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DISCLAIMER

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For M/s E2 Environmental
etiquette

Jamshedpur

(Dr. R Kumar)

(Principal Scientist and
Authorised signatory)

PREFACE

1. ESL steel Limited (formerly Electrosteel Steels Limited) is a 3.0 Million MTPA It has set up an Integrated Steel Plant located in villages Siyaljori, Bhagabandh, Budhibinor, Alkusha, Dhandabar, Bandhdih and Hutupathar of Bokaro District of Jharkhand. The present plant is spread over 374.81 ha of land (including the approach road to the plant). ESL steel Limited was acquired by Vedanta Resources Limited (VRL), a global diversified metals and mining company with its headquarters in London, UK in year 2018. VRL is the largest mining and non-ferrous metals company in India. Its main products are Zinc, Lead, Silver, Oil & Gas, Iron Ore, Steel, Aluminium and Power.
2. Steel making operation may alter or lead to Habitat loss or alteration, species extinction besides Introduction of invasive non-native species in the area. This may also change the way natural systems function and their ability to support biodiversity, species and people. All this may cause loss of benefits for people that depend on biodiversity and ecosystems for meeting their daily needs.
3. Aimed at developing Biodiversity management plan for 10 km Buffer area (314 sq. km) from the project battery limit, ESL steel Limited appointed M/s Environmental etiquette, Jamshedpur vide work order no. 4900012062 dated 11.02.2020 to document level of Biodiversity by screening of risks, Biodiversity impact assessment, Biodiversity risk rating and Biodiversity management plan by setting sustainable biodiversity management goals. Such a management plan has been necessitated as investors, capital providers, shareholders, civil society, local communities and regulators expectations has increased for their enhanced awareness.
4. The Buffer area of project site has been studied for performance of different flora and fauna in terms of biodiversity, frequency, abundance, density and use value vis a vis steel making. Attempt has been made to evolve tailor made Biodiversity Management Plan to counter challenges faced by Biodiversity of area by adopting state of art conservation measures based on life cycle approach. This will help improve Ecology, biodiversity, soil conservation and pollution control in cost

effective way besides ensuring a SUSTAINABLE BIODIVERSITY in the area. This will further address concerns of the Regulators and other stakeholders. These actions will also serve interests of locals for improved living standard for enhanced economic activity in the area without adversely affecting ECOSYSTEM services.

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ACRONYM

SL .NO	ACRONYM	DESCRIPTION
1.	AAQ	Ambient air quality
2.	API	Anticipated Performance Index
3.	APTI	Air Pollution Tolerance Index
4.	BRR	Biodiversity Risk Rating
5.	BDS	Biodiversity
6.	BIOCM	Biodiversity Conservation Measures
7.	BUFZ	Buffer zone
8.	BMP	Biodiversity Management Plan
9.	BIOR	Biosphere reserve
10.	BRS	Biodiversity Risk Screening
11.	BIODR	Biodiversity Risk Assessment
12.	CORZ	Core zone
13.	CRITH	Critical Habitat
14.	CARC	Carrying capacity
15.	CEESP	Critically endangered and endangered species
16.	DBH	Diameter at breast height
17.	DCF	Deputy conservator of forest
18.	DFO	Divisional forest officer
19.	ECS	Ecological services
20.	ESV	Ecosystem services value
21.	ENDS	Endangered species
22.	EXSP	Exotic species
23.	ESIA	Environment and social impact assessment
24.	GEBK	Gene bank
25.	GIS	Geospatial information system
26.	FSS	Flagship species

27.	GRHE	Greenhouse effect
28.	GRPN	Gross production
29.	IFC	International finance corporation
30.	INTRA	Internationally recognised area
31.	IS	Indicator species
32.	IR	Infiltration rate
33.	IUCN	International Union for Conservation of Nature
34.	KYSSP	Key stone species
35.	LEGRA	Legally recognised area
36.	LFLOB	Like for like or better
37.	LSCAPE	Landscape
38.	MTGH	Mitigation hierarchy
39.	NNL	No Net Loss
40.	NPG	Net Positive Gain
41.	PCE	Pollution Control Equipment
42.	RO	Range officer
43.	STKH	Stakeholders
44.	RCCF	Regional chief conservator of forests
45.	THRSP	Threatened species
46.	VS	Vulnerable species
47.	VRL	Vedanta Resources Limited

TERM AND DEFINITION

1. **Abundance:** The number of individuals per unit area calculated on the basis of number of quadrats of occurrence.
2. **Affected Communities:** Local communities directly affected by the new or existing project.
3. **Alien Species:** An alien or non-native plant or animal species is one that is introduced beyond its original range of distribution.
4. **Area restored:** Area that was used during or affected by operational activities, and where remediation measures have either restored the environment to its original state, or to a state where it has a healthy and functioning ecosystem.
5. **Baseline Biodiversity:** A survey of the habitats and species in the project area to determine the biodiversity baseline and may include identification of legally protected areas, critical and endangered habitats, natural and disturbed habitats, and alien (non-native) species of flora and fauna and shall address biodiversity attributes of all forms (e.g. water, land, flora, fauna, etc.).
6. **Biodiversity:** The variability among living organisms from all sources including inter alia, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part. This includes diversity within species, between species and between ecosystems.
7. **Biodiversity risk Area:** It maps the locations of important biodiversity areas, protected areas, and areas categorized by IUCN as significant for species of plants or animals.
8. **Biodiversity Management Plan (BMP):** A document that sets out the organizational arrangements to eliminate, minimize, mitigate and manage impact to all biodiversity attributes associated with an operation or new project. The plan shall be commensurate with the level of risk identified.

9. Carrying capacity: Maximum number of a particular species which could be maintained indefinitely on an area or renewable resource stock in use, then recover and regenerate products and materials at the end of each service life .
10. Conservation Value: Relates to the inherent value of biodiversity and ecosystems, which is typically measured in terms of ecological diversity and rarity. Ecological diversity relates to genetic diversity (within a species), species richness (the number and diversity of species), and ecosystem or community diversity (the variety and composition of habitats, biotic communities and ecological processes within and between ecosystems). Rarity relates to the value of specific or prioritized species or areas, in relation to their endemism (uniqueness), condition or endangered status.
11. Critical Habitats: Critical habitats are areas with high biodiversity value, including (i) habitat of significant importance to Critically Endangered and/or Endangered species (ii) habitat of significant importance to endemic and/or restricted-range species (iii) habitat of significant importance to globally significant concentrations of migratory species and/or congregator species; iv) regionally significant and/or highly threatened or unique ecosystems; and/or areas (v) Species listed on the International Union for the Conservation.
12. Critically Endangered and Endangered species: Species listed on the International Union for the Conservation of Nature (IUCN) Red List of Threatened Species.
13. Cumulative Impacts: Based on the IFC description, cumulative impacts are those that result from the incremental impact of the project when added to other existing, planned and reasonably predictable future projects and developments.
14. Edge forest: A woodland edge or forest edge is the transition zone (ecotone) from an area of woodland or forest to fields or other open spaces. Certain species of plants and animals are adapted to the forest edge, and these species are often more familiar to humans than species only found deeper within forests.
15. Ecosystem Services: The benefits that people, including businesses, derive from ecosystems. Ecosystem services are organized into four types of services:

16. (i) Provisioning services, which are the products people obtain from ecosystems; (ii) Regulating services, which are the benefits people obtain from the regulation of ecosystem processes; (iii) Cultural services, which are the nonmaterial benefits people obtain from ecosystems; and (iv) Supporting services, which are the natural processes that maintain the other services.
17. Ecosystem Services Value: Relates to the human benefits derived from biodiversity and ecosystems in the form of ecosystem services.
18. Evergreen trees: A forest in which there is no complete seasonal loss of leaves (i.e. trees shed old leaves and produce new ones partially, and sometimes throughout the year, rather than during particular periods).
19. Environmental impact: Any change to the environment whether adverse or beneficial wholly or partly beneficial resulting from an organizations environmental aspects.
20. Environmental and social impact assessment (ESIA): A formalized process designed to identify and assess environmental and social impacts associated with a project along with mitigation measures and management arrangements for ensuring such measures are implemented.
21. Flagship species: Popular and charismatic species that stimulate conservation awareness.
22. Hot spot: A biodiversity hotspot is a biogeographic region with significant levels of biodiversity that is threatened by human habitation.
23. Indigenous peoples: Identified as tribal peoples in independent countries whose social, cultural and economic conditions distinguish them from other sections of the national community, and whose status is regulated wholly or partially by their own customs or traditions or by special laws or regulations. This definition comes from the International Labour Organization (ILO) Convention 1969, Indigenous and Tribal Peoples Convention. 1989.

24. Internationally Recognized Area: Exclusively defined as UNESCO Natural World Heritage Sites, UNESCO Man and the Biosphere Reserves, Key Biodiversity Areas, and wetlands designated under the Convention on Wetlands of International Importance (The Ramsar Convention).
25. IUCN (International Union for Conservation of Nature) : A democratic membership union with more than 1,000 government and NGO member organizations, and almost 11,000 volunteer scientists in more than 160 countries which supports scientific research, manages field projects all over the world and brings governments, non-government organizations, United Nations agencies, companies and local communities together to develop and implement policy, laws and best practice.
26. Keystone Species: Species that exert a disproportionate influence on the integrity of an ecosystem relative to its abundance or total biomass.
27. Like for Like or Better 'Principle : In relation to biodiversity offsets, the adoption of this principle indicates that the offset must be designed to conserve the same biodiversity values that are being impacted by the project (an "in-kind" offset) or, that where the biodiversity to be impacted by the project may be neither a national nor a local priority, and there are other biodiversity attributes of higher priority for conservation or in need of protection, an "out-of-kind" offset that involves "trading up" may be designed.
28. Legally Recognized Area: A clearly defined geographical space, recognized, dedicated and managed, through legal or other effective means, to achieve the long-term conservation of nature with associated ecosystem services and cultural values.
29. Mitigation Hierarchy: The prioritized list of mitigation measures that shall be used to determine the most appropriate measures for mitigating impact on biodiversity attributes. The hierarchy starts with elimination of impact, followed by use of engineering controls to reduce at source, impact reduction measures, offsetting and restoration of damage caused by the project.

30. **Modified Habitat:** Areas that may contain a large proportion of plant and/or animal Species of non-native origin, and/or where human activity has substantially modified an area's primary ecological functions and species compositions. Modified habitats may include areas managed for agriculture, forest plantations, reclaimed coastal zones, and reclaimed wetlands.
31. **Natural Habitat:** Areas composed of viable assemblages of plant and/or animal species of largely native origin, and/or where human activity has not essentially modified an area's primary ecological functions and species compositions.
32. **Net Positive Gain (NPG;)** means that biodiversity gains from targeted conservation activities exceed the losses of biodiversity due to the impacts of a specific development project, so that there is a net gain in the type and amount of biodiversity present, over space and time.
33. **No Net Loss (NNL):** The point where biodiversity gains from targeted conservation activities match the losses of biodiversity due to the impacts of a specific development project, so that there is no net reduction overall in the type and amount of biodiversity present, over space and time
34. **Offset:** Measurable conservation outcomes resulting from actions designed to compensate for significant adverse biodiversity impacts arising from project development and persisting after appropriate avoidance, minimization and restoration measures have been taken.
35. **Protected forest:** These are natural areas where the habitat and resident wild species have certain degree of protection
36. **Reserved forest:** These are owned by Government of India and often upgraded to the status of wildlife sanctuaries and national parks.
37. **Restoration ecology:** It is process of repairing sites in nature whose biological communities (that is, interacting groups of various species in a common location) and ecosystems have been degraded or destroyed. It has potential to improve air quality, reverse forest clearance and desertification, slow biodiversity loss, enhance

urban environments and perhaps improve human livelihoods and humanity's relationships with nature.

38. Sustainability: Sustainability means meeting our own needs without compromising the ability of future generations to meet their own needs. In addition to natural resources, we also need social and economic resources.
39. Tropical moist deciduous forest: Moist deciduous forests are the mixture of trees and grasses. These forests are found in areas of moderate rainfall of 100 to 200 cm per annum, mean annual temperature of about 27°C and the average annual relative humidity of 60 to 75 per cent. Open grass patches are found in moist deciduous forest.
40. Use value: Talks about relative importance of plants known locally. Calculated by no. of uses mentioned by each informant for a given species divided by total no. of informants.
41. Vulnerable species: Species which are on the verge of becoming endangered.

EXECUTIVE SUMMARY

1. ESL Steel Limited (formerly Electrosteel Steels Limited) has set up 3.0 MTPA an Integrated Steel Plant located in villages Siyaljori, Bhagabandh, Budhibinor, Alkusha, Dhandabar, Bandhdih and Hutupathar in Bokaro District of Jharkhand. The present plant is spread over 374.81 ha of land including the approach road to the plant. The project has adopted steel making through Blast Furnace route and primarily consist of a Sinter Plant, Coke Oven, Blast Furnace, Basic Oxygen Furnace, Billet Caster, Wire Rod Mill, Bar Mill, DI Pipe Plant and Power Plant. The plant has been designed to produce bars, wire rods, DI pipes, pig iron and billets. Presently, ESL is operating with capacity of 1.5 MTPA crude steel along with 0.22 MTPA ductile iron pipe productions. The finished products include Pig iron, Wire rods, Rebars and DI pipes.
2. Steel making operation in may alter or lead to Habitat loss or alteration, species extinction besides Introduction of invasive non-native species in the area. This may also change the way natural systems function and their ability to support biodiversity, species and people. All this may cause loss of benefits to people that depend on biodiversity and ecosystems for meeting their daily needs.
3. Aimed at developing Biodiversity management plan for 10 km Buffer area (314 sq. km) from the project battery limit, ESL appointed M/s Envionmental etiquette, Jamshedpur vide work order no. 4900012062 dated 11.02.2020 to document level of BIODIVERSITY by screening of risks, Biodiversity risk and impact assessment, Biodiversity risk rating, Biodiversity risk management and set Sustainable biodiversity management goals. Realizing such goals will help maintain ecosystem of area at existing levels and improve it further. Such a management plan has been necessitated as part of company policy to address genuine concern of investors, capital providers, shareholders, civil society, local communities and regulators and long term interests of Biodiversity of impact area.
4. The 10 km impact area around project site has been studied for performance of different floral and faunal diversity in terms of biodiversity, frequency, abundance, density and use value using standard ecological and satellite imagery methods vis

steel making and other anthropogenic stresses in the area. Attempt has been made to evolve tailor made Biodiversity Management Plan to counter challenges faced by BIODIVERSITY of area by adopting state of art conservation measures based on life cycle approach. These have been designed for Implementation by company in collaboration with Forest department and community participation by involvement of Panchayat raj bodies, Village level community groups, Joint Forest Management committees (JFMCs), Eco development committees (EDCs), Civil Societies and voluntary organizations etc. This will help improve Ecology, biodiversity, soil conservation and pollution control in cost effective way besides ensuring a SUSTAINABLE BIODIVERSITY in the area. This will further address concerns of the Human population of area, Regulators and other stakeholders. These actions will also serve interests of locals for improved living standard for enhanced economic activity in the area without adversely affecting ECOSYSTEM services and BIODIVERSITY.

5. A large area about 25% of the district is under forest cover. The impact area cover 71 nos. of revenue villages and 26 patches of forests. All the PFs are in the Chas forest range of Bokaro Forest Division. They are degraded ones and have low crop density. There is presence of vegetation Patches all around the 10 km radius of the ESL Plant. These patches include plant and tree species with more or less semi-evergreen to evergreen nature of nature plant species. Main plant species occurring in the area patches include *Shorea robusta*, *Butea monosperma*, *Azadirachta indica*, *Pongamia pinnata*, *Mangifera indica*, *Syzgium cumini*, *Ficus benghalensis*, *Albizia lebbek*, *Zizyphus mauritiana*, and *Clerodendron species* etc. The shrubs consist of *Holorrhina antidysentrica*, *Nyctanthes arbortritis*, *Zizyphus* and *phoenix sylvestris*. Grass growth in area is plentiful. *Dendrocalamus stricuts* is the only bamboo species found in the area. Clumps of same are congested and malformed. It is thinly distributed all over in the mixed forests and is absent in Sal forests. Grasses consist of *Heteropogon contortus*, *Dicanthinum annulatum* *Cynodon dactylon* etc. The climber is mainly dominated by *Bauhinia variegata*,

Asparagus racemosus, Acacia pinnata, etc. Exotic species include *Lantana camara*, *Parthenium hysterophorus* and *Ageratum conyzoides*.

6. Overall BIODIVERSITY INDEX of terrestrial flora was as high as (6.58). The RICHNESS (3.62) and the EVENESS (5.11) also showed high values. Index value above 3.0 is considered good for natural systems. On comparison of the BIODEVERSITY (H) between Trees, Shrub and Herb maximum value was observed for Trees (5.93) < followed by Herb (3.87) and minimum was for shrub (3.75). RICHNESS was maximum for Trees (3.13) followed by < Shrub < followed by herb. But EVENESS showed opposite trend i.e maximum (48.23) for herb < followed by shrub (12.39) and < minimum is for tree (5.20). All 3 categories of flora showed maximum frequency Of 100. Abundance is maximum for trees (7.10)< shrub (2.50) and herb(2.40). Density also showed same trend. This signifies qualitatively the overall vegetation of the impact area is rich and uniform. Quantitatively there is great variation in species spread in the study area. The dominant plant species of area include *Shorea robusta* and *Butea monspersma*. Maximum frequency of (100) and Abundance (7.1) was also shown by same sp. The other evergreen and semi evergreen trees are far and few in number and noticed mostly during summer season as leaves fall off from deciduous trees. The entire area of 314.16 sq.km has many ponds and closed water bodies. It ranges from (0.4-2.5) % of the total area. Analysis of the area for the month of February 2020, 2021 indicated mostly clear water bodies with less eutrophication, followed by a constant increase in May and reaching the maximum levels during November. Satellite image analysis of successive seasons clearly gives us the pictorial evidence for same. Aquatic flora commonly reported from aquatic ecosystem namely River, Pond, Lake in the area are 28 number of species. The Aquatic plants present in impact area mainly include Pteridophytes dominated by *Azolla pinnata*, *Marsilia quadrifolia* and *Salvinia natans*, Angiosperms by *Nymphaea cristata* , *Hydrilla verticillata*, *Eichornia crassipes* while Phytoplanktons are dominated by *Rivularia elegans*, *Spirulina major*, *Oscillatoria principes*. Overall Biodiversity of aquatic plants is 3.68, Richness 0.79 and Evenness 0.36. As we do trend analysis between seasons, BIODEVERSITY index

was maximum in post monsoon (3.71). Eutrophication further diminishes the dissolved oxygen content in the water bodies negatively affecting phytoplankton and zooplankton. (Table – 10 & 11)

7. Biodiversity value of aquatic phytoplankton was maximum during Monsoon (3.69) and least was shown in pre monsoon (3.16). These are direct indicators of stagnant water bodies with less flow of fresh water into it. RICHNESS of aquatic plants was maximum in pre monsoon season (1.66) < monsoon (1.44) and was least in post monsoon season (1.14). In case of Evenness, it was maximum of 0.36 in post monsoon < monsoon season (0.34) and least was in pre monsoon season 0.31. Maximum frequency of 100 was observed. Abundance and density is maximum of 48.78. Satellite image study also show eutrophication of ponds and water bodies in area substantiating our observations from field study.
8. Aquatic fauna/zooplanktons commonly reported from aquatic ecosystem namely River, Pond, Lake in the area are 07 numbers of species. Among Zooplanktons Moina brachiate, Diaoptomus vulgares, Cyclops sp. dominate the aquatic bodies. Overall Biodiversity of Aquatic zooplanktons in study area is 2.42, Richness 0.62 and Evenness 0.38. BIODEVERSITY was maximum is in post monsoon (2.49) < pre monsoon (1.85) and minimum was during monsoon season (1.98). RICHNESS was also maximum in pre monsoon season(1.85)< monsoon(1.43) and was least in post monsoon season (0.74). In case of Evenness maximum was 0.39 in post monsoon<pre monsoon season (0.25) and least was in monsoon season 0.31. Maximum frequency is 100.Abundance and density was 33.89 each.
9. Company has already implemented Pollution control measures at source by fitting dust extraction system coupled with bag houses to Sinter Plant, Coke Oven and Blast Furnace. ESP is taking care of fly ash generated during coal combustion at thermal power plant. Other suitable control measures have been taken at Billet Caster, Wire Rod Mill, Bar Mill, DI Pipe Plant. Particulates produced at RMHs and conveyors during material loading, unloading, stockpiling and transfer have been controlled by erecting normal/atomised/ chemical dosed water based fixed and portable sprinklers. Further tall stacks are attached to each of process furnaces for effective

dispersal of flue gases to long distances produced during steelmaking operations. These environment management measures have effectively controlled pollutants that may have bearing on biodiversity of area keeping impacts to negligible level. This is also evident from high Biodiversity (> 6.0) in the impact area. Further dense green belt (33%) developed in core activity area act as sink for pollutants.

10. The Project and its 10 km buffer area falls under **MEDIUM RISK** category. Risks have been identified based on assessment made. Risk of each sensitive biodiversity receptors have been rated based on-

- i. Company policy and legal requirement on Biodiversity management
- ii. Sensitivity of Receptor w r t steel making/industrial activities and other anthropogenic stresses
- iii. Response potential to conservation measures and
- iv. Natural instinct to survival/revival for both flora and fauna.

Identified Risks to area has been calibrated on a scale of 10 for their risk appetite. Wild life and birds present in impact area has been rated HIGH(BRR -26 out of 30) for their risk appetite among of 12 type of receptors namely Land use, Wild life and bird, Schools, Health care facility, Habitation & Villages, Water bodies ,Agriculture, Vegetation patches, Open Scrub Land, Dry River Bed/Dry Land , disturbed land and Stakeholders interests.

11. The wildlife habitat is not good in the nearby forest areas. The impact area is not the habitat of any important carnivores like Tigers, Leopards etc. it is also not the home of Elephants. There is no Biosphere Reserve, Ramsar Site, National Park, Wild Life Sanctuary, Tiger Reserve, Elephant Reserve or Wildlife Corridor in study area. Wild Animals Present /visiting the area are of general type consisting mainly of wild Pig, Jackal, Langur, Kobra, Ajar and karait. The Schedule I animals found in the study area are Indian Python and Indian Pangolin. Domesticated animals include Cow, Hen, Buffalo, Dog and Goat.

