forest areas. The plant can be propagated through seeds.
- **B.** *Andrographis paniculata:* This herbaceous plant of much medicinal value grows extensively in the area. The plant can be propagated easily through seeds collected in the months of October-November.
- **C.** *Asparagus racemosus*: The plant grows much abundantly in the forests of the area. It is used also as a substitute to Safed Musli (*Chlorophytum* sp.) This is a perennial plant with a bunch of white, tuberous roots. The aboveground part of the plant dies every year at the end of growing season (March-April), new plant emerges from the underground stem, surviving with the tuberous root. The plant will be propagated through the tuber. Tubers will be collected at the end of growing season of the plant in the month on March. Tubers will be stored in some cool place in soil and will be planted in the aforestation area in the first week of June.

- D. Curculigo orchioides: The plant called Kali Musali is a much valued medicinal plant, but it grows abundantly in the region. This perennial plant grows naturally with a vertical, very deep rhizome. Aboveground part of the plant consists of only one or two leaves which dies away every year, regenerating again from the underground rhizome. Generally it grows gregariously near to the base of tree trunks of many tree species like the Shorea robusta and Madhuca latifolia trees. It will be regenerated in the aforestation zone from the rhizome and seeds.
- **E.** *Dioscorea bulbifera*: This twining plant is also a perennial plant, perennating through the underground rhizome. Like the earlier plant aboveground part of this plant also dies away every year. The plant is cultivated also as the bulbil and tuber of the plant are consumed as vegetable. Bulbils are produced in good numbers on the aboveground parts, in the axils of the leaves. Regeneration of the plant can be made easily by sowing the bulbils in the month of June or July. The bulbils will be placed below the soil, below some tree or shrub.
- **F.** *Diplocyclos palmatus:* This cucurbitaceous annual climber grows extensively around villages, climbing on hedges. It flowers and fruits extensively. It can be propagated easily through seeds.
- **G.** *Elephantopus scaber*: Generally it grows gregariously near to the base of tree trunks of many tree species like the *Shorea robusta* and *Madhuca latifolia* trees. The plant has a perennial rhizome. The plant can be propagated either through the seed or by transplantation.
- H. Evolvulus alsinoides: The plant grows abundantly in the area. The plant grows normally outside the forest area in open places, generally the grasslands. It was recorded presently in the grazed area of the forest. The plant species will not be included to be grown in the presently proposed aforestatin zone.
- I. *Hemidesmus indicus*: This twiner species is a perrenial plant with a very deep root system, signifying the name "*Anantmool*" given to the plant. It is a very common plant of the forests as well as undisturbed, open places. The plant flowers sporadically, hence, could be propagated mainly through cuttings and tranplantation.

- J. Holarrhaena antidysenterica: This small tree often becomes a problem after openings are formed due to cutting of the trees. It is not browsed by the cattle and is able to regenerate fast through coppicing as well as from abundant seeds. It can be propagated easily through seeds and does not require any special care for cultivation
- **K.** *Sphaeranthus indicus:* This annual medicinal plant grows as a weed in drying, pulse stable, water bodies. It starts growth from late winter and reaches full growth in the months of April-May. It can be grown easily through seeds.
- L. *Tephrosia purpurea*: This perennial plant grows almost like a weed on open, wastelands. It is a very hardy species tolerating dryness to a good extent. The plant can be easily propagated through seeds, which are produced abundantly by the plant. It is not a typical forest species, hence, will not be included in the list of plants to be grown in the aforestation zone.

# 23.STRATEGY OF MITIGATION OF THE PERCEIVED ADVERSE IMPACT OF THE PROJECT:

- (1) As the project area is gradually built up, socio-economic forces are likely to set in a process of gradual destruction of forests. The resident population of the area would be enamoured of the project activities, which confer immediate economic gain and employment. A climate of general apathy for the forests and wildlife might be created in the surrounding areas. It would therefore be necessary to prevent this decline in people's stake-holding of the forest and wildlife values of the area through massive awareness building exercise, management interventions, and well designed incentive structure.
- (2) A preventive ring of protection of flora and fauna would be built up around the impact area, and capacity would be built up within the Forest Division as well as among the other stakeholders in enforcing the protection measures. The protection measures would be sustained over the years as a long-term intervention.
- (3) Habitat quality would be maintained and wherever degradation and depletion has set in, measures of resurrection would be launched. These could be by way of assisted natural regeneration, plantation of species occurring naturally at the

site, soil and water conservation measures and incentives for prevention of fire and grazing.

(4) Special emphasis would be laid on creation and restoration of water bodies through measures of water harvesting to mitigate water stress to wild animals during the dry months.