12. Birds commonly reported from forest, village and nearby areas are 111 no. of species. It mainly include Bubulcus ibis , Black-crowned night Heron, Bronze-winged jacana, Lesser Whistling-duck, Northern Pintail, Little Grebe, White-breasted Water hen, Black kite, Rose-ringed Parakeet , Little Swift, Coppersmith Barbet, House Crow, Scaly-breasted Munia, House Sparrow, Paddyfield Pipit, Common Swallow, Streak-throated Swallow, Red-vented Bulbul, Jungle Babbler. Overall Biodiversity of birds in study area is 6.45, Richness 1.58 and Evenness 14.13. As we do trend analysis between seasons BIODEVERSITY maximum is in pre monsoon (7.01) followed by post monsoon (6.15) and minimum was during monsoon season (6.08). RICHNESS of Birds was also maximum in pre monsoon season(2.55) only followed by post monsoon(2.39) and was least n in monsoon season (2.27) . In case of Evenness same trend about occurrence of Birds in area has been observed where again maximum value was 7.49 in pre monsoon season followed by 7.41 in monsoon and least was in post monsoon season 7.04. This change in diversity with change in season may be because during pre-monsoon birds remain active to find their suitable mate. As the monsoon season starts nesting starts so they incubate and become less active and so they are less visible. In post monsoon with completion of nesting the young ones are added. So, the number is increased. Frequency of birds varies between 33.33 to 100.00, Abundance 1.00 to 55.33 and Density 0.67 to 55.33.
13. Biodiversity Management Plan sustainable goals have been set on the basis of maintaining Biodiversity in the area at existing levels and prevent any further degradation. Company to play an anchor role by promoting **HABITAT RESTORATION** and **BIODIVERSITY CONSERVATION** in consultation with Forest department and local populace is real answer to **COUNTER BUSINESS RISKS** that may crop up from Steel Making activities in the area.
14. Habitat development and preventing its degradation is one of the most important aspects of wildlife management. This is to be realized by enrichment plantations with emphasis on Bamboos, Ficus, Banana and other palatable species. Promoting Rescue centre in collaboration with forest department complete with trained wild

15. animal rescue team equipped with rescue vehicle, cage besides provision of crackers etc is key for conservation of wild life in the area. Installing an Animal Intrusion Detection & Repellent System (ANIDERS) plays important function by preventing man animal conflict as it makes multiple sound and light pattern and uses GSM for real time communications. Capacity building to local people in Duckery, fishery, honey bee keeping and mushroom cultivation besides distribution of Sal pattal making machine, Mahua and fruit collection net, grain bins and Bamboo craft making will add to villagers income. This reduces dependence on forest for the livelihood. Birds are important component for ecosystem and biodiversity. To promote Bird conservation in the area NESTS to be planted in the areas frequently visited by birds.
16. Setting a **SUSTAINABLE DEVELOPMENT GOALS** (SDGs) allows company to measure their biodiversity performance. These measures are aimed at sustainability teams, managers and other company staff whose roles include strategic planning and reporting related to biodiversity. The focus is on **a full-cycle, results-based management approach** (since assessing pressures on biodiversity, and planning and developing measurable goals, are key prerequisites for monitoring).
17. Responsible behaviour by company in terms of proactively promoting Biodiversity conservation in the area also adds to **CLIMATE ACTION** as it prevents and reverses prevailing **CLIMATE TRENDS**. Further, these also make us compliant to Paris agreement 2015, an important obligation on the country and the company.
18. These actions are apt to realize dream tag for company, the **GREEN, CLEAN and HEALTHY ESL**. This also sets new benchmark for **BIODIVERSITY CONSERVATION** in steel sector for others to follow.

1.0 INTRODUCTION

1.1 A BRIEF ABOUT PROJECT

ESL Steel Limited (formerly Electrosteel Steels Limited) has set up an 3.5MTPA Integrated Steel Plant located in villages Siyaljori, Bhagabandh, Budhibinor, Alkusha, Dhandabar, Bandhdih and Hutupathar of Bokaro District of Jharkhand. The present plant is spread over 374.81 ha of land including the approach road. The site coordinate from 86° 17' 10.618" E 23° 37' 34.882" N to 86° 18'39.599" E 23° 37' 52.733" N. It falls under Survey of India topo-sheet No. F45C2 and F45C6. The project has adopted steel making through Blast Furnace route it primarily consist of a Sinter Plant, Coke Oven, Blast Furnace, Basic Oxygen Furnace, Billet Caster, Wire Rod Mill, Bar Mill, DI Pipe Plant and Power Plant. The plant has been designed to produce bars, wire rods, DI pipes, pig iron and billets.

Presently, ESL is operating an integrated steel plant with capacity of 1.5 MTPA crude steel along with 0.22 MTPA ductile iron pipe production. The finished products include Pig iron, Wire rods, Re bars and DI pipes. Unit wise configuration and progress of development at present is 1.5 MTPA (Crude Steel production) along with 0.22 MTPA DI pipe production ISP configuration Stage is shown in **Table 1** below.

Table No 1. Existing plant configuration (1.5 MTPA ISP Stage)

Sl.	Plant	Unit	Present Configuration	Status	Present Capacity
1.	Coke Oven	CO1-NR (Vertical)	0.5 MTPA (4 X 35 Ovens)	Operational	0.5 MTPA
		CO2-NR (Horizontal)	0.5 MTPA (8 X 15 Ovens)	Partially Built	-
2.	Sinter Plants	SP1, SP2 (augmented)	2.744 MTPA (2 x 105 m ²)	Operational	2.74 MTPA
3.	Blast Furnace	BF1	1050 m ³	Partially Built	-
		BF2 & BF3	1.57 MTPA (1050 m ³ + 350 m ³)	Operational	1.57 MTPA

4.	Pig Caster	-	0.35 MTPA	Operational	0.35 MTPA
5.	SMS	SMS1	1.5 MTPA (2 x 60 T BOF + 1 x 60 T LRF + (2 x 5) Strand Billet Caster)	Operational	1.5 MTPA
6.	Calcination Plant	LCP1	1 X 800 TPD	Operational	950 TPD
		DCP1	1 X 150 TPD	Operational	
7.	DI Pipe Plant	DIP	0.22 MTPA	Operational	0.22 MTPA
8.	Rolling Mills	WRM	0.5 MTPA	Operational	1.2 MTPA
		Rebar	0.7 MTPA	Operational	
9.	Captive Power Plants	Coal based	80 MW (2 X 130 TPH)	Operational	80 MW
		Waste Heat Recovery	2X 75 TPH	Operational	
10.	Oxygen Plant	ASP1	840 TPD	Operational	840 TPD
11.	RMHS	-	Stacker-cum-reclaimer: 01 (Iron ore)	Partially Built	-

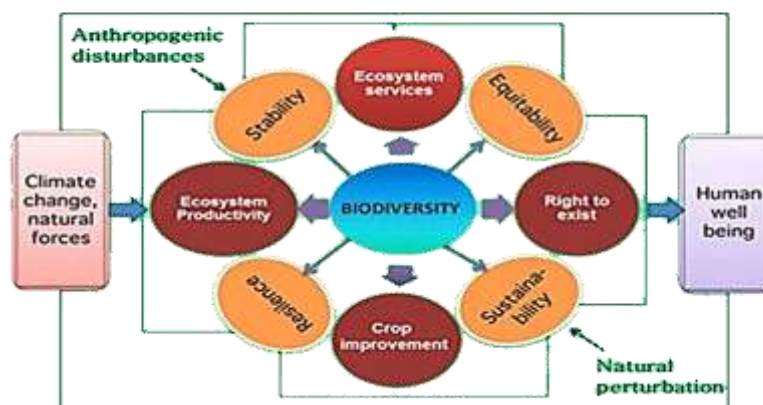
1.2 SIGNIFICANCE

Biodiversity and its maintenance is very important as it holds ecological, economic and evolutionary significance. This is also key to sustaining life on earth. Its most important function is providing Ecological Stability. Every species has a specific role in an ecosystem. They capture and store energy and also produce and decompose organic matter. The ecosystems provide services without which humans cannot survive. A diverse Biodiversity and ecosystem is more productive and can withstand environmental stress. We, as society derive multiple benefits called Ecosystem services. The services are-

1. Supporting services- These are necessary for the production of all other ecosystem services. Some examples include biomass production, production of atmospheric oxygen, soil formation and retention and nutrient cycling
2. Provisioning services- Food and water, regulation of floods, soil erosion and disease outbreaks.

3. Regulating services- It regulates essential processes such as supply of oxygen, purification of air, cleanses drinking water and wastewater, pollination of crops, pest control, decomposition of wastes, generation and renewal of soils, stabilises climate and sequesters carbon. All these regulations reduce risk to health without costly Infrastructure.
4. Cultural services- It includes non-material benefits such as recreational pursuits that rely on our unique biodiversity such as bird watching, hiking, camping and fishing besides spiritual benefits in natural areas.

Fig: 1 The Biodiversity and the ecosystem services



THREATS TO BIODIVERSITY

The company activities can result in Habitat loss or alteration, Species extinction, introduction of invasive/ non-native species, changes in the way natural systems function and changes in their ability to support species and people and Loss of benefits for people that depend on biodiversity and ecosystems. This becomes a source of business risk when stakeholders raise concerns about real or perceived impacts that have occurred, or may occur in future. These effects does not seem to have been affected to any significant level for project implementation and its operation since 2010.

Important threats leading to loss of biodiversity are:

1. **Habitat Loss and Fragmentation:** The destruction of habitats is the primary reason for the loss of biodiversity. When people cut down trees, fill a wetland, plough grassland or burn a forest, and other anthropogenic stresses including industrial activity. Another pyogenic stresses including the natural habitat of a species is changed or destroyed. These changes can kill or force out many plants, animals, and microorganisms, as well as disrupt complex interactions among the species. A forest patch surrounded by croplands, orchards, plantations, or urban areas is an example of fragmented habitats. With the fragmentation of a large forest tract, species occupying deeper parts of forests are the first to disappear.
2. **Overexploitation:** This reduces the size of population to an extent that it becomes vulnerable to extinction. Human need and greed have afflicted for maximization of biomass exploitation in our forest. Forests is the bank where whole checks have been drawn without hindrance. For this simple reason our forests have suffered the most and consequently plant and animal biodiversity has been the major causality.
3. **Disturbance and Pollution of Soil, Water and Environment:** Communities are affected by natural disturbances such as fire, tree fall, and defoliation by insects. Man induced disturbances differ from natural disturbances in intensity, rate and spatial extent. For example, man, by using fire more frequently may change species richness of a community. Then, some human Impacts are new, never faced before by biota, e.g., massive releases of pollutants, radiations or spill over of oil in the area. These impacts lead to a change in the habitat quality. Pollution may reduce and eliminate populations of sensitive species. Eutrophication (nutrient enrichment) of water bodies drastically reduces species diversity.
4. **Global Climate Change:** A massive side effect of air pollution is global warming which can play havoc with h biodiversity. Human caused increase in green house effects including industrial operations are likely to create disturbances in atmospheric temperature affecting living flora and fauna. Forest is as a whole shall

be under stress because environmental condition and shall deteriorate causing further problem to the biodiversity.

5. Introduction of Invasive/ Exotic Species: Introduction of species new to the geographical region are basically exotic or alien for the host area. Such exotic invasive species are considered second only to habitat destruction as a major cause of extinction of species. Water hyacinth clogs rivers and lakes and threatens the survival of many aquatic species in lakes and river flood plains in several tropical countries, including India. Lantana camara, Parthenium hysterophorus , Ageratum conyzoides etc have invaded different parts of India including ESL site and its surrounding and strongly competes with the native species.

Parthenium hysterophorus (Exotic species)



1.3 REFERENCE FRAMEWORK

- i. Company policy
- ii. The Biological Diversity Act, 2002
- iii. EIA notification 2006
- iv. EIA Guidance Manual for area development projects
- v. Wild life Protection act, 1972
- vi. IFC Performance Standard 6 on Biodiversity Conservation and Sustainable Management of Living Natural Resources 2012

- vii. Vedanta Resources Ltd, sustainability governance system, guidance note GN 04 v2
Biodiversity management
- viii. IUCN guidelines regarding planning and monitoring corporate biodiversity
performance

1.4 Legal Provisions in Relation to Biodiversity

1.4.1 Constitutional Provision

Article 48-A of Directive Principles of State Policy added by constitution 42nd Amendment, 1976 says “the State shall endeavour to protect and improve the environment and to safeguard the forests and wildlife of the country”.

Art. 51-A Sub-clause (g) on Fundamental Duties states “it is duty of every citizen of India to protect and improve the natural environment including forests, lakes, rivers and wildlife and to have compassion for living creatures.”

1.4.2 Laws of the land

Following LAWS have direct or indirect bearing on BIODIVERSITY conservation in the area.

- i. India have exclusive BIOLOGICAL DIVERSITY ACT 2002. This was enacted in the background of Convention on Biological Diversity adopted in Earth summit held at Rio De Janerio, Brazil in year 1992. GOI is signatory to this convention. It aims at conservation of biological resources, managing its sustainable use and enabling fair and equitable sharing of benefits arising out of the use and knowledge of biological resources with the local communities.
- ii. Indian Forest Act, 1927
- iii. Wildlife (Protection) Act 1972
- iv. Forest (Conservation) Act 1980
- v. Environment (Protection) Act 1986
- vi. Water (Prevention and Control of Pollution) Act 1974

- vii. Air (Prevention and Control of Pollution) Act 1981
- viii. EIA notification 2006
- ix. National Green Tribunal act (NGT), 2010

1.4.3 POLICIES having bearing on Biodiversity

There are TWO main GREEN policies in the country that guides country in this regard:

- i. National forest policy 2018
- ii. National Environmental policy 2006

1.5 NEED OF STUDY

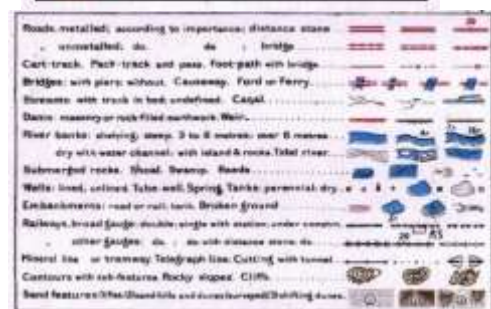
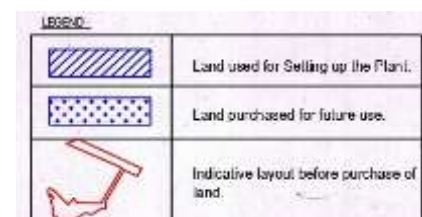
- i. Company policy
- ii. Identify biodiversity area, protected areas, and areas categorized by IUCN as significant for species of plants or animals vis a vis location of ESL site at Bokaro and fix critical habitat in area, if present
- iii. Conduct a biodiversity risk assessment based on local biodiversity and ecosystem services and associated regulations to verify that the site has been assigned the most appropriate biodiversity risk rating such as High, medium and low.
- iv. Document legal obligations of company for biodiversity management including restrictions on where industrial sites can be located, additional costs payable for operating in or near areas of importance for biodiversity, offset impacts through the purchase of biodiversity offset land or credits, management actions expected or required by regulators under local, regional or national biodiversity plans, biodiversity on the site and surrounding areas, including the presence (permanent or temporary) of important or endangered species of plants or animals, as listed on the IUCN Red list, land uses on and around the site (residential, agricultural, industrial, recreational, commercial etc.) and stakeholders who may be interested in the site (e.g. local communities, NGOs, academics).

- v. Draw Biodiversity management plan for the area based on RISK CATEGORY

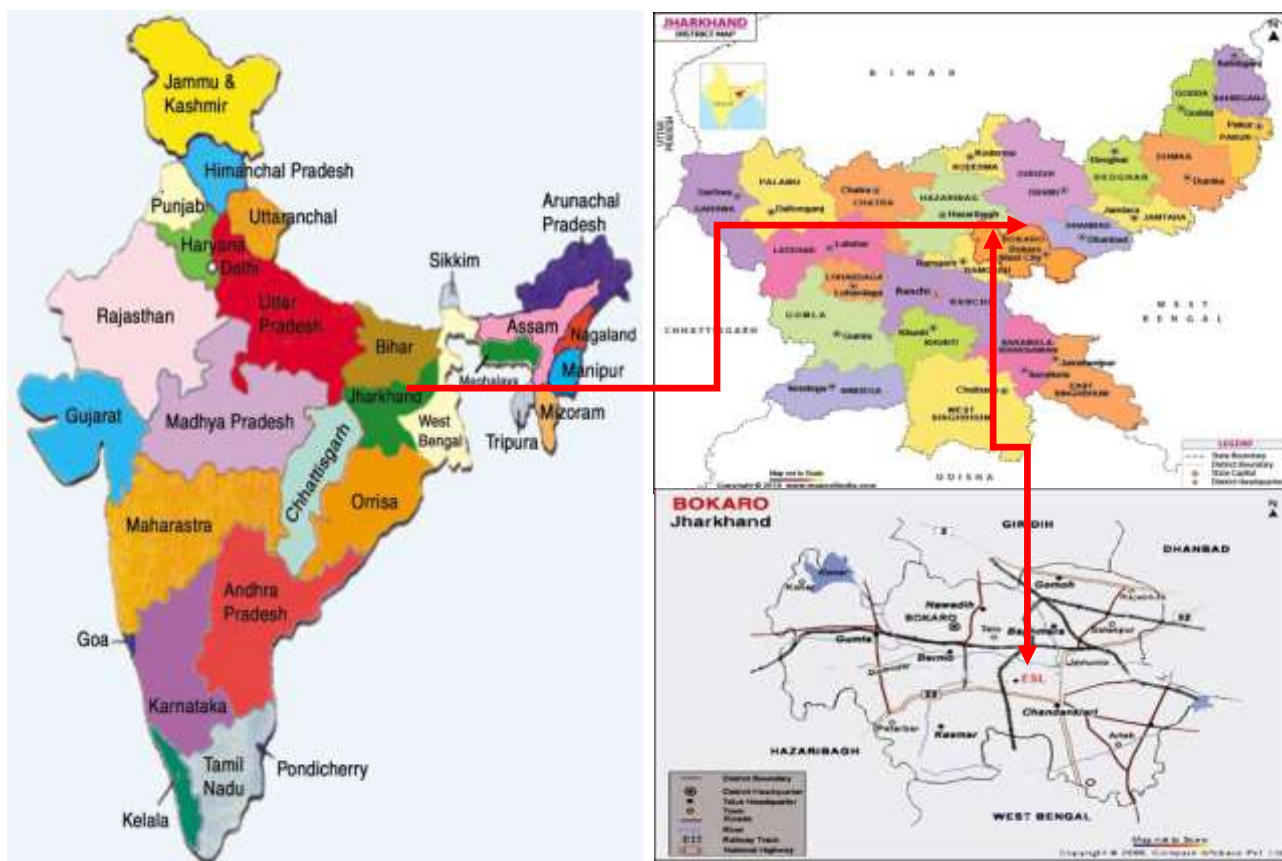
1.6 SCOPE OF STUDY

- i. Carry out Biodiversity study in 10 km impact area of ESL steel limited at Bokaro, Jharkhand.
- ii. Baseline survey of Bio-diversity study area
- iii. Bio-diversity risk screening of the area
- iv. Biodiversity impact assessment of area throughout life cycle of the plant.
- v. Preparation of Bio-diversity Management plan and mitigation measures
- vi. BMP to be updated in response to any changes in law.

FIG NO.2 - The 10 km STUDY AREA



LOCATION MAP SITE
ESL Steel Limited, BOKARO, JHARKHAND



1.6.1 Location & Accessibility

The project is located at villages Siyaljori, Bhagabandh, Budhibinor, Alkusha, Dhandabar, Bandhdih and Hutupathar, District Bokaro of Jharkhand. It is spread over an area of 374.81 ha. The co ordinate extends from 86° 17' 10.618" E 23° 37' 34.882" N to 86° 18' 39.599" E 23° 37' 52.733" N and falls under Survey of India topo-sheet No. F45C2 and F45C6.

The district is located at an elevation of 200 to 546 m from above mean sea level. Bokaro District is situated in the eastern part of the state of Jharkhand and is bounded on the east by Dhanbad district and some portion of West Bengal State, on the west by Ramgarh district, on the south by Purulia district of West Bengal and on the north by parts of Giridih, Hazaribag and Dhanbad districts. Bokaro district is well connected by road, rail and air communication system from other parts of the country.

1.6.2 Geology of the Area

The Bokaro district is part of Chotanagpur Plateau. It is hilly and highly undulating all over the district. The regional slope of the district is towards east and is controlled by the alignment of the tributaries of Damodar river. The hill ranges trends WNW - ESE. The average elevation of the pediplain is between 150 - 350 m above MSL. The northern and western part of the district is having hilly ranges. The highest hill prominent block is Gomia. Chas and Chandankiyari are low upland where cultivation is practiced Geologically the area comprises with Archean rocks of meta- sediments, limestone, Phyllites, Chotanagpur granite gneisses. In eastern, northern and western part has Gondwana rock formation.

The soils occurring in different landforms in the District are namely Entisols, Inceptisols and Alfisols. Alfisols were the dominant soils covering 62.0 percent of TGA followed by Inceptisols (21.4 %) and Entisols (12.7 %). Texturally the soils of Bokaro district are classified into four classes namely Stony and Gravelly, Sandy Soils, Loamy Soils and Aayey Soils The area is very fertile but yielding capacity improves with addition of sand, lime and organic manures etc. Soil fertility status has been studied by National Bureau of Soil Survey and Land Use Planning, Kolkata in association with Birsa Agricultural University, Ranchi. Soil pH ranges from 4.4 to 7.2. Soils of 2.2% area of the district are neutral in reaction. The organic carbon content in the district ranges from 0.09 to 3.9%. Soils of majority area (83.4%) have high organic carbon content. Medium and low organic carbon content constitutes 7.4 and 4.5% area, respectively. Available nitrogen content in the surface soils of the district ranges between 58 and 785 kg/ha. Majority soils (74.2% of total area) of the district are medium in available nitrogen (280-560 kg/ha). Soils of 17.0 and 4.2% area have high (>560 kg/ha) and low (<280 kg/ha) available nitrogen content, respectively. Available phosphorus content in these soils ranges between 1.0 and 15.6 kg/ha. Majority of the soils (68.8%) are low whereas 26.5% soils are medium in available phosphorous content. Available potassium content in these soils ranges between 49 and 952 kg/ha. Most of the soils (48.4% of total area) have low available potassium content (below 108 kg/ha). Soils of 37.9% area are medium (108-280 kg/ha) and 9.0% area are high (above 280 kg/ha) in available potassium content. The available sulphur content in the soils ranges from 0.34 to 43.43 mg/kg and soils of 13.9% of the area are low (<10mg/kg) in available sulphur content, respectively. All the soils of

district are sufficient in available iron and manganese whereas soils of 2.1 and 0.3% area are deficient in available zinc and copper, respectively. Available boron content in the soils ranges between 0.22 to 5.90 mg/kg and 9.1% area of district are deficient (<0.50 mg/kg).

1.6.3 Hydrogeology

The shallow and medium dug wells are suitable for extraction structures in the district. It is necessary for drinking as well as irrigation purpose. The stage of ground water development in the district is 31.31% only. Thus there is sufficient scope for development through dug well, shallow and medium bore wells.

The total ground water draft for irrigation in the district is 5203.99 ham. The net annual ground water availability and the existing ground water draft for all uses is 25408.41ham and 7956.10 ham respectively.

**Table No 2. Depth to water level fluctuation between May 2015 to January 2016 at
BOKARO**

Sl No.	District	No. of wells analysed	Depth to water level (m bgl)		No./Percentage of wells Showing Depth to Water Level in the Range of									
					0 to 2		2 to 5		5 to 10		10 to 20		20 to 40	
			Min	Max	No	%	No	%	No	%	No	%	No	%
1	May 2015	12	2.75	11.60	0	0.0	2	16.7	8	66.7	2	17	0	0
2	August 2015	14	1.24	11.38	1	7.1	10	71.4	2	14.3	1	7.1	0	0
3	November 2015	12	2.01	12.65	0	0	6	50	5	42	1	8.3	0	0
4	January 2016	10	4.41	12.65	0	0	3	30	3	0	4	40.0	0	0

Source: Ground water year book Jharkhand (2015 - 2016) prepared by goi, ministry of water resources, rd & gr and central ground water board

1.6.4 Geographical Area of Bokaro is 2883 Sq. km. Administrative Divisions of the District include Blocks (09), Panchayat(249) and villages (635). Total population is 20,62,330 (2011 census) persons. Main tribe in the area is Oraon , Chero, Korwa and Parahiya. ST population

is 2, 18, 600, languages spoken are Hindi & Oraon. Population per Sq Km 715 person. Sex ratio 922, Climate is Humid & Sub-tropical climate, important minerals include Coal, CBM, Limestone, Stone, Quartzite, Sand and Bricks.

1.6.5 Vegetation cover of the area conform to Northern tropical dry deciduous forest and is classified as 5-B as per champion and Seth(1968). This further falls into following subtypes as Dry peninsular Sal forest (5B/C-1), Northern dry mixed deciduous forest(5B/C-1) and scrub/degraded forests.

1.6.6 Climate

Climate of the area is Humid & Sub-tropical climate. It has three distinct seasons (i) Hot and dry summer (ii) Warm and humid Rainy season and (iii) Winter. Period of these three broad seasons is described as Winter Season- November to February, Summer Season- March to May & Rainy Season- June to September.

We have studied and analyzed Climatological Data for the period March 2020 to May 2021.

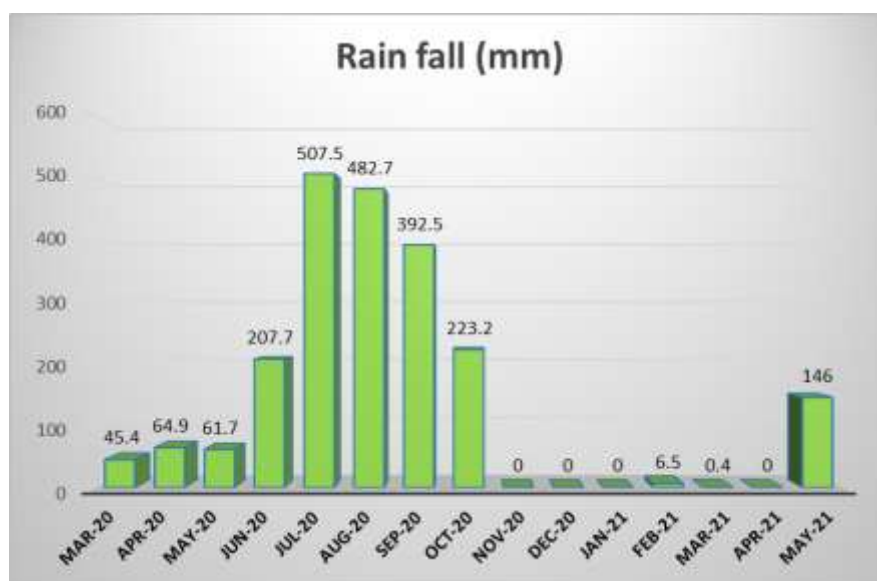
Table 3. Climatological Data March 2020 to May 2021												
Year	Month	Month	Max temp C	Min temp C	Rain mm	Avg wind speed Kmp/h	Avg wind gust Kmp/h	Visibility Km	Humidity	Pressure MB	Cloud cover	Sun hour
2020	Mar-20	3	33	23	45.4	9.8	13.2	10	36	1011.1	20	343
2020	Apr-20	4	39	27	64.9	10.1	13.7	10	28	1007.2	16	354
2020	May-20	5	40	29	61.7	13.4	16.9	10	39	1002.9	16	355
2020	Jun-20	6	36	29	207.7	12.3	16.6	9	56	1000.7	48	329
2020	Jul-20	7	34	27	507.5	10.7	16.1	9	71	1001	65	242
2020	Aug-20	8	33	27	482.7	11.4	17.2	9	76	999.4	67	212
2020	Sep-20	9	33	26	392.5	8.6	13.7	9	76	1003.9	63	234
2020	Oct-20	10	31	24	223.2	7.9	11.7	9	69	1007.6	40	314
2020	Nov-20	11	29	20	0	8.3	11.9	10	43	1015	8	360
2020	Dec-20	12	28	18	0	8.1	11.3	10	38	1015	6	372
2021	Jan-21	1	28	16	0	8	11.8	10	37	1013.7	8	341
2021	Feb-21	2	31	20	6.5	9.1	12.8	10	30	1013.2	9	332
2021	Mar-21	3	39	27	0.4	8.8	12.2	10	16	1008.3	5	371
2021	Apr-21	4	42	28	0	10.6	15.4	10	19	1005	14	352
2021	May-21	5	37	27	146	13.2	17.9	10	48	1002.6	35	319

SOURCE- World Weather Online

Fig No. 3 - Climatological Data March 2020 to May 2021

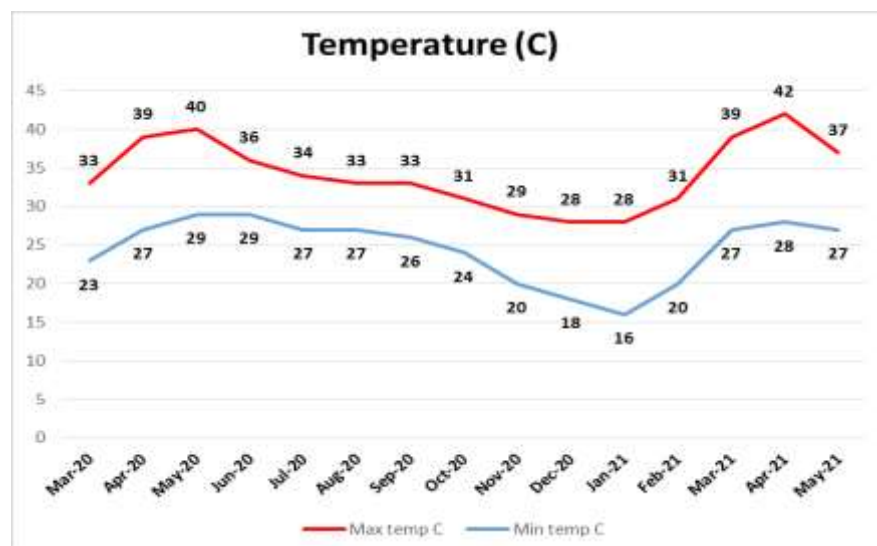
Rainfall

The average rainfall in this area is about 2138.5 mm (15 Months) during the study Period. Maximum rainfall was in July 2020 (507.5 mm) and minimum was observed in the month of April 2021 (0 mm)



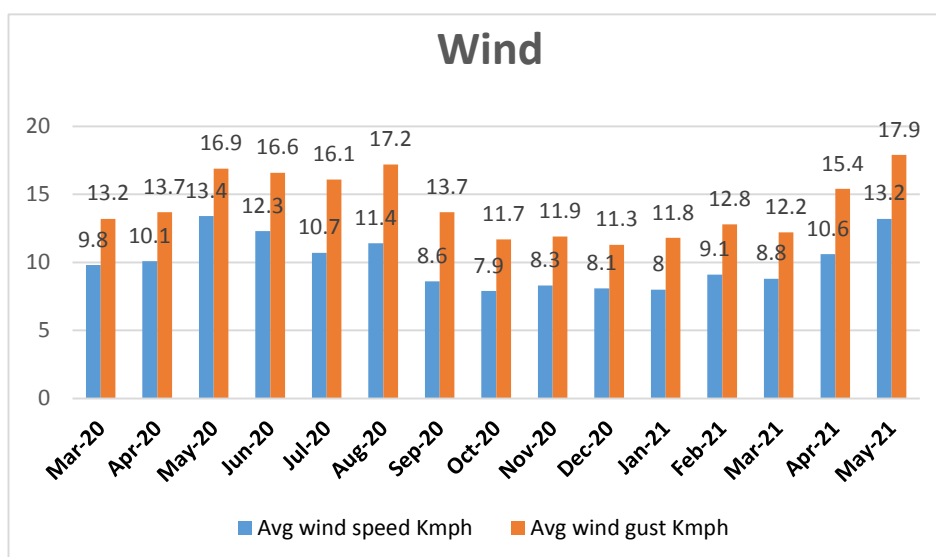
Temperature

The average temperature in this area is about 29.3 °C (15 Months) during the study Period. Maximum temperature was in the month of April 2021 (42 °C) and minimum was observed in the month of Jan 2021 (16 °C).



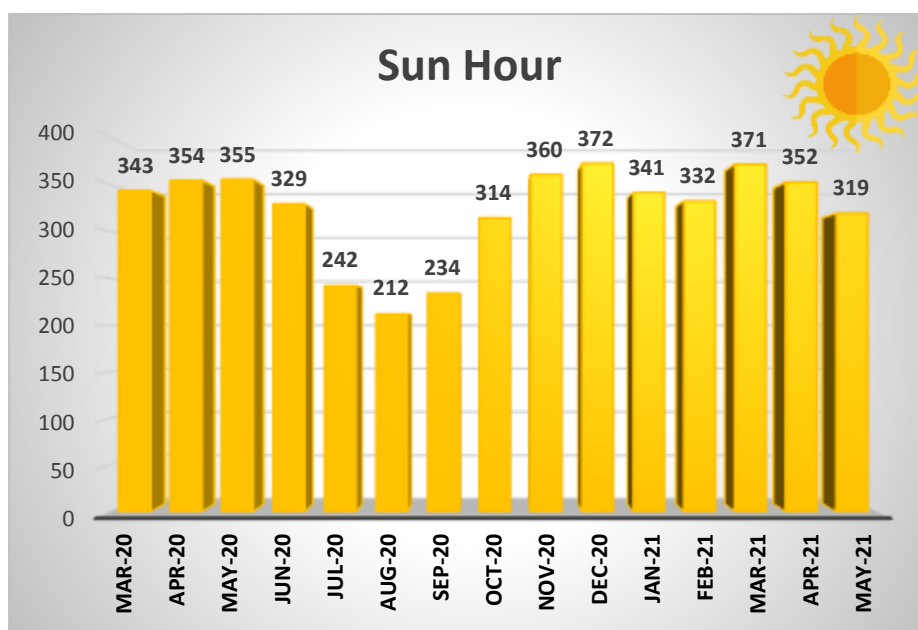
Wind velocity

The average wind in this area is about 10.02 (15 Months) during the study Period. Maximum wind was in May 2020 (13.4 km/h) and minimum observed in the month of Jan 2021 (8 km/h) .



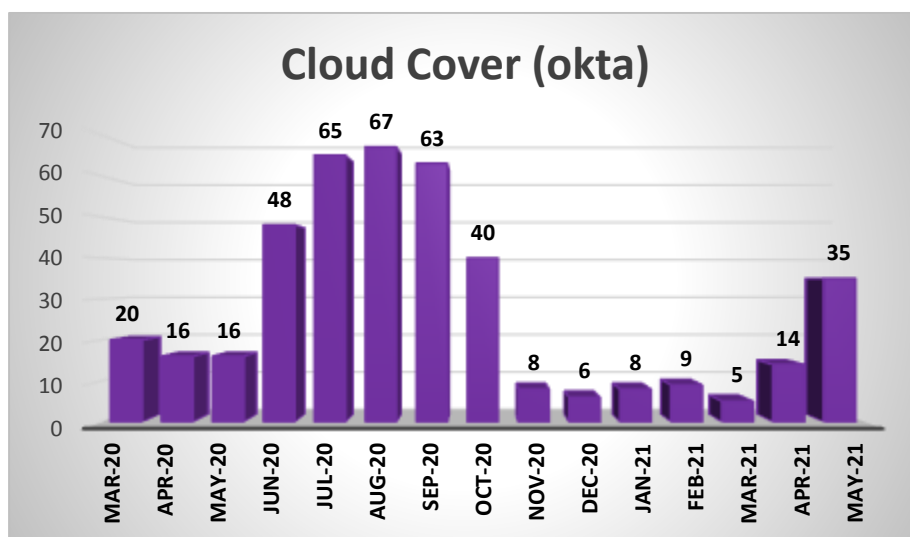
Sun Hours

The average Sun hours in this area is about 322 (15 Months) during the study Period. Maximum Sun hour was in Dec 2020 (372) and minimum observed in the month of Aug 2020 (212).



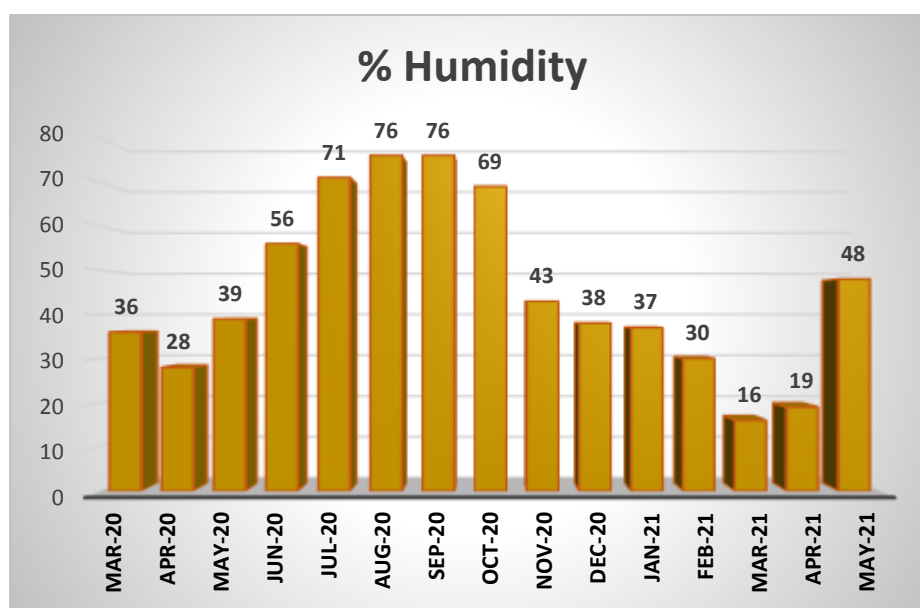
Cloud Cover

The average Cloud Cover in this area is about 28 (15 Months) during the study Period. Maximum Cloud Cover was observed in Aug 2020 (67) while minimum was in the month of Mar 2021 (5) .



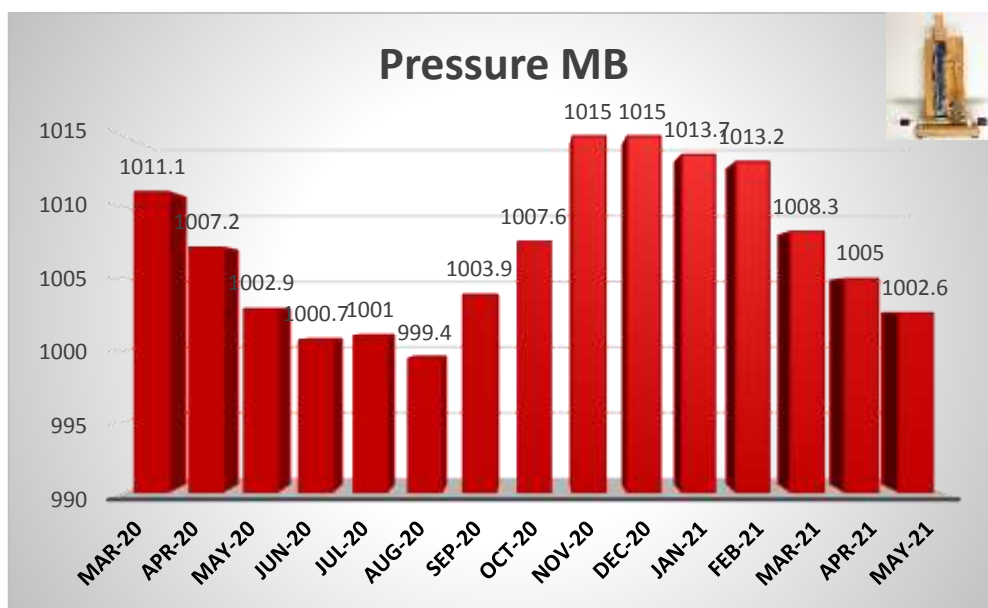
Humidity (%)

The average Humidity (%) in this area is about 28 (15 Months) during the study Period. Maximum Humidity (%) was observed in Aug 2020 (76) while minimum was observed in the month of Mar 2021 (16).



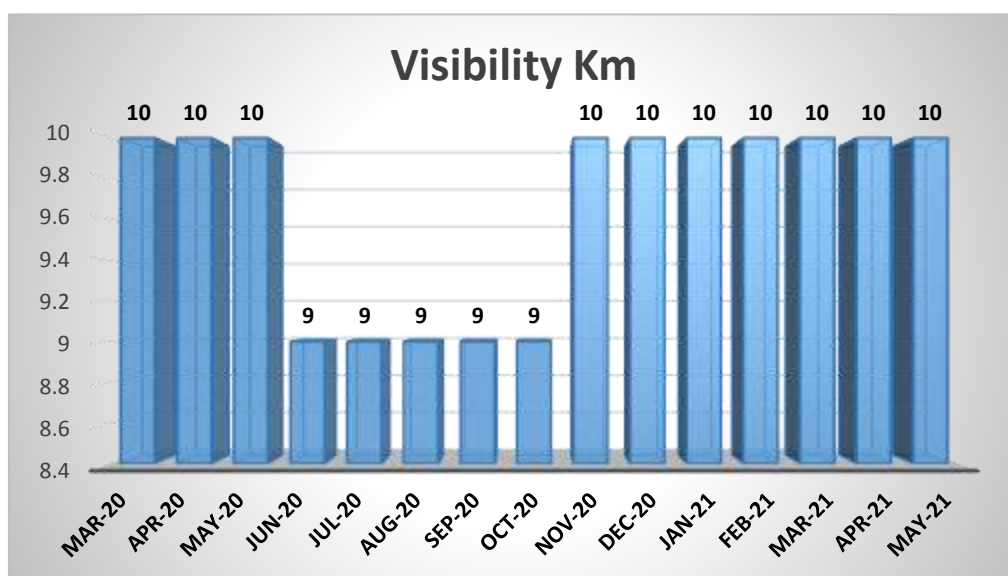
Pressure (MB)

The average Pressure (MB) in this area is about 1007 (15 Months) during the study Period. Maximum Pressure (MB) was observed in Nov 2020 (1015) and minimum was observed in the month of Aug 2020 (999.4)



Visibility Km

The average Pressure (MB) in this area is about 1007 (15 Months) during the study Period. Maximum Pressure (MB) was observed in Mar 2020 (10) and minimum in the month of Aug 2020 (09)



1.6.7 Habitations and villages

Geographical area of Bokaro is 2883 Sq. km. About 71 villages are located in the 10 km study area. Company has identified 27 villages for intervention having maximum impact of its operations. Total population is 20,62,330 (2011 census) persons. Main tribe in the area is Oraon , Chero, Korwa and Parahiya. ST population is 2, 18, 600, languages spoken are Hindi & Oraon. Population per Sq Km 715 person. Sex ratio 922. In study area there are about 100 villages. Details of 27 villages are described below-

Table 4. ESL CSR INTERVENTION VILLAGES

SL.NO	BLOCK	PANCHAYAT	CORE VILLAGES	Approx Distance from ESL (Maithan)	As per Census 2011						
					No of Households	Total Population Person	Total Population Male	Total Population Female	Population in the age group 0-6 Person	Population in the age group 0-6 Male	Population in the age group 0-6 Female
1	Chas	Chandaha	Chandaha	4 KM	760	3640	1826	1814	735	368	367
			Buribinor	4 KM	428	2317	1174	1143	426	211	215
			Bhagabandh	1 KM	312	1485	761	724	276	134	142
			Brindawanpur	3 KM	92	519	267	252	83	48	35
		Madhuniya	Mudunia	7 KM	415	2240	1153	1087	436	220	216
			Huthupather	4 KM	233	994	476	518	134	63	71
			Bhandidh	8 KM	448	2077	1074	1003	319	157	162
		Belunja	Usardih	8 KM	152	722	394	328	107	54	53
		Brahman Dwarika	Gopalpur	11 KM	333	1583	801	782	269	127	142
		Alkusha	Alkusha	6 KM	539	2876	1472	1404	476	240	236
			Dhandabar	7 KM	280	1470	726	744	265	123	142
2	Chandankiyari	Sabra	Sabra	7 KM	696	3620	1842	1778	535	261	274
			Udalbani	6 KM	404	2504	1270	1234	416	201	215
		Siyaljori	Siyaljori	6 KM	628	4954	3080	1874	586	305	281
			Tentulia	13 KM	628	3470	1780	1690	546	274	272
		Badajor	Bangaria	13 KM	157	878	464	414	146	66	80
			Surjudih	13 KM	174	977	501	476	148	75	73
		Nayaban	Babugram	7 KM	296	1494	766	728	250	141	109

		Devgram	Jogidih	13 KM	120	654	348	306	89	48	41
			Asansol	13 KM	366	1663	863	800	254	130	124
			Nepurcho w	13 KM	46	255	131	124	37	23	14
			Upparban dha	14 KM	156	802	404	398	128	66	62
		Mohal	Mohal	18 KM	1775	9304	4876	4428	1515	790	725
		Chandra	Murrabad	5 KM	1322	7174	3678	3496	1211	616	595

1.6.8 Social and culture w.r. t Biodiversity

Many a festivals in the area and state are celebrated showing close relation between nature and the tribals/ local population. This include-Sarhul is celebrated during the spring season when the Shaal trees get new leaves. Sarhul festival is the worship of the village deity who is considered to be the protector of the tribes. The deities are worshipped with shal flowers. The shal flowers represent the brotherhood and friendship among villagers. The priest is called Pahan and he distributes shal flowers to every villager. The Prasad is then distributed among the villagers.