## **24. ACTION PLAN**

- (1) A comprehensive action plan would be launched immediately to strengthen the administration to combat illicit felling of trees, smuggling of forest produce, protection of wildlife habitat and protection of wild flora and fauna in the area. This will include augmenting the staff strength, motivated local youths and personnel drawn from private security agencies on contractual basis.
- (2) 'Wildlife camps' can be set up at strategic locations with infrastructure such as watch tower, communication equipments, vehicles for mobility to effectively handle poaching of animals, smuggling of forest produce and also depredation caused by wild animals.
- (3) Mobile units will be constituted for intensive surveillance and enforcement of forest and wildlife protection activities. This will create a deterrent effect on the forces of forest destruction.
- (4) VHF communication network will be strengthened by erection of VHF stations and towers and provision of hand sets to staff manning different posts.
- (5) Habitat conservation and restoration measures will consist of (a) soil and moisture conservation measures on the slopes, (b) water harvesting structures and creation of water bodies, assisted natural regeneration and plantation of species occurring naturally in the area to cover the degraded & barren areas.
- (6) Fire prevention and fire beating operation will be organised both by provision of incentives to villagers actively cooperating in the task and also by engaging labourers to combat forest fire. Systematic monitoring and surveillance of all fire prone areas would be launched through a squad to continuously assess the damage, and the extent and efficacy of counter fire prevention and fire measures.

- (7) Plantation would emphasize on local species for regeneration of degraded areas.
- (8) Cattle immunization will be carried out in all villages within the project impact area and in villages in the vicinity to check the spread of infectious diseases among wild animals. This will be done through health camps to be conducted with the local Veterinary officers.
- (9) Imaginative Eco-development activities to provide opportunities for alternate livelihood with reduction of dependence on forest, and Eco-tourism promotions will be carried out.
- (10) Monitoring, evaluation and motivation of the surrounding villagers through ecoclub activities and through formation of Green Brigades will be carried out.

## **25. ACTION PLAN MONITORING**

- A. Monitoring: By a committee under the chairmanship of D.F.O Dharamjaigarh Forest Division with mine representative, V.S.S presidents (2), Labour representative, Range officer, as members. The committee meets twice a year in April and November to sort out bottle necks and recommend future course of action. In addition, committee shall review progress of reclamation and restoration in mined out area.
- B. Data Inputs: Committee takes input from field formation of F.D., Mine Manager, Van Sahayaks, Fire Watchers, V.S.S members regarding habitat, status of wild animals, movement pattern of the animals, depredation control, progress and survival of plantations, eco-development and their outcome, participation levels of villagers, environmental data and advice desirable action.

	Proposed Activity	Target Expenditure (Lacs)							
S.N.		Years from the beginning of Mining							
		1	2	3	4	5	6-10	Total	(Rs.
								Lacs)	
1	Improvement of water resources								
1.1	Water Shed Improvement	10	10	10	10	10	1X 5=5	55	
1.2	Improvement of existing water	05	05	05	05	05	01X5=05	30	
	resources(Ponds and water Holes)								
1.3	Developing New Water Sources	40	30	30	30	30		160	
1.4	Construction of Check Dams on	05	05	05	05	05		25	
	running streams								
	Total Amount (Lac Rs.)							270	
2	Improvement of food Sources								
2.1	Pasture Development	05	05	05	05	05		25	
2.2	Control of Grazing	01	01	01	01	01		05	
2.3	Weed Control	03	03	03	03	03		15	
2.4	Burning Regime, seeding and grass	01	01	01	01	01	01X5=05	10	
	cutting								
2.5	Development of Brow, Fruits, seeds	10	10	10	10	10	02X5=10	60	
	and mast								
	Total Amount (Lac Rs.)							115	
3	Improvement of cover	0.5	0.5	0.5	0.5	0.5	001/05 40		
3.1	Escape Cover	05	05	05	05	05	02X05=10	35	
3.2	Ambush Cover	08	08	05	05	02	03X5=05	33	
3.3	Reproductive Cover	05	05	05	05	05	01X5=05	30	
3.4	Special Refuges	07	07	07	07	03		31	
3.5	Shade and resting place.	05	05	05	05	05	01X5=5	30	
	Total amount in (Lac Rs.)							159	
4	Capacity Building & Awareness								
	Generation	0.2	02	0.2	0.1	01			
4.1	Improving Conservation awareness	02	02	02	01	01		08	
4.2	Training (Officers and subordinates)	02	02	02	01	01		08	
4.3		05	05	05	05	03		23	
_	Total Amount (Lac Rs.)	0.2	02	0.2			001/5 4.0	39	
5	Provision of salt Licks	02	02	02	02	02	0285=10	20	
6	Fire Protection	05	05	05	05	05	1X5=05	30	
7	Conflict Management	05	05	05	02	02	2X5=10	29	
	(Compensation for the loss due to								
	wild life)	05	05	05	05	05		25	
ð	Survey and Documentation for	05	05	05	05	05		25	
	deposited with Riediversity Poard								
	Total Amount (Lac Re )							607	
	Total Amount (Lac KS.)							60/	

26. TENTATIVE COST OF IMPLEMENTING THE SCHEME (In Lakhs of Rupees)

#### 27. SUMMARY

Conservation of Biodiversity has become the most important requirement of the present day world, because survival of the man depends upon the biodiversity. Present account is, thus, an evaluation of the status of the biodiversity of the proposed mining lease area, and proposed offset measures to any negative impact on biodiversity.