Karam- Karam Devta, the God of Power, youth and youthfulness is worshipped during the festival. The festival is held on the 11th day of the phases of moon in the Bhadra month. The groups of young villagers go to the jungle and collect the items required for Puja i.e. wood, fruits and flowers. During this entire period people sing and dance in groups. The entire valley seems to be dancing with the drumbeats. This is one of the rare examples of such a vital and vibrant youth festival in Jharkhand's Tribal area. At the same time, the unmarried young tribal girls celebrate the Jawa festival. This is held mainly in expectation of good fertility and better household. The unmarried girls decorate a small basket with germinating seeds. It is believed that the worship for good germination of the grains would increase the fertility. The girls offer green melons to the Karam deity as a symbol of 'son' which reveals the primitive expectation of human being, i.e. grains and children. The entire tribal area of Jharkhand becomes tipsy during this time.

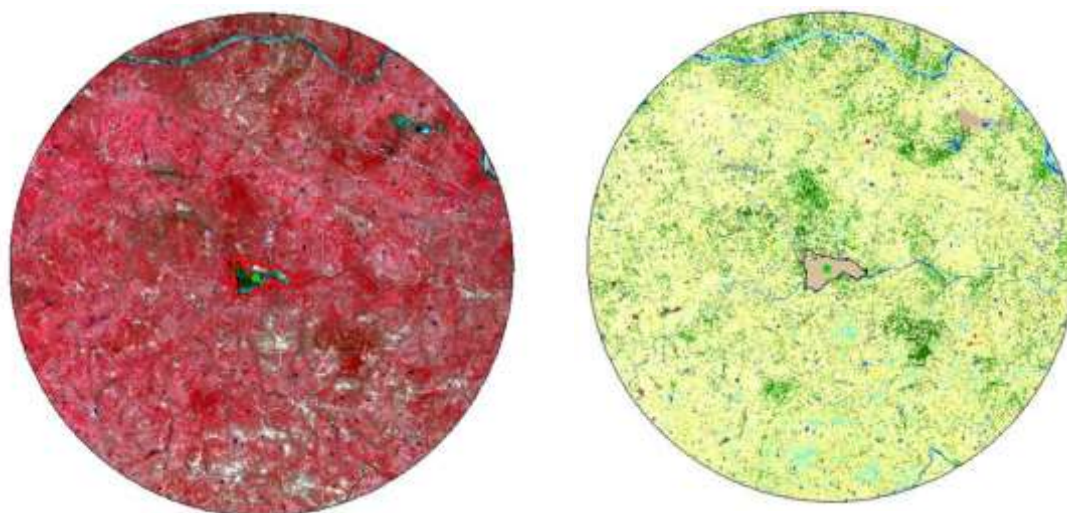
Tusu Parab or Makar-This festival is mostly seen in the area between Bundu, Tamar, Raidih and company adjoining villages. TUSU is a harvest festival held during the winter in the last day of Poush month. It is also for the unmarried girls. Other tribal festivals are Hal Punhya, Bandna, Rohin, Bhagta Parab etc.

Other festivals like Diwali, Holi, Id, X-Mas, Dusshera are also celebrated.

1.6.9 Land Use & Cropping Pattern

- i. Land use- A large area about 25% of the district is under forest cover. The cultivable land are divided into two categories - Low lands and uplands. Block wise statistical data reveals that only 29% of the total geographical area is cultivable. The highest percentage of cultivable area is found in Chandankiyari and Lowest being in Gomia block. The gross irrigated area is 14543 ha. Land use and land cover data taken using Satellite image in 10 km study area between February 2020, May 2020, November 2020 and February 2021 are reproduced below-

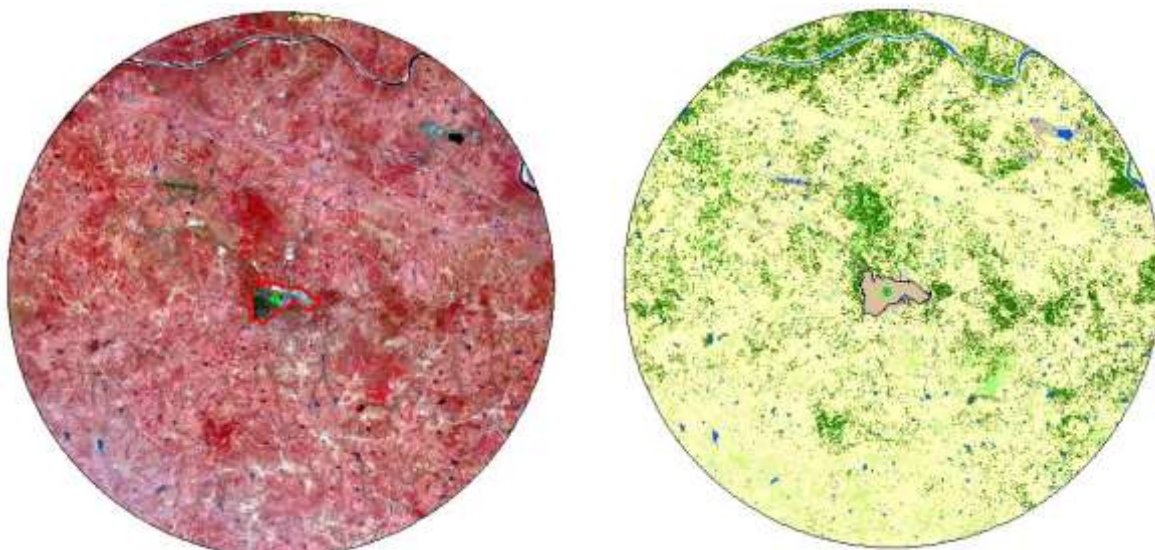
Table 5. Land use and land cover changes between Feb 2020 to May2021



False Color Composite Image of FCC 17th May 2020

Sl. No.	Land Use & Land Cover Classes	Area (Sq.km.) May 2020	Area (Percent)May 2020
1	Dense Vegetation Patches	26.82	8.53
2	Less Dense Vegetation	37.93	12.06
3	Built-Up/Dry River Bed/Dry Land	9.48	3.01
4	Water Body	8.22	2.61
5	Agriculture Land	146.14	46.48
6	Open Scrub Land	28.50	9.06
7	Disturbed Land	3.23	1.03
8	Grassland	9.89	3.15
9	Fallow Land	42.07	13.38
10	Pond Eutrophication	2.16	0.69
	Total	314	100

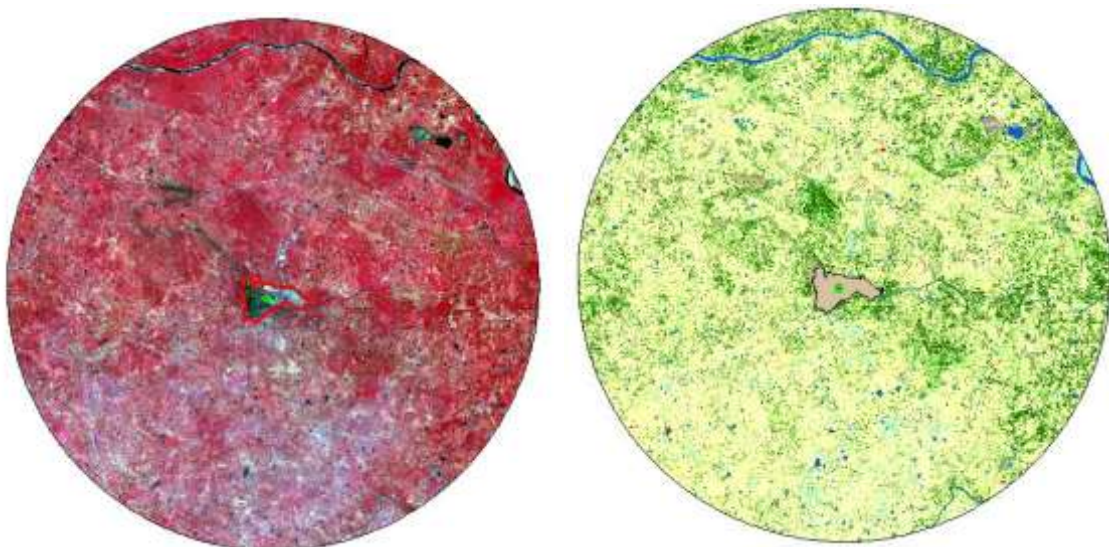




False Color Composite Image of FCC 12th February 2020

Sl. No.	Land Use & Land Cover Classes	Area (Sq.km.) Feb 2020	Area (Percent)Feb 2020
1	Dense Vegetation Patches	44.38	14.13
2	Less Dense Vegetation	12.16	3.87
3	Built-Up/Dry River Bed/Dry Land	2.05	0.65
4	Water Body	5.54	1.76
5	Agriculture Land	183.43	58.39
6	Open Scrub Land	15.52	4.94
7	Disturbed Land	4.19	1.34
8	Grassland	22.91	7.29
9	Fallow Land	23.98	7.63
10	Pond Eutrophication		
Total		314	100

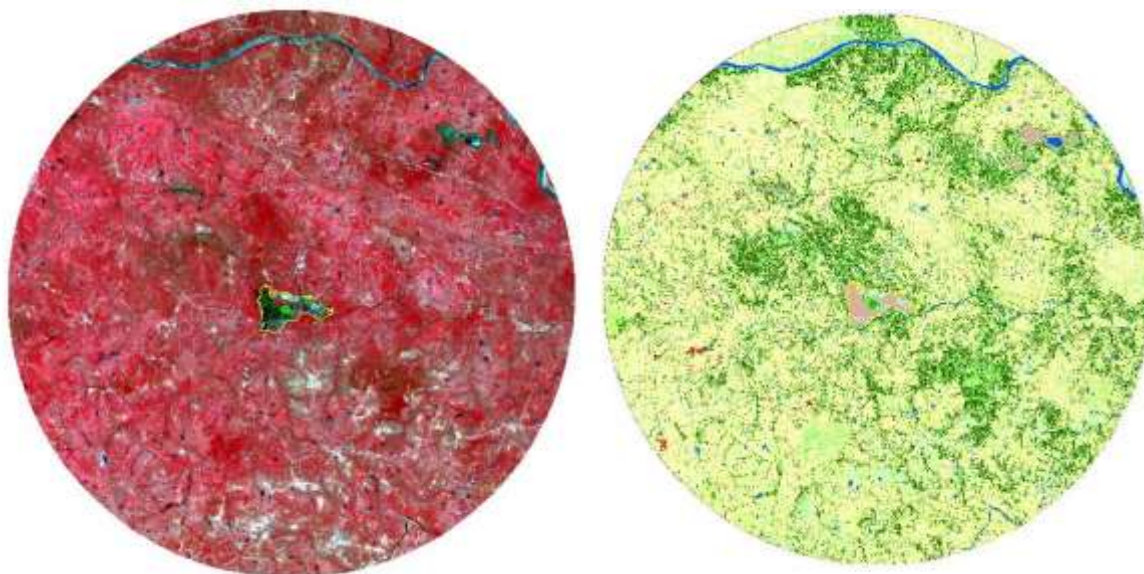
- Dense Vegetation Patches
- Less Dense Vegetation
- Built-up/ Dry River Bed/Dry Land
- Water Body
- Agriculture Land
- Open Scrub Land
- Disturbed Land
- Grassland
- Fallow Land



False Color Composite Image of FCC 8th November 2020

Sl. No.	Land Use & Land Cover Classes	Area (Sq.km.) Nov 2020	Area (Percent)Nov 2020
1	Dense Vegetation Patches	45.98	14.64
2	Less Dense Vegetation	36.35	11.57
3	Built-Up/Dry River Bed/Dry Land	7.19	2.29
4	Water Body	5.79	1.84
5	Agriculture Land	152.84	48.65
6	Open Scrub Land	37.55	11.95
7	Disturbed Land	4.38	1.39
8	Grassland	6.28	2.00
9	Fallow Land	16.85	5.36
10	Pond Eutrophication	0.96	0.30
Total		314	100

- Water Body
- Disturbed Land
- Built-up/Dry River Bed/Dry Land
- Lakes with Eutrophication
- Dense Vegetation Patches
- Less Dense Deciduous Vegetation
- Agriculture Land
- Fallow Land
- Open Scrub Land
- Grassland



FCC Satellite Image of February 2021

Sl. No.	Land Use & Land Cover Classes	Area (Sq.km.) Feb 2021	Area (Percent)Feb 2021
1	Dense Vegetation Patches	50.72	16.15
2	Less Dense Vegetation	43.23	13.76
3	Built-Up/Dry River Bed/Dry Land	14.34	4.57
4	Water Body	4.94	1.57
5	Agriculture Land	104.56	33.28
6	Open Scrub Land	39.03	12.42
7	Disturbed Land	4.86	1.55
8	Grassland	37.56	11.96
9	Fallow Land	13.61	4.33
10	Pond Eutrophication	1.29	0.41
	Total	314	100

Water Body
Disturbed Land
Built-up/Dry River Bed/Dry Land
Lakes with Eutrophication
Dense Vegetation Patches
Less Dense Deciduous Vegetation
Agriculture Land
Fallow Land
Open Scrub Land
Grassland

Source: Satellite imagery

- ii. There are 26 patches of Protected patches (PF) located in the study area. Larger chunk of the forests area is composed of the dry peninsular Sal forest rests on northern aspects and in the valley of hills and on slopes. Composition Of forest in the top and middle stories are Shorea robusta, Terminalia tomentosa, Madhuca indica, Pterocarpus marsupiam, Adina cordifolia and Diospyros melenozylon. The shrubs consist of Holorhina antidysentrica, Nyctanthes arbortrities, Zizyphus and phoenix sylvestris. The grasses consist of Heteropogon contortus, Dicanthinum annulatum Cynodon dactylon etc. The climber is mainly dominated by Bauhinia variegata, Asparagus racemosus , Acacia pinnata, etc.

- iii. The miscellaneous forests are observed on relatively drier hill tops and hills having poor soil and moisture condition. This is classified as northern dry mixed deciduous forests. The trees in the top storey are generally open. It includes *Boswellia serrata*, *Artocarpus integrifolia*, *Lagerstroemia parviflora*, *Diospyros melanoxylon*, *Petrocarpus marsupium*, *Adina cordifolia*, *Syzygium cumini*, *Madhucha indica*, *Emblia officinalis* and *Lagerstromia parviflora*. *Acacia katechu* is found in scattered patches in eroded areas. The scrub mostly consists of *Woodfordia fruticosa*. *Nyctanthes* is scarce. The middle storey consists of frequent and extensive bamboo breaks of *Dendrocalamus strictus* for better soil conditions. The area contain miscellaneous shrubs as *Ixora parviflora* and *Lantana camara* and a very little mesh of climbers like *Bauhinia vahlii*, *Smilax zeylanica*, *Combretum decandrum* etc and Scattered *Bombax malabaricum* trees are found in moist localities while *Boswellia serrata* are found on ridges and drier localities.
- iv. Grass growth in area is plentiful. *Dendrocalamus strictus* is the only bamboo species found in the area. Clumps of same are congested and malformed. It is thinly distributed all over in the mixed forests and is absent in Sal forests. *Heteropogon contortus* dominates among the grasses. Other prevalent ones are *Andropogon gerardii*, *Dicanthium annulatum*, *Bothriocloa pertusa*, *Cynodon dactylon* and *Panicum repens*.
- v. The entire land area is interspersed with forest and agriculture land/fallow land. Agriculture land occupies around (33-58) % of the total area along with a variation of (4-13) % for fallow agriculture land. Agriculture productivity in area is very poor as it is mainly dependent on monsoon rains besides wells and canals to meet its water demand. During the summers, there is an increase in the fallow land area. Major Kharif crops in the region includes paddy, maize, pigeon pea, groundnut, and pulses like arhar, urad and moong though it is in small patches. During the winter the Rabi crops grown are wheat, gram, mustard and linseeds. Apart from these crops seasonal vegetables are also grown in the region, both during Kharif and Rabi season. It is also observed that at some places tree plantation is practiced along the agricultural bunds. Major crops grown in the district are rice, wheat and pulses.

1.6.10 Livelihood - Collection of NTFP & Method of Collection and Its Impact on Biodiversity

The main NTFP species being collected & marketed are Sal Seed, Mahua flowers, Mahua Seeds, Karanj, Palas seeds, Sabai grass, Medicinal plants/herbs, Tassar Silk Cocoon, Harida, Bahera, Amla, Chiraunji, Kendu leaves, Gums, Lac and silk cocoons.

NTFP Collection

Most of the NTFP items available in this tract have one year collection cycle. In general collection after the rains (October) and is over by the end of spring (Mar-April). This enables the poor and labour class people to take up NTFP collection after planting seasons and before harvesting season of major agricultural crops. The growing demand for herbal treatments and ayurvedic medicines has ultimately increased the demand for N.T.F.P. as a raw material for many industries like herbal cosmetics, herbal dyes, ayurvedic drugs etc.

This huge demand for a few varieties of NTFPs is resulting in unsustainable and destructive exploitation of these resources by the primary collectors, which is abetted by traders and middlemen. Continued exploitation in this manner will endanger the resource itself.

Methods of Collection

It is generally believed that collection of NTFP cause little or no deleterious effect on the forests. This is however not always true. The method of collection of some NTFP have very adversely affected forests and is often unsustainable. Forest floors are often burnt before collection of many oil seeds, kendu leaf, and grasses, particularly fodder grasses. This practice is, very harmful to forests as it destroys the regeneration and also kills



micro -flora and fauna in the top layers of the soil. It also physically compact the soil and this situation are further aggravated when the forests floors are swept for leaf litter and humus. This practice adversely impacts nutrient re-cycling.

Mahua Flower:

Mahua flowers fall from the tree in very early morning. There after falling slows down and again picked up from evening. People used to hand pick the flowers from the ground. As the ground in many times are covered with dry leaf the pickers used to set fire around the tree. After the fire the back ground became black and golden yellow coloured flower is visible prominently. The fire set by the pickers sometimes remain un attended and spread in the nearby forest and cause forest fire with major loss of regeneration, habitat loss and damage to eggs of birds / reptiles. Mahua flower is also a good food to sloth bear, Elephant and birds. Collection by local people sometimes reaches 90% of fallen flower. This causes stress / scarcity of food to animals specially to bear. Man- Bear conflict and injury due to bear is seen mostly in this collection period.



Sal Leaf:

Sal leaf usually collected from young sal poles. 1/3rd of the leaf should be collected in a season. But in practice 70% of leaf in a young pole is used to be plucked by pluckers. Sometimes they cut down the young poles to reach the top leaves which causes enormous damage to sal regeneration.

Fruits& Flowers:

For collection of char, kendu, Amla, kusum etc the pickers should wait till the fruit become ripe and fall naturally. In many cases it is seen that the fruit pickers cut the branches and took all the fruits and flowers at a time. This hampers regeneration of the species and reduced the future yield.

SERICULTURE:

Sericulture plays an important role in the development economy of the district. A large number of tribal are engaged in the activity. Sericulture is very crucial in terms of employment and income generation avenues and opportunities to raise the economic status of rural people. These commodities are playing vital role for the up-liftment of women.

Collection of NTFP items by Scientific Methods

Many times, while collecting NTFP items, the local inhabitants do not use proper scientific method. The setting fire in the forest floor for collecting Sal seed, cleaning beneath Mohua trees by setting fire for collecting Mohua flowers, lopping of branches bearing seeds and fruit uprooting the plants bearing useful roots and tubers, complete debarking of trees having barks of commercial importance etc are the examples of unscientific exploitation. The items shall be collected without causing any harm to the trees and plants yielding them. Following scientific methods are suggested for collection of various NTFP items.

Seed Based

The burning of forest floor for easy collection of Sal seeds and setting fire for getting wing less Sal seed shall be strictly prohibited as it poses fire hazard. For collecting Mohua flowers and seeds, the floor beneath the tree should be cleared without setting fire. For collecting seeds, lopping of branches shall be strictly avoided and seeds will be collected in natural condition without branches and twigs.

Leaf based

Only the usual scientific method of cutting bushes above ground shall be for production of kendu leaves. While plucking and collecting kendu leaves care should be taken not to damage buds, branches and shoots. As per the Govt. order number 2957/F&E dt.11.02.91, sal leaves are not to be plucked from silvicultural point of view.

Bark based

The debarking of trees yielding bark of commercial importance, viz, Lodha, Medha, Phan Fena, Arjun etc is to be done at least five foot above the ground so as to prevent injuries from fire, microbes and white ants. The debarking should be confined to the arms reach only for preventing damage to tender barks and juvenile buds. It is to be confined to one face only and should not exceed more than 40% of surface of the bowl. The remaining portion of bole should be left untouched so as to maintain continuity of the cambium.

Gum and resin based

While collecting gums and resins, no harm shall be done to the trees yielding them. Artificial incision made over trunk should not be too large and deep to adversely affect the growth of trees. Intensive tapping for gums and resins is to be avoided as it may lead to damage and death of trees. The blazing will be done in staggered manner and not haphazardly. The shape of blaze should be triangular with angles pointing towards the ground. The initial blaze should be given at the breast height.

Root based

The roots and tubers of plants like Satabari, Dioscorea, Rauwolfia having commercial and medicinal importance are to be exploited in such a manner that least damage is caused to the plant. For this purpose, only some portion of peripheral roots and tubers are to be extracted. In no case, plants are to be uprooted. The exploitation of endangered plants species like *Dioscorea deltoides* (herbaceous climbers) *Dioscorea indica* (herb), *Rauwolfia serpentina* and some species of Entada (gila) is to be discouraged.

Table 6- NTFP collection

Sl No	Item of Collection	Effect
1	Sal Leaf	Delay in establishment of Regeneration.
2	Siali Fiber	Reduction in Siali crop – Depletion of growing stock
3	Siali leaf	Collection of leaf above 50% of available tender leaf hampered the growth.
4	Sal Seed	Hampered Regeneration
5	Mohua Flower	Reduction in food availability to Bear, Elephant, Birds.
6	Collection of Jamun, Jack Fruit, Tamarind, Char to nearly 90%	Reduction of food availability to Bear, Monkey, Fox, Jackal, squirrel
7	Honey, Sweet roots, Tubers	Reduction of food availability to Bear
8	Myrobalance (Amla/ Harida/ Bahada	Depletion of Tree population, Lopping of trees hampers the growth.

1.6.11 Horticulture

As the area is highly dissected and has rough terrain. Horticulture crops in the district are guava, papaya, mango and jackfruit. Due to long gestation period and shortage of quality planting stock, people are not very enthusiastic towards horticulture crops.

1.6.12 Mining

The Bokaro district is rich in coal minerals. Other mineral like stone, sand, limestone, quartz etc are also available in the district.

1.6.13 List of industries within 10 km of the project area

The 10 km area around the project is not an industrial area and ESL Steel Ltd. plant is the only major industry in the area. The list of other industries within 10 km radius of the Project is given in following table.

Table no. 7- Industries located within 10 km from ESL

S.no	Description of industry	Distance (km) from Plant boundary	Direction from plant boundary
1.	Parbatpur Central Coal Block BCCL (Capacity: 1.8 MTPA)	4.5	N.E
2.	CBM ONGC	6.2	N.E

2.0 METHODOLOGY AND APPROACH

Biodiversity study was conducted between February 2020 to May 2021 in 10 km area around project site.

The methods adopted for the study included-

2.1 ECOLOGY BASED STUDIES

HOW TO SELECT A REPRESENTATIVE SAMPLE

Following methods have been used for real time QUALITATIVE and QUANTITATIVE CHARACTERISATION of BIODIVERSITY in 10 km aerial radius distance (314 sq.km) around ESL site at Bokaro

Qualitative characterisation

Terrestrial flora

This has been studied in terms of floristic enumeration, sociability, dispersion, habit and habitat using standard floral sampling techniques such as:

1. Species area curve method (Ambasht R.S, 1990) was used to determine minimal size of quadrat. This gave us the quadrat size of 10 m x 10 m where with minimum size of sampling efficiency is maximum.

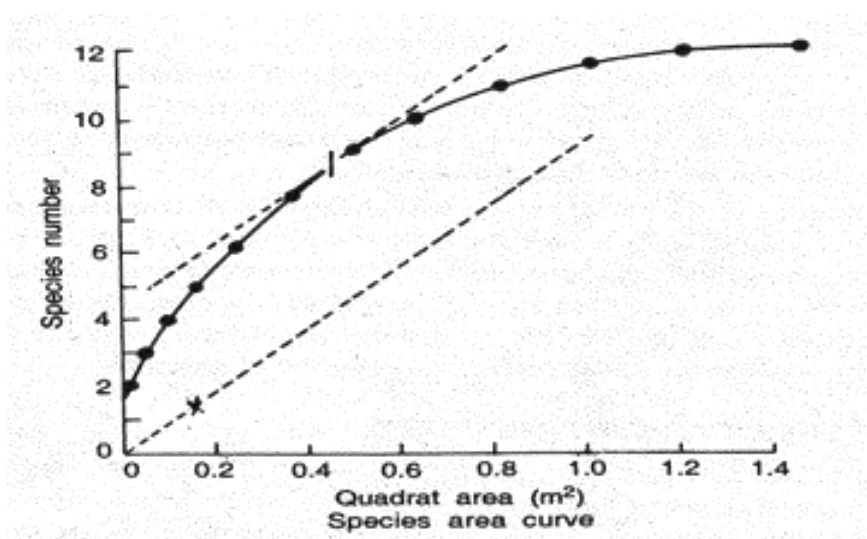


Fig. Species-area curve showing an initial rapid increase in number of species with increase in area of the quadrat. Gradually the rate of increase in number of species declines. A tangent is drawn on this curve parallel to a line drawn at 10% value joining the axis extending upwards.

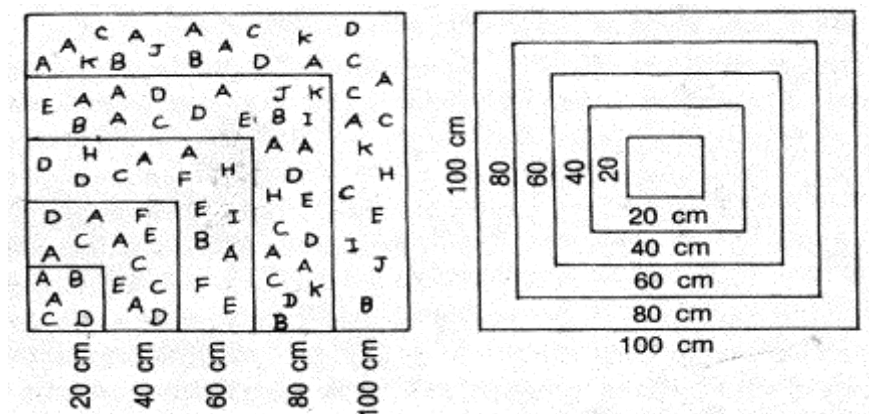


Fig. Diagrammatic representation of increasing size of quadrats and the numbers of species (represented by letters A -) in determination of the minimal requisite size of a quadrat by species area curve method.

Aquatic phytoplankton - These are simple circular top of overall conical shape net through which known volume of water sampling using allowed to pass through before taking it out for count studies of aquatic ecosystems.

Fauna study

Terrestrial Fauna was studied for wild life including Birds, Mammals, Reptiles, Pisces of the area and the Domestic animals using Secondary data/documents available with government bodies, Published literature was consulted to know status of biodiversity existing in area and discussion with Employees, local people and contract employees.

BIRDS The study area has different habitats such as forest patches, scrubs, wetlands, Grasslands, small rocky hill areas and agricultural as well as human habitations. During visit /survey the team walked on fixed routes in different habitats. Local people were also interviewed to assess for poaching of birds and other animals and their dependency on water bodies like ponds, rivers etc.

The study area was visited twice at interval of 15 days during pre-monsoon, Monsoon and Post monsoon period. Average number of birds encountered in the area were listed.

Survey was conducted in morning between 6.30 am to 9 am and evening hours between 3.30 pm to 5.30 pm. Encountered method was adopted to make a checklist of fauna present in the area. It also included random sampling method. Road transects of standard length 700 to 800 M in forest habitats on a fixed path to cover fauna on either both using binocular.

For bird's survey point count method, area search method was adopted. Wetland birds were surveyed as per guidelines of AWC, wetland international during day time. Finally check list was drawn.

Tools used for bird survey included Olympus binoculars (10x50), Sony Cyber shot HX 100v - 24 X, Field guide books to identify birds and other wild animals, Birds of south Asia by Rasmussen and Anderton, The book of Indian Birds by Salim Ali and on Birds of India and Glimpses from India's Natural World by A K Sahay.

Aquatic zooplankton study- Zooplanktons present in water bodies was studied using plankton net for sampling

Quantitative characterisation

Biodiversity has been measured and described community structure in term of Frequency, abundance, density and Diversity described(Singh, Mishra and Ambasht 1980). Same are as below-

Frequency

This describes degree of dispersion of individual species in an area. Usually expressed in terms of percentage (%) occurrence. It is probability of an individual of a given species to be present in a randomly placed quadrat. For instance if a species occurs in two quadrats out of a total 10 quadrats studied, then its frequency is 20%.

$$F = \frac{\text{Number of quadrats in which a species occurs} \times 100}{\text{Total number of quadrats sampled}}$$

Abundance

This is the study of number of individual of different species in the community per quadrat. Here samplings are made at random at several places and the number of individuals of each species is summed for all the quadrats. The total number of individuals of different species if divided by the number of quadrats where that species occurs.

$$\text{Abundance} = \frac{\text{Total no. of individuals of a species in all quadrats}}{\text{Total no. of quadrats in which the species occurred}}$$

Density

Density is an expression of the numerical strength of a species where the total number of individuals of each species is divided by the total number of zones/quadrats studied and expressed in numbers per sq m

$$\text{Density} = \frac{\text{Total no. of individuals of a species in all quadrats}}{\text{Total no. of quadrats sampled}}$$

The above formula would give the density value per quadrat.

Diversity Indices

It is a statistical abstraction with 2 components includes RICHNESS and EVENNESS (Lewis 1970). The product of these is described as Species diversity. The diversity is principally a mechanism which generates community stability. Greater diversity provides a number of alternative pathways in the ecosystem functioning which gives stability to the ecosystem whereas single species crops are least productive. A number of Species diversity indices have been given by ecologists from time to time. Most popular among indices are that given by Shannon index of diversity (1949)-

$$\bar{H} = - 3.3219 \sum (n_i / N \times \log (n_i / N))$$

Where H = Shannon index n_i = number of species, N= Total number of individuals (or any other parameter of importance).

Species Richness: Describes the number of different **species** present in an area (more **species** = greater **richness**)

$$D = S/\sqrt{N}$$

D=Species Richness

S=No. of Species

N=No. Individual of all Species

EVENNESS: Describes the relative abundance of the different **species** in an area (similar abundance = more **evenness**)

$$E = \frac{1}{S} \sum_{i=1}^S \left(\frac{H_i}{N} \right)^2$$

E= $\frac{1}{S}$ / $\ln(S)$ Richness

2.2 SATELLITE BASED STUDIES

Earth surface study using satellite images-

Conduct Satellite image based analysis of area in and around ESL covering a radius of 10 km.

1. Nature of Green belt
2. Defining Stress in the region through interpretation of landforms
3. Marking of Stress regions/landforms within the study area
4. Conduct Satellite Image based Mapping of Land Use and Land cover forms for three Seasons covering an area of 10 km radius around the ESL within a year.
5. Generate NDVI Images of the three time period and see changes in greenness index
In-order to assess the area, **Sentinel 2** (European Space Agency, ESA) multispectral satellite images of multiple dates were used to access the land use and land form and also analyse the changes if any in the region of interest

2.3 BIODIVERSITY MANAGEMENT PROCESS STUDIES

The approach for Biodiversity management process is as below-Biodiversity Risk Screening - Biodiversity risk screening has been undertaken using IBAT (Integrated Biodiversity Assessment Tool). IBAT is a central database of globally recognised biodiversity information. It has been used to map out the locations of important biodiversity areas, protected areas, and areas categorised by IUCN (International Union for Conservation of Nature) as significant for species of plants or animals vis a vis ESL plant operations at Bokaro.

Biodiversity Impact Assessment

Biodiversity impact assessment consists of desk-based study of information on associated regulations (national and international), agreements and conventions and Biodiversity and ecosystem services status of study area. This is aimed at assigning the most appropriate biodiversity risk rating.

Biodiversity Risk Rating

The risk rating has been undertaken for site based on Secondary and primary data collected on biodiversity of the area. The data so collected has been used to define biodiversity risk category (High, Medium and Low) that best describes the characteristics of the site. Further risks of individual sensitive receptors have been identified, assessment made and relative rates (on a scale of 10) attributed to each of sensitive receptors for both flora and fauna present in 10 km study area.

Develop Bmp for Risk Management based on risk rating of site. Low and Medium risk site aims to achieve No Net Loss (NNL) of biodiversity. High risk sites aims to achieve Net Positive Gain (NPG) in biodiversity.

The stakeholders (Investors, capital providers and shareholders, civil society and local communities, regulators) are increasingly aware of the importance of biodiversity and their expectations for how company manage biodiversity are rising. In these places, the steel making activities could have severe or irreversible impacts on biodiversity and ecosystems, so special attention is needed to ensure we operate responsibly.

Critical Habitat definition

Critical Habitats are areas of the planet where the significance of biodiversity conservation is high. It may include areas where particular species or habitats are threatened or rare. The following types of habitats are classed as critical-Habitat of significant importance to Critically Endangered and/or Endangered species (as defined in the IUCN Red List).

- Habitat of significant importance to unique species and/or species which occupy a small geographical area.
- Habitat supporting globally significant concentrations of migratory species and/or species for which an important portion of the world population gathers in one place in a stage of their life cycle.
- Highly threatened and/or unique ecosystems.
- Areas associated with key evolutionary processes.

Source: IFC Performance Standard 6 (2012)

No Net Loss of Biodiversity

No Net Loss (NNL) is the point where biodiversity gains from targeted conservation activities match the losses of biodiversity due to the impacts of a specific development project, so that there is no net reduction overall in the type and amount of biodiversity present, over space and time (Business and Biodiversity Offsets Program (BBOP), 2011).

Where Critical Habitat is present, we aim to achieve Net Positive Gain (NPG) of biodiversity, in recognition of the importance of biodiversity at these sites.

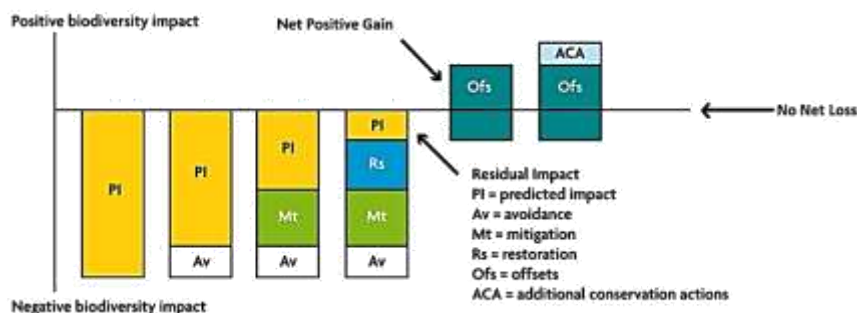
Net Positive Gain of Biodiversity

Net Positive Gain (NPG) means that biodiversity gains from targeted conservation activities exceed the losses of biodiversity due to the impacts of a specific development project, so that there is a net gain in the type and amount of biodiversity present, over space and time (BBOP, 2011).

No Net Loss (NNL) and Net Positive Gain (NPG)

The concepts of NNL and NPG are gaining widespread recognition and form the basis of overarching biodiversity goals in countries (e.g. NNL goals set in US wetland habitat policy), states, financial institutions (including the IFC) and companies.

Conservation activities may serve to avoid, mitigate, or offset an operation's impact on biodiversity. The diagram below demonstrates how various biodiversity management actions can contribute towards the goal of NNL or NPG.



For Low and Medium risk site, Biodiversity management process involves baseline study through field surveys of the total area affected by the operation and making observations of the land uses and species present there.

Critical Habitats and other areas considered important for biodiversity, and to enhance biodiversity at High Risk sites.

Similar to low and medium risk sites, biodiversity management actions is selected according to the mitigation hierarchy. Refer to *Box below*. Impact avoidance should be prioritised in the first instance, and if avoidance is not possible, impacts is minimised through mitigation measures. Compensation for biodiversity impacts through biodiversity offsets is the last step.

Box – The Mitigation Hierarchy

The mitigation hierarchy provides a structure for prioritising biodiversity management actions. It prioritises avoidance of impacts, followed by mitigation of impacts, and finally implementing offsets.

Specific risk management measures, as they apply to avoidance, mitigation and offsetting activities, are discussed in more detail below.



Biodiversity management actions is selected according to the mitigation hierarchy. Impact avoidance is prioritised in the first instance, and if avoidance is not possible, impacts is minimised through mitigation measures. Compensation for biodiversity impacts through biodiversity offsets is the last step.

A description of the type(s) of land use on the site which include:

- Undeveloped land (in this case, provide a description of the main type of vegetation, such as grassland, scrubland, or natural forest)
- Plantation forest
- Agricultural land (crops) or Agricultural land (grazing)
- Housing
- Industrial and commercial

A list of plant and animal species known to live on the site (permanently or temporarily during the year e.g. birds during migration), and their approximate population size

A list of stakeholders that may be interested (Annexure 1) in biodiversity or species/habitat conservation at the site, such as local communities, local NGOs and other people that use the land. Using the information gathered, areas have been mapped out on site that are most important to biodiversity and ecosystem services i.e. those areas that are important for uncommon species of plants of animals, or areas where local communities derive some value from using the land. The purpose of the biodiversity site map is to identify areas of focus for biodiversity management and protection. The biodiversity site map has been supplemented with a summary description of ways in which areas of biodiversity importance could be impacted over the course of the steel plant operation. In addition to the avoidance, mitigation, and offsetting actions, additional conservation actions are planned particularly when trying to achieve Net Positive Gain (NPG) in biodiversity, and may include (amongst others):

- Forming partnerships with and providing capacity building support to existing local conservation initiatives

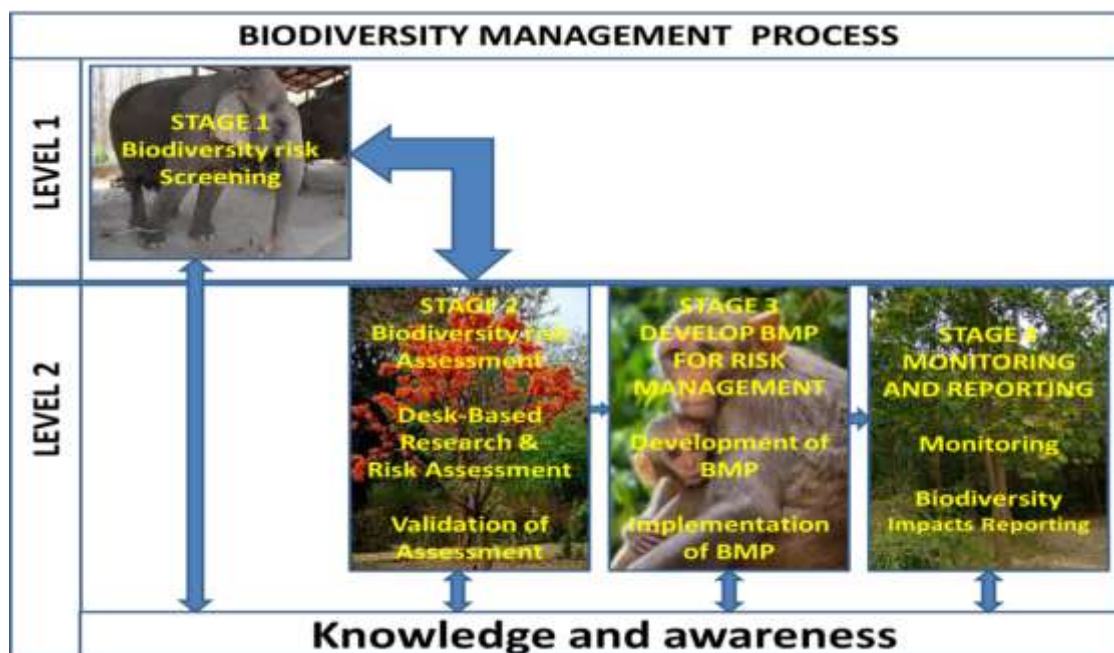
- Conserving natural habitats within management control of the operation, and implementing measures to protect such habitats from damage through the control or eradication of any existing invasive alien species;
- Supporting scientific research on areas of biodiversity importance and supporting community education programmes on the environment, Biodiversity, and sustainable resource use.

Participate by funding State Government runs Compensatory Afforestation and Wildlife Management initiatives such as Awareness and education programs in core and buffer area aimed at Social mobilization, Eco development programs in the area through community participation, Habitat protection through skill development, Fire Protection and prevention program through skill development, Habitat management wildlife Corridor Management, Prevention of Exotic and alien species from establishing itself in the area and remove established ones like Leonotis, Parthenium, Ageratum and Lantana etc and making available de weeded space ready for plantation with native fruit and timber yielding plants helping in pollution control etc, Water shed management of the area, Strengthening infrastructure for forest and wildlife protection, focussed conservation measures to protect Wild Boar, jackal, Hare and Other Wildlife of area, Establishing WILD LIFE RESCUE and REHABILITATION center in the division complete with technically competent and trained RESCUERS, Veterinary doctor, Compounder and Nursing staffs and Anti-depredation measures. These initiatives are designed to offset the impacts that industrial operations have on biodiversity in one area with positive gains in biodiversity in another area.

Table- 8 Sampling locations in 10 km study area is as below-

SAMPLING LOCATIONS IN 10 KM STUDY AREA						
SL.NO	BLOCK	PANCHAYAT	RECONNISANCE STUDY OF VILLAGES	APPROX DISTANCE FROM ESL	DIRECTION	CORE VILLAGES STUDIED
1	Chas	Chandaha	Chandaha	4 KM	NE	Chandaha
			Buribinor	4 KM	NE	
			Bhagabandh	1 KM	NW	Bhagabandh
			Brindawanpur	3 KM	NW	Brindawanpur
		Madhuniya	Mudunia	7 KM	SW	Mudunia
			Huthupather	4 KM	NW	Huthupather
			Bhandidh	8 KM	NW	
		Belunja	Usardih	8 KM	NE	
		Brahman Dwarika	Gopalpur	11 KM	NW	
		Alkusha	Alkusha	6 KM	NW	
			Dhandabar	7 KM	NW	
SL.NO	BLOCK	PANCHAYAT	RECONNISANCE STUDY OF VILLAGES	APPROX DISTANCE FROM ESL	DIRECTION	CORE VILLAGES STUDIED
2	Chandankiyari	Sabra	Sabra	7 KM	SW	
			Udalbani	6 KM	SW	
		Siyaljori	Siyaljori	6 KM	NE	Siyaljori
			Tentulia	13 KM	NE	Tentulia
		Badajor	Bangaria	13 KM	SE	Bangaria
			Surjudih	13 KM	SE	
		Nayaban	Babugram	7 KM	NE	Babugram
		Devgram	Jogidih	13 KM	NE	
			Asansol	13 KM	NE	
			Nepurchow	13 KM	NE	
			Upparbandha	14 KM	NE	
		Mohal	Mohal	18 KM	NE	Mohal
		Chandra	Murabad	5 KM	SE	Chandra

BIODIVERSITY MANAGEMENT PROCESS



3.0 BIODIVERSITY OBJECTIVES AND COMMITMENT

- i. Draw strategies to mitigate and minimize adverse impacts observed in the field
- ii. Make specific objectives for Biodiversity management such as No net loss(NNG) according to Risk rating at site
- iii. Setting of sustainable biodiversity management goals based on screening of risks
- iv. Draw Biodiversity management plan vis a vis steel making operation based on No net loss(NNG) according to Risk rating at site
- iv. Draw actions and responsibilities for managing impacts throughout lifetime of the
Operation of the plant
- v. Updating plan for any new activities and developments taking place at site
- vi. Updating plan in response to any changes in laws

5.0 BIODIVERSITY BASELINE AT SITE

1. The Bokaro district is part of Chotanagpur Plateau. It is hilly and highly undulating all over the district. The regional slope of the district is towards east and is controlled by the alignment of the tributaries of Damodar River. The hill ranges trends WNW - ESE. The average elevation of the pediplain is between 150 - 350 m above MSL. The northern and western part of the district is having hilly ranges. The highest hill is present in block is Gomia. Chas and Chandankiyari are low upland where cultivation is practiced. Geographical Area of Bokaro is 2883 Sq. km. Total population is 20,62,330 (2011 census) persons. Main tribe in the area is Oraon , Chero, Korwa and Parahiya. ST population is 2,18,600. Languages spoken are Hindi & Oraon. Population per Sq Km is 715 person and Sex ratio 922. Climate is Humid & Sub-tropical. Important minerals include Coal, CBM, Limestone, Stone, Quartzite, Sand, Bricks. The forest of the area conform to Northern tropical dry deciduous forest and is classified as 5-B as per champion and Seth(1968). This further falls into following Sub types as Dry peninsular Sal forest (5B/C-1), Northern dry mixed deciduous forest (5B/C-1) and scrub/degraded forests. A large area about 25% of the district is under forest cover. The cultivable land are divided into two categories - Low lands and uplands. Only 29% of the total geographical area is cultivable. The highest percentage of cultivable area is found in Chandankiyari and Lowest in Gomia block.
2. ESL Steel Limited (formerly Electrosteel Steels Limited) has set up an Integrated Steel Plant located in villages Siyaljori, Bhagabandh, Budhibinor, Alkusha, Dhandabar, Bandhdih and Hutupathar of Bokaro District of Jharkhand. The present plant is spread over 374.81 ha of land (including the approach road to the plant).
3. The ESL plant site is a guarded and fenced property where in the core plant lies. The major classes encountered within the core plant area includes major industrial units in the southern part of the plant, the northern part was more of buildings units. The western part of the plant showed dumps with transportation facility in the form of trucks aligned. There is a water body passing through the plant and there a few ponds in the centre. There is a thick green plantation patch (>3.0 Lakh) trees have been planted within the ESL plant.