Climate of the area is on the boundary of tropical to sub-tropical and dry to sub-humid. The area comes under broad category of sub-humid to dry deciduous, mixed and sal forests. Durgapur II/Sariya coal block is located in north-eastern part of Raigarh district, Chhattisgarh state. A total of 693.326 Ha, has been applied for lease. The area comes under broad category of sub-humid to dry deciduous, mixed and sal forests. According to Champion and Seth two types of forests are visible in the area 1.  $3C/C_2e$ . The Moist Peninsular sal forest and 2. The  $3C/C_3$  Moist mixed deciduous Forest. Basal area, Abundance, Frequency and density, their relative values and Importance value index (IVI) of trees, shrubs and herbs of the individual specie, from the core zine were calculated. Shanon idex of diversity and evenness have beed estimated for the tree layer of the core zone.

The core zone consists of Forest land, revenue forest land as *chhote jhad ka jungle*, *bade jhad ka jungle* other revenue land and private revenue land. The applied lease area has two compartments of forest of Dharamjaigarh forest division. It is noteworthy to observe the rarity of some important species in the forest like the *Emblica officinalis* and *Pterocarpus marsupium*. Total basal cover in compartment No. 275 is 0.23% while in compartment No. 295 is 0.10%. Diversity index in both the compartments is very low with Shanon index of diversity (H) value of only 0.0654 and 0.0480 and Evenness index (EH) values of only 0.0285 and 0.0198 for compartments 275 and 295 respectively.

Sloth bear is the only Schedule I animal, in the lease area. Monitor lizard (*Varanus benghalensis*)

Buffer zone consists of cultivated land, fallow land, highly degraded forest to very dense forest with a good diversity of species in the later. Forests are of mixed or of sal type. The two types of forests gradually change in to one another. Schedule I species of animals, recorded from the buffer zone, include sloth bear, elephant, Indian leopard, peafowl, monitor lizard and python. Green belts will be developed along the boundary of the open cast mining area. Species selected for the green belt will include:

- 1. Imli (*Tamarindus indica* seed)
- 2. Mahua (Madhuca latifolia- seed)
- 3. Saja (Terminalia tomentosa seed)
- 4. Aam (Mangifera indica seed, seedling transplantation)

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- 5. Kumhi (Careya arborea seed)
- 6. Rohan (Soymida febrifuga seed)
- 7. Sidha (Lagerstroemia parviflora seed)
- 8. Bargad (Ficus benghalensis Transplantation)
- 9. Pipal (*Ficus religiosa -* Transplantation)
- 10. Umar (Ficus racemosa Transplantation)
- 11. Pakar (Ficus infectoria Transplantation)
- 12. Neem (Azadirachta indica- seed)
- 13. Sal (Shorea robusta- seed)
- 14. Karanj (Pongamia pinnata seed)
- 15. Haldu (Adina cordifolia seed)
- 16. Bel (Aegle marmelos Seed)
- 17. Maharukh (Ailanthus excelsa Seed)
- 18. Kala sisris (Albizzia lebbeck seed)
- 19. Chichwa (Albizzia odoratissima seed)
- 20. Asta (Bauhinia racemosa seed)
- 21. Kasai (Bridelia retusa seed)
- 22. Amaltas (Cassia fistula seed)
- 23. Mainphal (Catunaregam spinosa seed)
- 24. Lasora (Cordia myxa seed)
- 25. Jamrashi (Elaeodendron glaucum seed)
- 26. Bhonrsal (Hymenodictyon excelsum seed)
- 27. Baranga (Kydia calycina seed)
- 28. Kari (Miliusa tomentosa seed)
- 29. Kusum (Schleichera oleosa seed)
- 30. Jamun (Syzgium cumini seed)

#### Shrubs

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- 1. Chilhi (Casearia tomentosa seed)
- 2. Dikamali (Gardenia gummifera seed)
- 3. Adusa (Adhatoda vasica seed)
- 4. Akol (Alangium salvifolium seed)

- 5. Karonda (*Carissa spinarum* seed)
- 6. Chipti (Desmodium pulchellum seed)
- 7. Chapar (*Moghamia chapar* seed)
- 8. Baibirang (*Embelia ribes* seed)
- 9. Marodphali (Helecteres isora seed)
- 10. Dudhi (Holarrhena antidysentirica seed, transplantation)