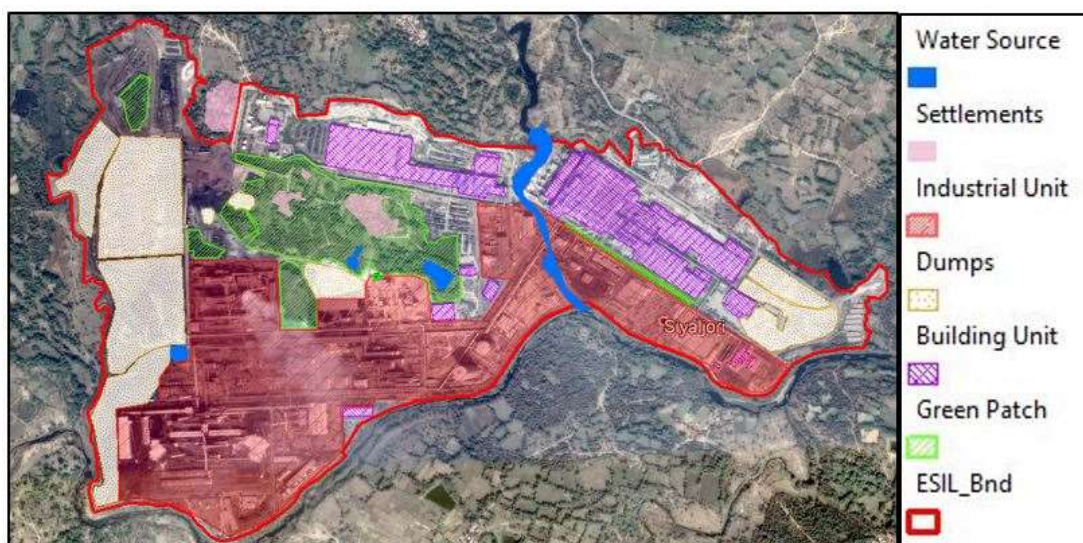


Fig No. 4 - Distribution of land forms within the core plant area using Sat image.

4. The project has adopted steel making through Blast Furnace route and primarily consist of a Sinter Plant, Coke Oven, Blast Furnace, Basic Oxygen Furnace, Billet Caster, Wire Rod Mill, Bar Mill, DI Pipe Plant and Power Plant. The plant has been designed to produce bars, wire rods, DI pipes, pig iron and billets.
5. There is presence of dense vegetation patches all around the 10 km radius of the ESL Plant. These patches included plant and tree species with more or less semi-evergreen to evergreen nature of nature plant species occurring in the region. Composition Of forest in the top and middle stories mainly are *Shorea robusta*, *Terminalia tomentosa*, *Madhuca indica*, *Pterocarpus marsupiam*, *Adina cordifolia* and *Diospyros melenozylon*, *Azadirachta indica*, *Pongamia pinnata*, *Mangifera indica*, *Syzigium cumini*, *Ficus benghalensis*, *Albizzia lebbeck*. The shrubs consist of *Zizyphus mauritiana*, *Clerodendron sp*, *Nyctanthes arbortrities*, *Lantana camara* etc, *Holorrhina antidysentrica*, *Nyctanthes arbortrities*, *Zizyphus* and *phoenix sylvestris*, . The grasses consist of *Heteropogon contortus*, *Dicanthinum annulatum* *Cynodon dactylon* etc. The climber is mainly dominated by *Bauhinia variegata*, *Asparagus racemosus* , *Acacia pinnata*. Based upon satellite image interpretation and classification dense vegetation patches varies from (8.5-16) % of the total area interpreted during the four seasons. In February 2020 it ranged from 44 sq.km to 27 sq.km in May 2020, again to around 46 sq.km in November 2020 and around 50 sq. km in February 2021(Table 5) . This clearly highlights that the lowest interpretation

of around 8.5 % is during the peak summer season when trees and plants undergo defoliation and only the evergreen and semi- evergreen patches remain constantly green. Change in greenness (indirect redness in FCC satellite image) is clearly visible while comparing satellite images from (Feb to May to November) 2020 and Feb 2021. Dark red to maroon patches in Feb, 2020 and 2021 images are thick closely spaced dense vegetation patches, wherein leaves of trees are subject to retain more moisture and water content. Comparing the same patch with that of nearby bright red to orange patch indicates species having leaves with less water content and more of gregarious in nature. Uniformity in redness of vegetation is nearly achieved in the post monsoon November image which indicates parallel growth of under shrubs in opening areas.(Plate no – 5,6,7 and 8)

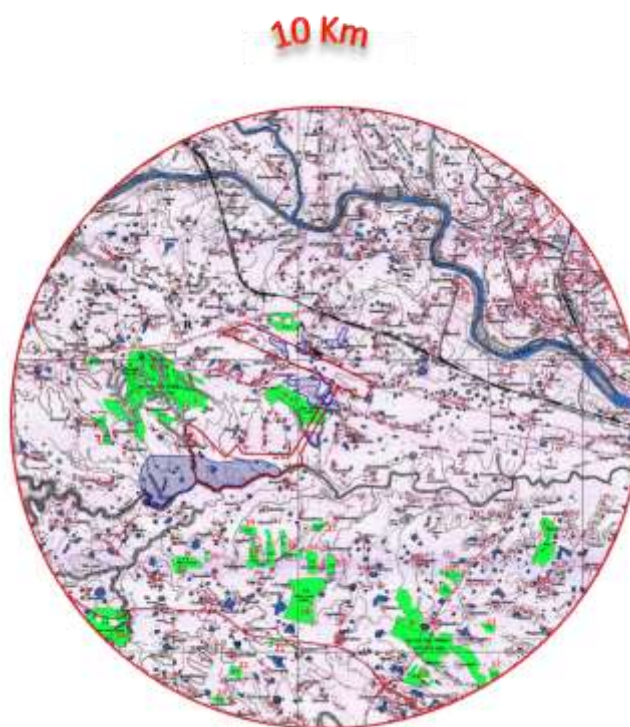


Fig No. 5 - Study area

6. **Less Dense Deciduous Vegetation:** Dominant with deciduous species interspersed with the dense vegetation patches. These are prominently on the fringe areas of dense vegetation patches. Also, there presence is more obvious on agricultural bunds planted. The vegetation in such area is less dense in with soil exposure and reflectance. Some of the species dominant in the class includes *Boswellia serrata*,

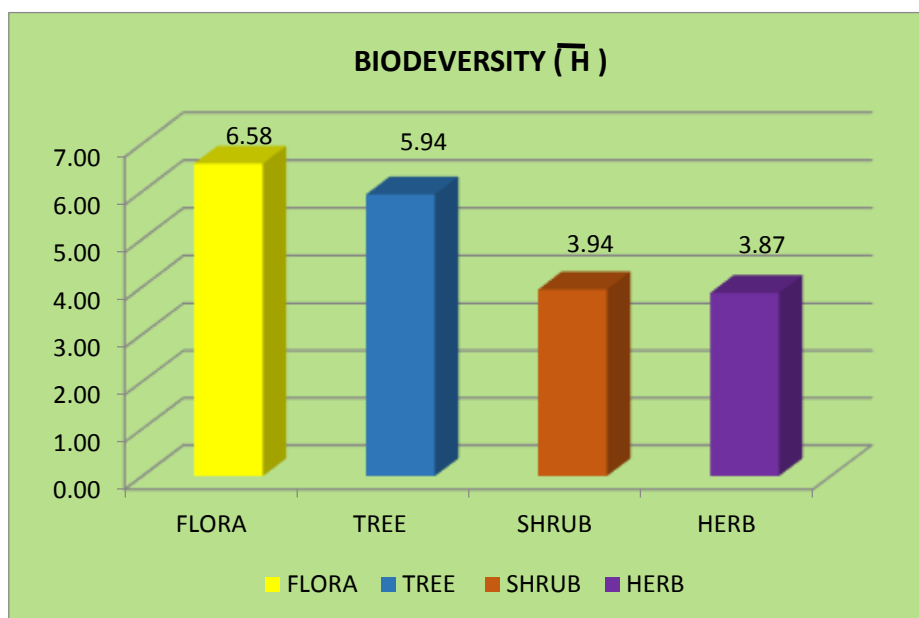
Artocarpus integrifolia, *Lagerstroemia parviflora*, *Diospyros melanoxylon*, *Petrocarpes marsupiam*, *Adina cordifolia*, *Syzygium cumini*, *Madhucha indica*, *Emblica officinales* and *Lagerstromia parviflora*, *Dalbergia sissoo*, *Cassia fistula*, *Albizia lebbek* and *Leucaena leucocephala*, *Acacia katechu* is found in scattered patches in eroded areas. It also consists of frequent and extensive bamboo breaks of *Dendrocalamus stricutus* for better soil conditions. The area contain miscellaneous shrubs as *Ixora parviflora* and *Lantana camara* and a very little mesh of climbers like *Bauhinia vahlii*, *Smilax zeylanica*, *Combretum decandrum* etc and. Scattered *Bombax malbaricum* trees are found in moist localities while *Boswellia serrata* are found on ridges and drier localities.

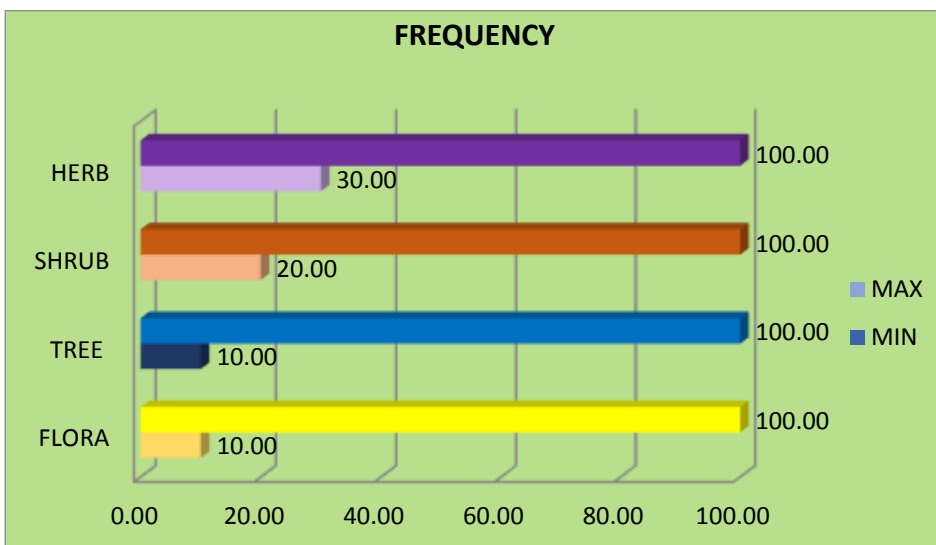
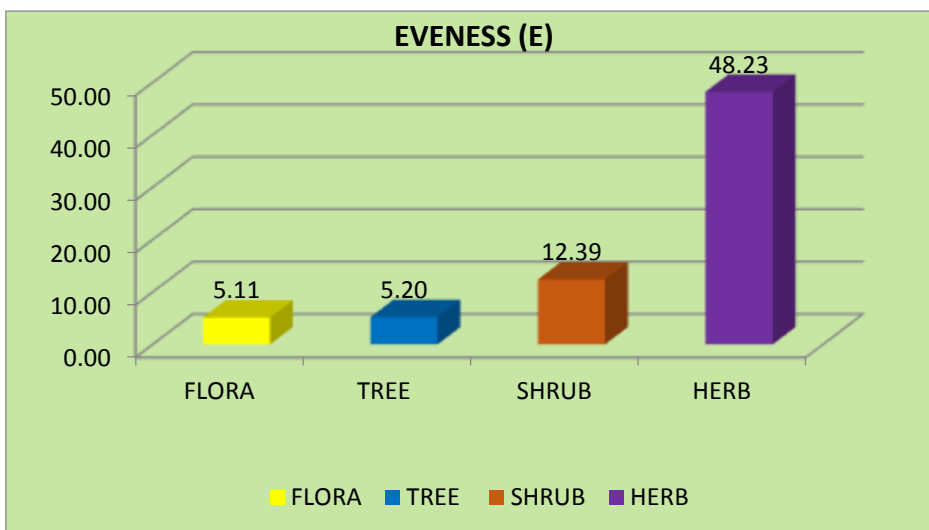
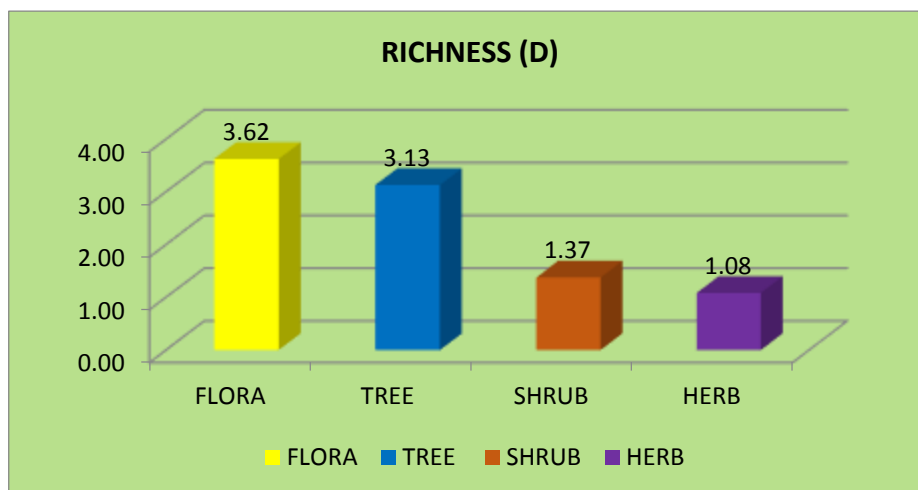
7. **Disturbed Land:** In the entire area of interest there are three distinct separate regions visually and spectrally similar areas indicating disturbed land status due individual regions. The total area of disturbed land ranges from (1.26 - 1.5) % for all four seasons. The north eastern part of the area has a distinct patch of disturbed land evidently due to extraction/mining and later discarded or abandoned. The second area where disturbed land can be encountered is a region presumed to be an off-loading sites along railway track. This has been proved using secondary images which shows evidence of trucks / carriage vehicles taking away unloaded material to other destination. The third area is actually the ESL plant site and its North Western front which has huge dumps with satellite image evidence showing transport carrier. All these areas are presumed to be ecologically highly disturbed regions. In such regions or fringe area of disturbed land also promotes dominance of exotic weeds which may adversely impact the local flora (natural and cultivable) and fauna. These mainly include *Parthenium hysterophorus*, *Lantana camara*, *Cynodon dactylon*, *Dicanthium annulatum*, *Heteropogon contorts*, *Bothriocloa pertusa* etc.
8. **Built-up/Dry River Bed/Dry land-** They are basically differentiated based upon their association and presence. Built-up categories are those with settlements around. These could be small city, villages or a cluster of villages aligned either in circular fashion or distributed along roads in a linear fashion. Apart from built-up; the other land form which has nearly similar spectral signature been that of dry river bed. It mostly contains exposed rocks and dry sands. These areas are distinguished from the

former due to their association with that of water bodies in the form of non-perennial rivers. It has been observed that such dry river beds are exposed during summers and are mostly submerged into water post monsoon or during winters. The third forms are the dry land mostly occurring in the southern part of the image with occurrence of land areas with minimum water content and least of vegetation or top cover vegetation. These can also be categorized into a variant of disturbed land with chances of weeds dominating these areas post monsoon. Rest of the year these areas or more or less dry and do not support any considerable vegetation in the region. All three forms (built-up, dry river bed and dry land) constitute around (1-4.6) % of the total area. Landforms appear more exposed during late February as it can be visually seen in the images of February 2021.

9. **Agriculture Land and Fallow Land:** The entire area is dominant with agriculture land and fallow land (agriculture land devoid of crops due to harvesting or not sowing). Agriculture land occupies an area of around (33-58) % of the total area along with a variation of (4-13) % for fallow agriculture land. During the summers, there is an increase in the fallow land area. Major Kharif crops in the region includes; paddy, maize, pigeon pea, groundnut, and pulses like arhar, urad and moong. During the winter the Rabi crops grown frequently are wheat, gram, mustard and linseeds. Apart from these crops seasonal vegetables are also grown in the region, both during Kharif and Rabi season. It is also observed that at some places tree plantation is practiced along the agricultural bunds.
10. **Open Scrub Land and Grassland:** Open scrub land area are characterized by presence of low trees and bushes. Such area with least vegetation diversity is present in and around dry land areas with least productivity. Around (9-12) % of the area is characterized by such area. Surround these are patches of grassland with dominant tall and dwarf grasses. They occupy areas where water availability is not a major problem, like areas along the river bed, fringe areas of water bodies like lake /ponds. Some of the characteristic species growing in open scrub land includes *Zizyphus mauritiana*, *Sida ecardifolia*, *Ichnocarpus frutescens*, *Cortaderia selloana*, *Desmostachya bipinnata*, *Cymbopogon citratus* etc.

11. As we surveyed overall terrestrial flora of the study area the BIODIVERSITY INDEX was found to be as high as (6.58). The RICHNESS (D- 3.62) and the EVENESS (E- 5.11) also showed fairly high values. This means qualitatively the overall vegetation of the impact area is rich and uniform but quantitatively there is a great variation in plant species spread. The area is dominated (Density 2.80) by *Shorea robusta*. Frequency of (60) and Abundance (4.67) was observed same. The other evergreen and semi evergreen trees are far and few in number and noticed mostly during summer season as leaves fall off from deciduous trees.
12. On comparison of the BIODEVERSITY (H) between Trees, Shrub and Herb maximum value was observed for Trees (5.94). RICHNESS also showed similar trend where it was maximum for trees (3.13) followed by shrub and herb. But EVENESS is maximum (48.23) for herb followed by shrub (12.39) and minimum is for tree (5.20). All 3 categories of flora showed maximum frequency of 100. Abundance is maximum for trees (7.10) < shrub (2.50) and herb (2.43). Density also showed same trend Tree (7.1), < Shrub (2.50) < Herb (2.40).





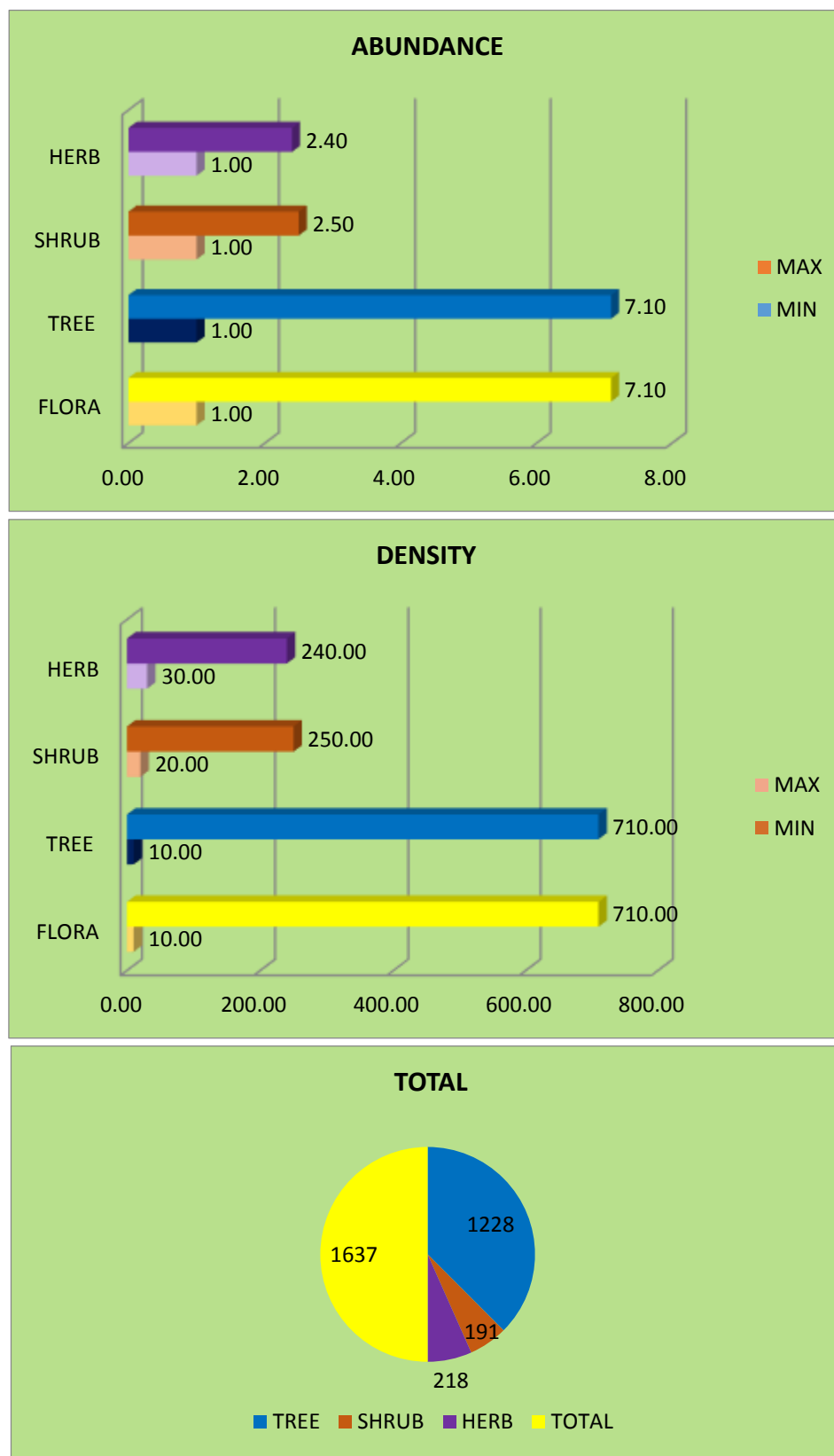
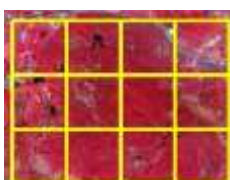


Fig No.6 - Biodiversity, Richness, Evenness, Frequency, Abundance and Density of VARIOUS MORPHOTYPES OF TERRESTRIAL FLORA IN STUDY AREA

13. Above findings are also substantiated from satellite based study of images of various land use and land cover forms in the area. Three distinct zones (grids) have been diagnosed and prioritized from such a study. In first type, regions have characteristically high compactness (Intactness) of dense or less dense vegetation. This indicates high species abundance in these areas. Here, conservation strategies should aim at retaining these compact vegetation patches and increase the area and connectivity of patches through conservation measures like plantation of native and economically important tree species in the area having higher turn over time. Second type denotes 2 types of high stress area. One due to transportation of coal to the ESL Plant and the other due to abandoned mines located in the north eastern part of the region. Immediate actionable interventions need to be planned in these regions to restore water bodies and maintain vegetation intactness in the region. Reclamation of abandoned mines should be prioritized in consultation with Government agencies. The third types are potential conservation areas. These areas mainly constitutes plantation areas of natively grown and planted trees especially *Sal*, *Butea*, *Phonex* species etc. This area helps in establishing a continuous patch or greenness in the region as also they help in restoring the perturbed ecosystem.



Yellow grid-Dense vegetation



Cyan grid-stress area

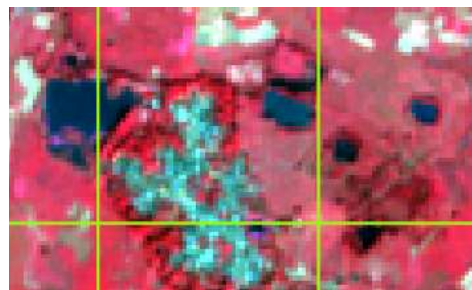
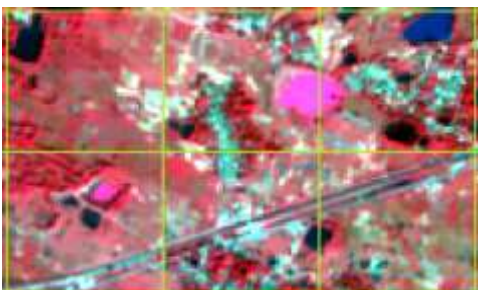
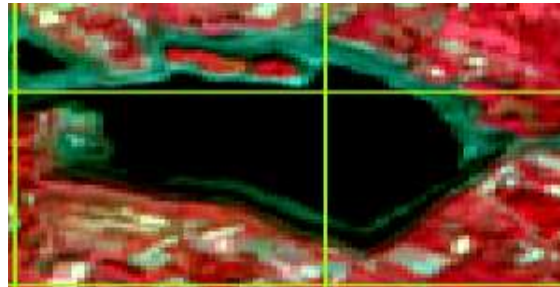
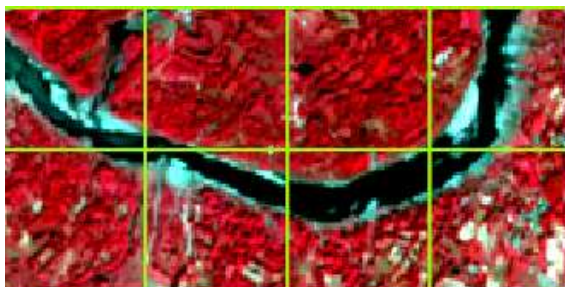


Green grid-Potential conservation area

Display of grids (yellow, cyan and green)

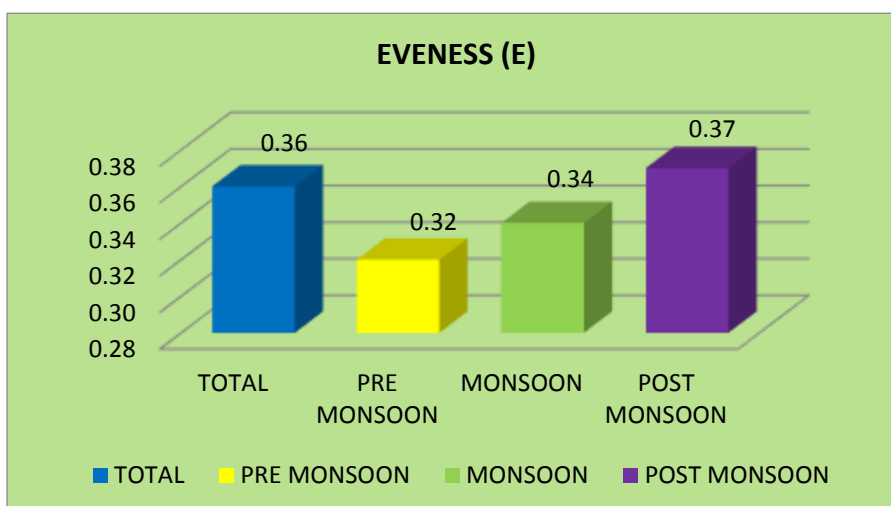
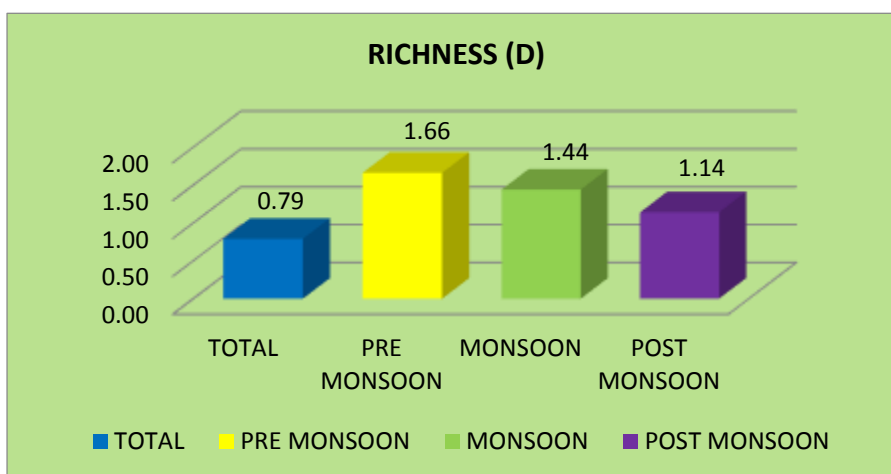
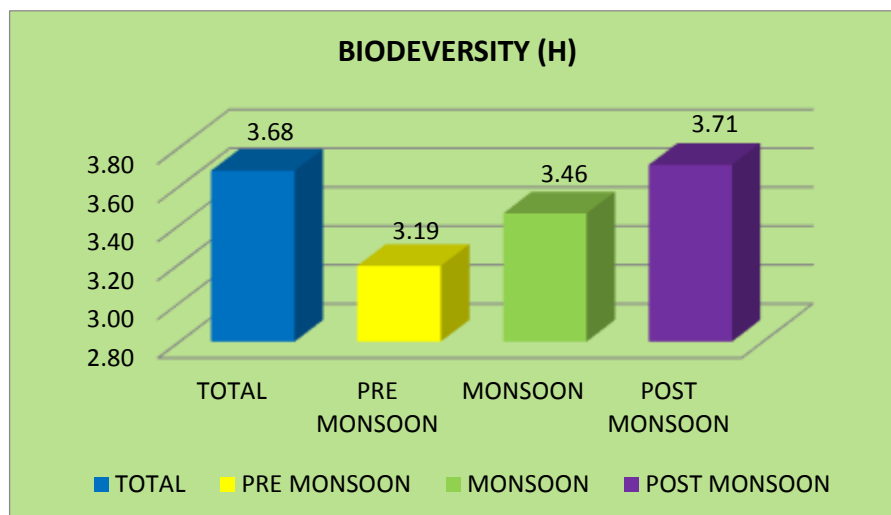
14. Aquatic flora commonly reported from aquatic ecosystem namely River, Pond, Lake in the area are 28 number of species. The Aquatic plants present in impact area mainly include Pteridophytes dominated by *Azolla pinnata*, *Marsilia quadrifolia* and *Salvinia natans*, Angiosperms by *Nymphaea cristata*, *Hydrilla verticillata*,

Eichornia crassipes while Phytoplanktons are dominated by Rivularia elegans, Spirulina major, Oscillatoria principes.

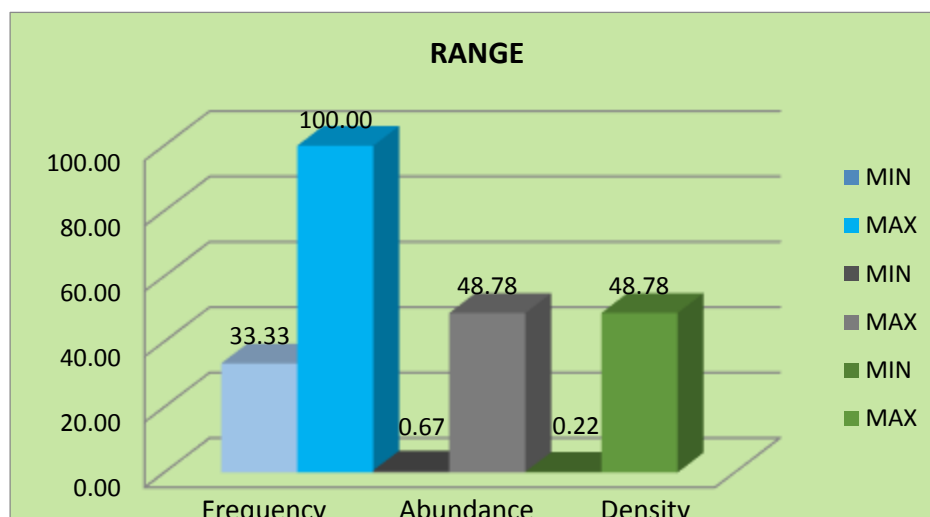


Various Forms of water bodies in the study area - River, artificial pond, small ponds with eutrophication and clear water bodies in the form of ponds and lakes

15. Overall Biodiversity of Aquatic phytoplanktons in study area is 3.68, Richness 0.79 and Evenness 0.36. As we do trend analysis between seasons, BIODEVERSTY index was maximum in post monsoon (3.71) signifying maximum eutrophication leading to Azolla blooms etc. The values diminished during < Monsoon (3.46) and least was shown in pre monsoon (3.19). Eutrophication diminishes the dissolved oxygen content in the water bodies negatively affecting flora and fauna. These are direct indicators of stagnant water bodies with less flow of fresh water into it. RICHNESS of aquatic plants was also maximum in pre monsoon season (1.66) < monsoon (1.44) and was least in post monsoon season (1.14). In case of Evenness, it was maximum of 0.37 in post monsoon < monsoon season (0.34) and least was in pre monsoon season 0.32. (Table-10).



16. Maximum frequency of 100 was observed in all seasons. Abundance and density is maximum of (48.78) Satellite image study also show eutrophication of ponds and water bodies in area substantiating our observations from field study.



17. Further total no. of flora (Fig no.9) in aquatic system is 714. Pteridophytes dominated the scene (305) followed by Phytoplankton (269) was registered by Angiosperms (140). As we compare seasonality, Post monsoon had maximum no< followed by Monsoon and minimum was during< Premonsoon.

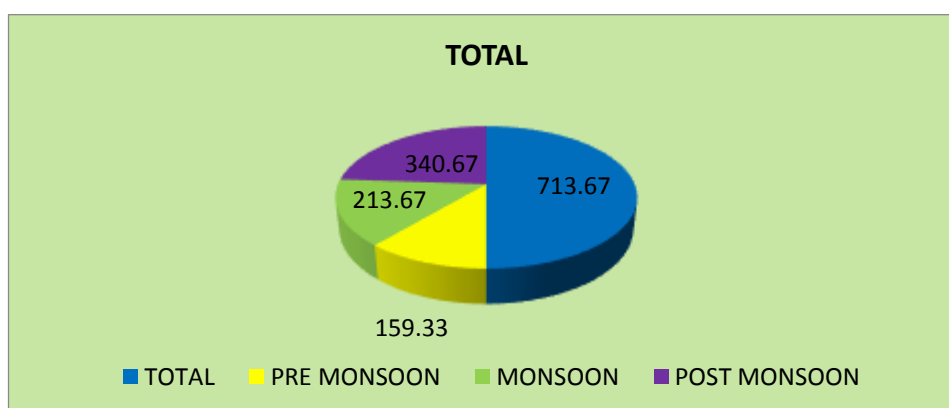
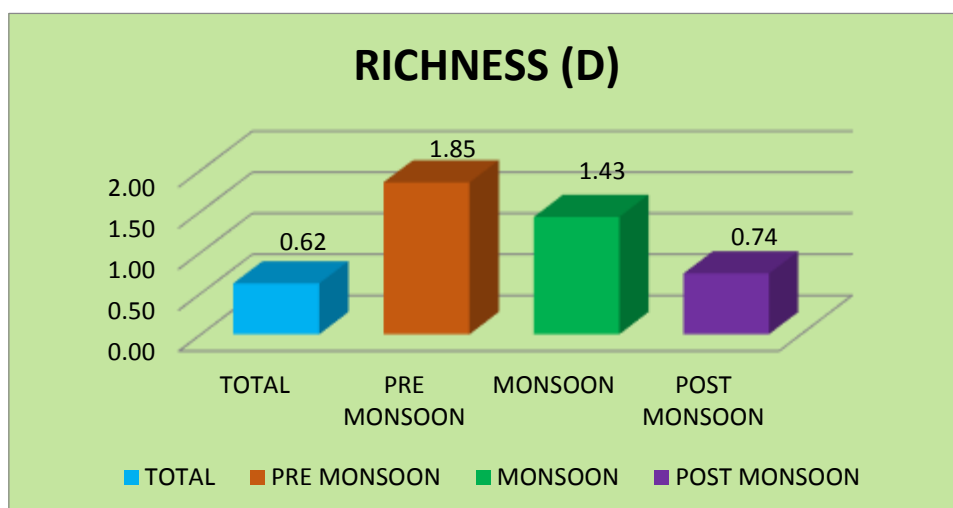
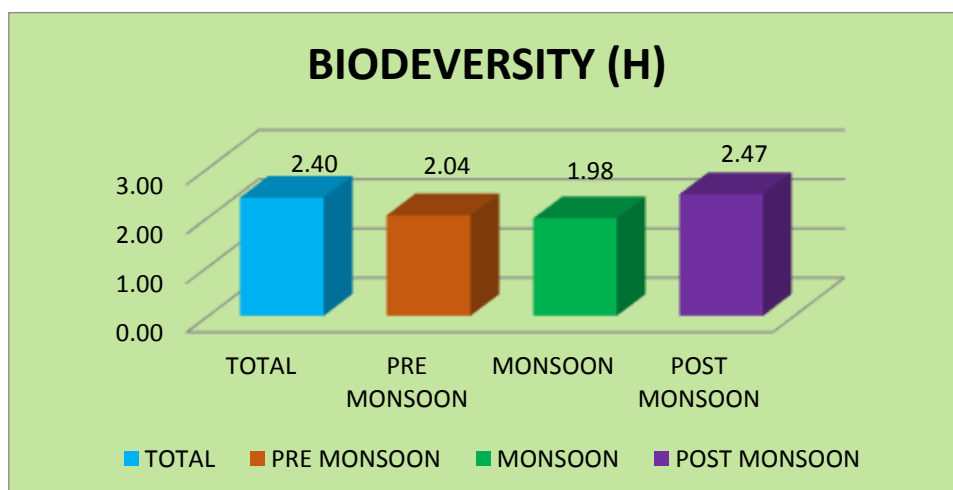


Fig No 7 - Biodiversity, Richness, Evenness, Frequency, Abundance and Density VARIATIONS in Morphotypes of Aquatic flora in Study area

18. Aquatic fauna/zooplanktons commonly reported from aquatic ecosystem namely River, Pond, Lake in the area are 28 numbers of species. Among Zooplanktons Moina brachiate, Diaoptomus vulgares, Cyclops sp. dominate the aquatic bodies. Overall Biodiversity of Aquatic zooplanktons in study area is 2.42, Richness 0.62 and Evenness 0.38. As we do trend analysis between seasons BIODEVERSIY maximum is in post monsoon (2.49) < pre monsoon (2.03) and minimum was during monsoon season (1.59). RICHNESS was also maximum in pre monsoon season(1.85)< monsoon(1.43) and was least in post monsoon season (0.74) . In case of Evenness maximum was 0.39 in post monsoon<pre monsoon season (0.31) and least was in monsoon season 0.25. Maximum frequency is 100, abundance 33.89 and density 33.89. (Table – 10 & 11 and Plate no – 3 and 4).



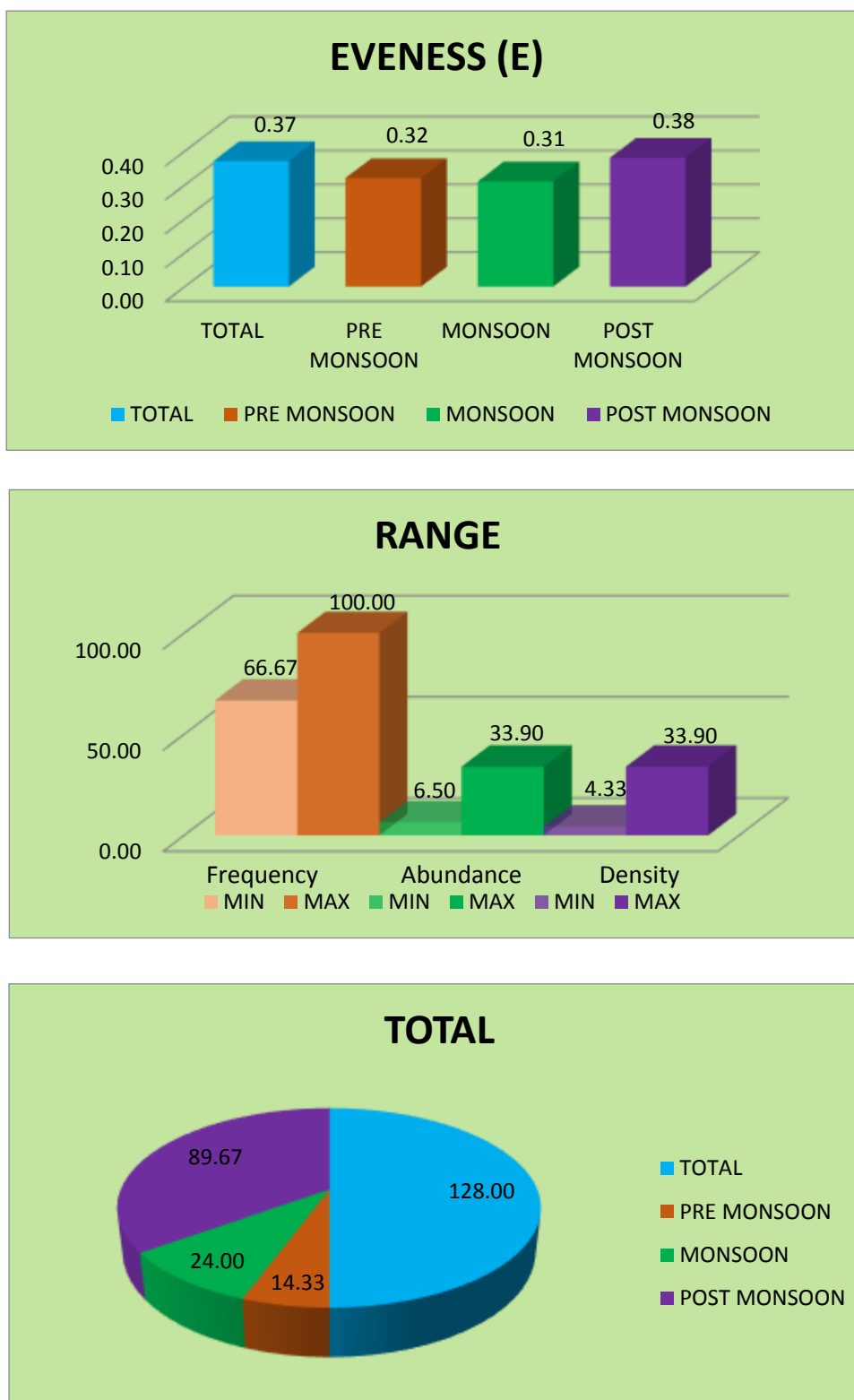


Fig No. 8 - Biodiversity, Richness, Evenness, Frequency, Abundance and Density VARIATIONS in Morphotypes of Aquatic fauna in Study area

19. Use of plant parts for treating various ailments based on traditional knowledge base is quite common practise. Plants/parts popularly used to treat ailments include

20. Neem, Harjor, Tulsi, Amarsankar, Lal Pata and Shive pata. Trees worshipped by villagers are Pipal, Bargad, Tulsi and Mahua.

21. Fauna

Pisces (Fishes) commonly reported from village Pond and nearby river are 06 species. It primarily includes Rohu, Katla, Silver carp and Golden carp. Mammals reported are 05 species and mainly comprise Indian hare, Golden jackal (Indian fox), Pangolins (Scaly anteater), Indian flying fox (Indian fruit bat). Reptiles are 12 species and primarily include Common Indian krait, Cobra (Kharish), Russell's Viper, Banded Krait, Python (Ajgar), Rat snake, Garden lizard, Striped skink, Bengal monitor lizard (Goh). 05 species of insects were observed and include Cockroach, praying mantis, seven-spot ladybird, ladybird, blister beetle, Holotrichia (Table - 12). There are 06 species of Amphibians in area and mainly include Indian bull frog, Common Indian Toad, Balloon frog, Common eastern froglet, Painted Kaloula.

Table 12- Fishes, Mammals, Reptiles, Insects and Amphibians Name, Family, Habit and habitat below -

Pisces					
S.No	Common name	Scientific name	Family	Habit	Habitat
1	Garai	<i>Channa punctatus</i>	<i>Channidae</i>	Looks like a snake and distinguished by their long dorsal fins, large mouths, and shiny teeth. They breathe air with gills	Found in swamps, ponds and brackish water systems

2	Rohu	<i>Labeo rohita</i>	<i>Cyprinidae</i>	The rohu is a large, silver-colored fish of typical cyprinid shape. Mainly Eats phytoplankton and submerged vegetation.	It is abundantly found in fresh water in ponds, lakes, rivers and reservoirs.
3	Pothia	<i>Punctius ticta</i>	<i>Cyprinidae</i>	This is an active fish usually keep in groups. The eggs hatch in 1 day and is free-swimming a day later.	Prefer still and shallow waters with mud bottoms of their native habitat.
4	Bokwa	<i>Eutropichtys baache</i>	<i>Schilbeidae</i>	It is carni omnivorous and predatory in habit	It mainly inhabits standing and running waters.
5	Zebra	<i>Danio rerio</i>	<i>Cyprinidae</i>	Feeds on aquatic crustaceans and other invertebrates As they age, portray a declining exercise capacity.	Found in small to large mountainous and lowland streams/rivers, wetlands, and paddy fields.
6	Mangoor	<i>Clarius batrachus</i>	<i>Clariidae</i>	Omnivorous. . In wild it is typically an annual species	Found in the muddy substrates of several water systems.