#### Climbers and Lianas

- 1. Satawar (Asparagus racemosus seed, tuber)
- 2. Mahul (*Bauhinia vahlii* seed)
- 3. Palasbel (Spatholobus roxburghii seed)
- 4. Malkangni (Celestrus peniculata seed)
- 5. Baichandi (Dioscorea hispida tuber, bulbil)
- 6. Dangkanda (Dioscorea bulbifera seed, tuber, bulbil)
- 7. Gudmar (*Gymnema sylvestre* cutting, seed)
- 8. Dhimarbel (Ichnocarpus frutescens seed)
- 9. Ramdaton (Smilax zeylanica seed)
- 10. Guruch (Tinospora cordifolia cutting, seed)
- 11. Keoti (Vallaris heynei seed)
- 12. Keoti (Ventilago calyculata seed)

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Green belt development will be started immediately after the sanction of permission for mining. The overburden soil will first be dumped, temporarily and then later on it will be used for filling the void. Backfilling will start from 3<sup>rd</sup> year of the project operation Plantation in the buffer zone will be done at selected places only and only local species will be used in the plantation. To fulfill the requirements of nursery plants, a nursery will be established at the site. Conservation plan for wildlife species belonging to schedule I have been given for:

- 1. Varanus bengalensis (Bengal monitor lizard)
- 2. Python molursus (Indian Python)
- 3. Pavo cristatus (Common Peafowl, Indian Peafowl)
- 4. Melursus ursinus (Sloth bear)
- 5. Elephas maximus (asian elephant) ssp. Indicus (indian elephant)
- 6. Panthera pardus (Indian Leopard)

Over burden dump, before using it for refilling, will initially be planted with soil binding grasses and herbs. After back filling local species will be planted over it but care will be taken to give emphasis on planting species of food values to wildlife particularly the bear and elephant. Some suggestions to prevent man elephant conflicts and elephant damage have

also been given. Conservation plan for medicinal plants has been given for some of the important medicinal plants of the area. Strategy of mitigation of the perceived adverse impact of the project and action plan has also been discussed. Action plan monitoring procedure has also been mentioned.

		Target Expenditure (Lacs)           Years from the beginning of Mining							
S.N.	Proposed Activity								
		1	2	3	4	5	6-10	Total	(Rs.
								Lacs)	
1	Improvement of water resources								
1.1	Water Shed Improvement	10	10	10	10	10	1X 5=5	55	
1.2	Improvement of existing water	05	05	05	05	05	01X5=05	30	
	resources(Ponds and water Holes)								
1.3	Developing New Water Sources	40	30	30	30	30		160	
1.4	Construction of Check Dams on	05	05	05	05	05		25	
	running streams								
	Total Amount (Lac Rs.)							270	
2	Improvement of food Sources								
2.1	Pasture Development	05	05	05	05	05		25	
2.2	Control of Grazing	01	01	01	01	01		05	
2.3	Weed Control	03	03	03	03	03		15	
2.4	Burning Regime, seeding and grass	01	01	01	01	01	01X5=05	10	
	cutting								
2.5	Development of Brow, Fruits, seeds	10	10	10	10	10	02X5=10	60	
	and mast								
								445	
								115	
<b>3</b>		05	05	05	05	05	02205-10	25	
3.1	Ambuch Cover	05	05	05	05	03	02X05-10	22	
3.2	Andusticover	06	06	05	05	02	0375-05	20	
5.5	Special Refuges	05	05	05	05	03	0172-02	21	
5.4 2 E	Shada and recting place	07	07	07	07	05	0176-6	20	
5.5	Total amount in (Las Ps.)	05	05	05	05	05	0172-2	50	
4	Conacity Building & Awaronoss							159	
4	Generation								
11	Improving Conservation awareness	02	02	02	01	01		80	
4.1	Training (Officers and subordinates)	02	02	02	01	01		00	
43	Workshop	05	05	05	05	03		22	
4.5	Total Amount (Lac Rs.)					0.5		39	
5	Provision of salt Licks	02	02	02	02	02	02X5=10	20	
6	Fire Protection	05	05	05	05	05	1X5=05	30	
7	Conflict Management	05	05	05	02	02	2X5=10	29	
	(Compensation for the loss due to				-				
	wild life)								
8	Survey and Documentation for	05	05	05	05	05		25	
-	Biodiversity by the BMC (To be								
	deposited with Biodiversity Board)								
	Total Amount (Lac Rs.)	1						687	

Tentative cost of implementing the scheme (Amount in Lakhs of Rupees)

Total tentative cost of the Scheme=Rs. Six Crore Eighty Seven Lakhs