Mammals					
S.No	Common name	Scientific name	Family	Habit	Habitat
1	Indian flying fox(Indian fruit bat)	<i>Pteropus giganteus</i>	<i>Pteropodidae</i>	It is nocturnal, feeds mainly on ripe fruits, and one of the largest bats in the world.	It prefers to roost on tall canopy trees and prefers close proximity to water, human residences, and agricultural land.
2	Menuri, Lakati, Jharaka kutta, Khatas (Indian palm civet)	<i>Viverricula indica</i>	<i>Viverridae</i>	Identified with white patches across the forehead, ears and below the eyes.	Arboreal and terrestrial frolics in scrub forest, evergreen, tropical deciduous forests and even roof top of houses and abandoned buildings.
3	Pangolins (Scaly anteater)	<i>Manis crassicaudata</i>	<i>Manidae</i>	Has large, overlapping scales on its body which act as armour.	Feeds on ants and termites and is nocturnal and rests in deep burrows during the day.

4	Golden jackal (Indian fox)	<i>Canis aureus indicus</i>	<i>Canidae</i>	Jackals are medium-sized, wide spread, terrestrial carnivore.	Normally lives in open grassland.
5	Indian hare	<i>Lepus nigricollis</i>	<i>Leporidae</i>	Patch of black fur that runs along the nape of the neck. The top of the tail is black and the back and face are brown with black hairs scattered. The underparts are white.	Found in areas where large tracts of bush and jungle alternate with farmland.

Reptiles

S.No	Common name	Scientific name	Family	Habit	Habitat
1	Common Indian krait	<i>Bungarus caeruleus</i>	<i>Viperidae</i>	Krait is one of most venomous snakes inject their prey and then they feed on it.. Chew food as they do not have right kind of teeth.	It lives in fields and low scrub jungle, as well as settled areas. It rests in termite mounds, brick piles, rat holes, even inside houses.
2	Cobra(Khari sh)	<i>Naja naja</i>	<i>Elapidae</i>	Cobras use their forked tongue to smell prey and are not aggressive. A	Habitats , include forests, bamboo thickets, mangrove swamps, high-

				mouse, rat, ground squirrel, or rabbit are its main prey	altitude grasslands, and in rivers.
3	Russell's Viper	<i>Daboia russelii</i>	<i>Viperidae</i>	Responsible for the most snakebites. Head is flattened, triangular, and distinct from the neck. Feeds p on rodents and reptiles, land crabs, scorpions, and other arthropods.	Most common in plains, coastal lowlands, and hills of suitable habitat in open, grassy or bushy areas
4	Banded Krait	<i>Bungarus fasciatus</i>	<i>Elapidae</i>	Shy, and are mainly nocturnal. More dangerous than other snakes.	Inhabit termite mounds and rodent holes close to water, and often live near human settlement, especially villages.
5	Python(Ajgar)	<i>Python molurus</i>	<i>Boidae</i>	Body covered with smooth glossy scales. Head flat with small eyes and large nostrils. Sensory pits and 1st 2 labials distinguish them from Rock python and other snakes.	Prefers to live near permanent source of water, like river, lakes.

6	Rat snake	<i>Zamenis longissimus</i>	<i>Colubridae</i>	Nonvenomous snake. Grows up to 2 metres	Fields, woodlands, farmlands, and suburban communities. Excellent swimmers and climbers
7	Fresh water snake	<i>Nerodia sipedon</i>	<i>Colubridae</i>	Breed April – June. Feed on amphibians and slow moving fish and basks on banks of rivers or ponds or on branches overhanging the water.	Seen basking on rocks and prefer slow-moving or standing water.
8	Grass snake	<i>Natrix natrix</i>	<i>Colubridae</i>	Grayish with a yellow or orange band around the back of the neck and a yellow or orange underside.	Found in woodland and "edge" habitat. Undergoes thermoregulation through basking.
9	Garden lizard	<i>Calotes versicolor</i>	<i>Agamidae</i>	Male is brightly coloured, golden yellow with a greenish tinge. Throat is scarlet red, often with a black transverse bar. Female is not so brightly coloured.	Found among the undergrowth in open habitats including highly urban areas.
10	striped	Mephitis	Mephitida	Easily identifiable	Prefer Open

	skink	mephitis	e	coloration. Specific pattern of the stripes on the head, body and tail can vary among individuals, and is accompanied by a thin, white stripe running from the snout to forehead.	grasslands , scrub lands and vinelands and enjoys basking.
11	Bengal monitor lizard(Goh)	Varanus bengalensis	Varanidae	Reach 175 cm with a snout-to-vent length (SVL) of 75 cm and a tail of 100 cm. Males are generally larger than females.	Inhabit jungles, coastal forests and areas close to the rivers.
12	Softshell turtle	Nilssonia gangetica	Trionychidae	Thin, oval, elongated shells grow to 3 to 4 inches in length and shells are chalky white with a thin, brittle covering brownish to gray in color. Omnivorous.	This large softshell inhabits deep rivers, streams, and large canals, lakes and ponds with mud and sand bottoms. It prefers turbid water.

Insects					
S.No	Common Name	Scientific name	Family	Habit	Habitat
1.	Cockroach	<i>Blatta orientalis</i>	<i>Blattidae</i>	Adult male cockroach are about 18–29 mm and adult females being 20–27 mm.3. It is dark brown or black in color and has a glossy body.	Prefer cool, damp locations. Their natural habitat is outdoors, they may infest homes in summer. Inside, they tend to remain on lower floors.
2.	praying mantis	<i>Mantis religiosa</i>	<i>Mantidae</i>	Have large, triangular heads with a beak-like snout and mandibles. They have two bulbous compound eyes, three small simple eyes, and a pair of antennae.	Inhabits in higher growing, bushy nutrient-poor grasslands and fallow land in xerothermous lowlands.
3.	Seven-spot ladybird	<i>Coccipela septempunctata</i>	<i>Coccinellidae</i>	These have oval, dome-shaped bodies with six short legs. They have a black head with white patches on either side.	Preferred habitats includes grasslands, forests, cities, suburbs, and along rivers.
4.	Blister beetle	<i>Mylabris pustulata</i>	<i>Meloidae</i>	Produces a toxin called cantharidin. In humans, this can	Blister beetles are often found where grasshoppers (their

				cause minor side effects like skin irritation and blistering.	main source of food) are common
5.	Holotrichia	<i>Holotricha serrata</i>	<i>Scarabaeidae</i>	It is a genus of beetle re well known as "chafer beetles" or "white-grubs" for their white larvae that are found under the soil where they feed on the roots of plants.	White larvae that are found under the soil where they feed on the roots of plants.

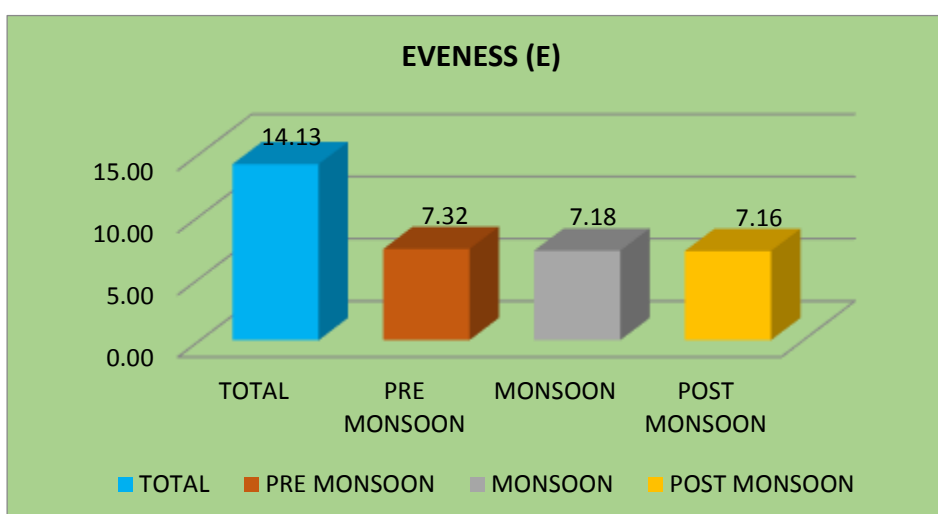
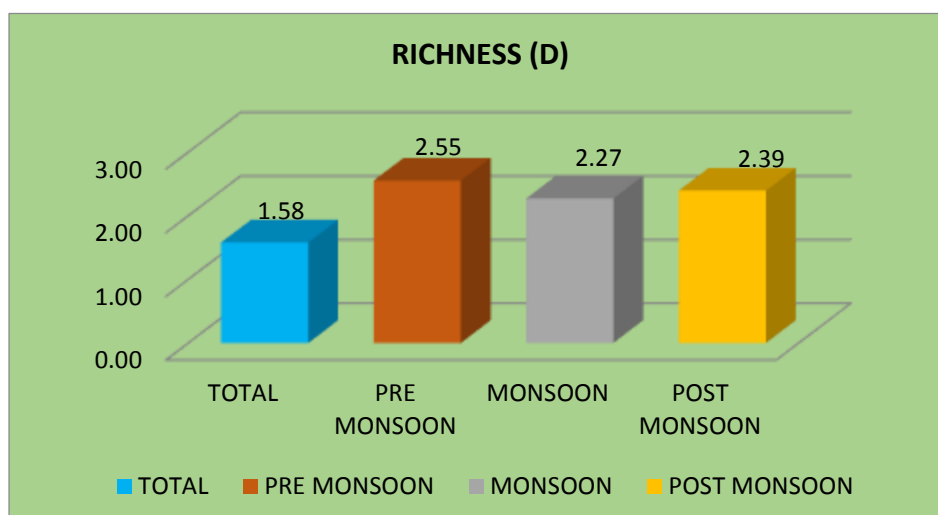
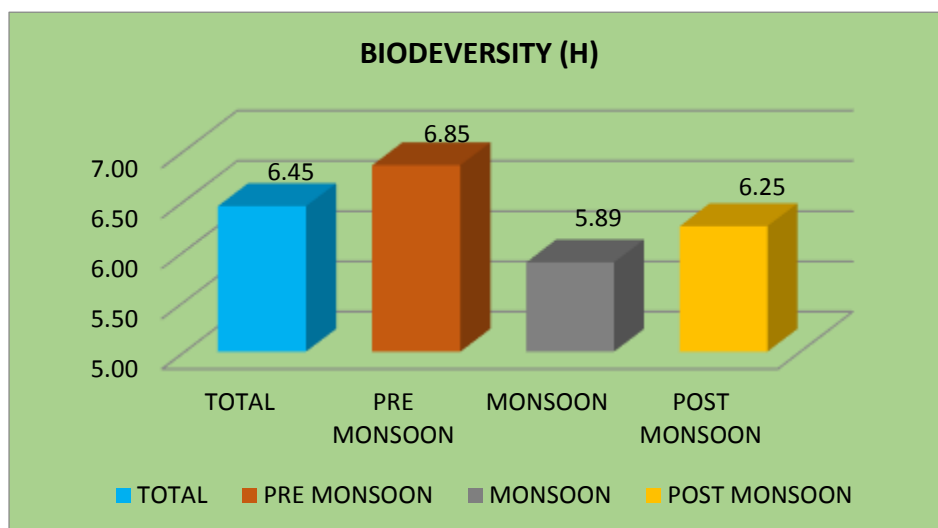
Amphibians

S.No	Common name	Scientific name	Family	Habit	Habitat
1	Indian bull frog	<i>Hoplobatrachus tigerinus</i>	<i>Dicroglossidae</i>	Found in mainland. Breeding takes place during the Feeds on invertebrates, small mammals and birds.	Adult frogs live in fresh water and on dry land. Frogs typically lay their eggs in water.

2	Common Indian Toad	<i>Bufo melanostictus</i>	<i>Bufonidae</i>	Active at night as they hunt for a variety of invertebrates including slugs, spiders, worms, aphids and ants. They sneak up on prey and use their sticky tongues to catch it.	Adults are terrestrial and may be found under ground cover such as rocks, leaf litter, and logs, and are also associated with human habitations.
3	Common Tree frog	<i>Polypedates maculatus</i>	<i>Rhacophoridae</i>	Adult tree frogs are insectivores. Commonly tadpoles emerge from frog eggs.	Tree frogs are arboreal. Non-arboreal tree frogs find habitats in lakes and ponds or among moist ground cover.
4	Balloon frog	<i>Uperodon globulosus</i>	<i>Microhylidae</i>	It is a species of narrow-mouthed frog found in India, Nepal, and Bangladesh.	Adults are only seen during the summer and monsoon. Else, they retreat into the soil.
5	Common eastern froglet	<i>Crinia signifera</i>	<i>Myobatrachidae</i>	Common Froglets can be found in streams, ponds, dams and flooded ditches. The fives of the Common	This is often associated with static, temporary or permanent water bodies where it shelters under leaves.

				Froglet are not webbed.	
6	Painted Kaloula	Kaloula taprobanica	Microhylid	Feeds on a variety of insects, crickets, mealworms and waxworms.	Narrow-mouthed frog, lovely reddish brown colour pattern on the back of these frogs.

21. Birds commonly reported from forest, village and nearby areas are 111 no. of species. It mainly include Bubulcus ibis , Black-crowned night Heron, Bronze-winged jacana, Lesser Whistling-duck, Northern Pintail, Little Grebe, White-breasted Water hen, Black kite, Rose-ringed Parakeet , Little Swift, Coppersmith Barbet, House Crow, Scaly-breasted Munia, House Sparrow, Paddyfield Pipit, Common Swallow, Streak-throated Swallow, Red-vented Bulbul, Jungle Babbler. Overall Biodiversity of birds in study area is 6.45, Richness 1.58 and Evenness 14.13. As we do trend analysis between seasons BIODEVERSTY maximum is in pre monsoon (7.01) followed by post monsoon (6.15) and minimum was during monsoon season (6.08). RICHNESS of Birds was also maximum in pre monsoon season(2.55) only followed by post monsoon(2.39) and was least n in monsoon season (2.27) . In case of Evenness same trend about occurrence of Birds in area has been observed where again maximum value was 7.49 in pre monsoon season followed by 7.41 in monsoon and least was in post monsoon season 7.04. This change in diversity with change in season may be because during pre-monsoon birds remain active to find their suitable mate. As the monsoon season starts nesting starts so they incubate and become less active and so they are less visible. In post monsoon with completion of nesting the young ones are added. So, the number is increased. Frequency of birds varies between 33.33 to 100.00, Abundance 1.00 to 55.33 and Density 0.67 to 55.33 as same is compared during trend analysis between seasons. (Table -9 & Plate no -9,10)



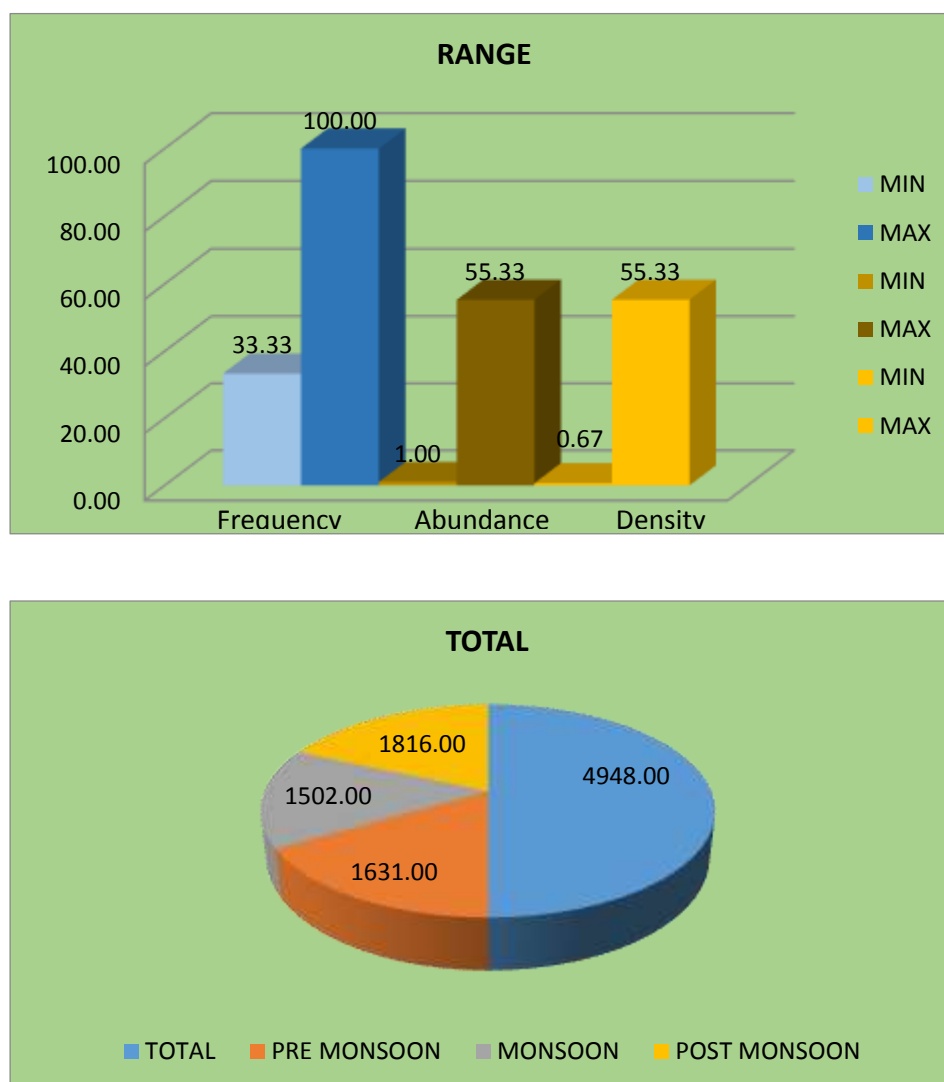


Fig No.9 - Biodiversity, Richness, Evenness, Frequency, Abundance and Density VARIATIONS in Birds in Study area

22. The wildlife habitat is not good in the nearby forest areas. The impact area is not the habitat of any important carnivores like Tigers, Leopards etc. it is also not the home of Elephants. Wild Animals Present /visiting the area are of general type consisting mainly of wild Pig, Jackal, Langur, Kobra, Ajar and karait. The Schedule I animals found in the study area are Indian Python and Indian Pangolin. Domesticated animals include Cow, Hen, Buffalo, Dog and Goat. There is no Biosphere Reserve, Ramsar Site, National Park, Wild Life Sanctuary, Tiger Reserve, Elephant Reserve or Wildlife Corridor in study area.
23. Green belt inside premises been developed in > 123 Ha(33%) out of 374.81 Ha of project area. Top 10 species constituted 77% of total trees planted. These include *Senna*

siamea (14830), the maximum no. It is followed by *Alstonia scholaris* (13624). *Butea monosperma* was minimum with 24 no of trees . Shannon-Weiner biodiversity index for the site showed a value of 4.60. This shows good biodiversity index at site. Any index value above 3 shows good biodiversity of area and an indicator of health of environment. This help reduce pollution load as also improve aesthetics of area. As we studied abundance of different plant species, *Senna siamea* showed maximum abundance of 3707, followed by *Alstonia scholaris* at 1946. Minimum was for *Acacia auriculiformis* with 1644. In case of frequency, 5 species namely *Alstonia scholaris*, *Terminalia arjuna*, *Milletia pinnata*, *Delonix regia* and *Acacia auriculiformis* was present in all 7 zones studied. *Gmelina arborea* and *Artocarpus heterophyllus* occurred only in 43% of zones. Habit of *Senna siamea*, the most dominant sp at core area, a medium-size, evergreen tree with a crown that is dense and rounded when young, later becoming irregular and spreading with drooping branches. It grows up to 18 metres tall a short, straight bole that is up to 30cm in diameter. The tree is particularly valued for firewood and agroforestry. In case of 2nd dominant sp. *Alstonia scholaris*, it is evergreen glabrous tree and grows up to 40 m tall. Leaves grow in whorls of 3-10 ten leaflets. The least dominant *Butea monosperma* grows to 15 m tall. Leaves are pinnate, 8–16 cm long petiole and 3 leaflets. Tree plantation done along roads are liner, growing well but are normally in single row only. Plantation done in Oxygen plant and clean water tank area are taken care of and are growing well. Growth of plantations done in RMHS and CHP area are marred by dusts generated from process plants. These observations are based on site visits and high resolution satellite image for core area using Google earth.

24. The baseline for Environment quality has been monitored by company during 2019-20 winter season for AAQ, Noise, Water quality and traffic density. Same has been considered for the study.

AMBIENT AIR QUALITY

25. Process stacks have been fitted with ESP, Bag house and water sprays to collect dust before clean air is discharged outside using tall stacks such that dispersion of pollutants goes to distance and is fully diluted meeting CPCB norms for ambient air quality. During handling of raw material in the stockyard, major area source emission is fugitive dust.

Fugitive emissions are generated during unloading of raw material on ground hopper, transfer of material at junction boxes, during crushing and stocking the material. In order to minimize the fugitive emissions from the handling area, water based dust suppression systems have been installed at all the dust generating sources. The amount of dust generated is dependent on a number of variables like nature of handling of material, the physical characteristics of the material handled (degree of compaction, content of silt, moisture content), Meteorological conditions. ESL steel limited presently receives all the raw materials by road from the Bandidih railway siding. The raw material is been loaded on trucks and travels about 0.5 km on the Chas-Talgaria public road and enter in to the ESL private road. It travels about 6 km (Vedanta lane) to reach the ESL plant. Finished products are also dispatched by road in separate road on the east side of the plant. It has been estimated that 15 truck trips per hour of raw material enter the plant and around 8 truck trips of finished products are despatched per hour. Due to this, about 2.27 g/s of dust is generated from the roads. In order to mitigate various impacts of air pollution during operation of the existing plant, the environmental mitigation measures include water spray using fixed and portable water sprinklers. To quantify the impact of the project and allied activities on traffic, it is necessary at first to evaluate the existing load of vehicular traffic near plant site such. Traffic volume survey was done at 5 (five) locations during the study on a particular day for 24 hours as this road carry major traffic. The total traffic density at Talgaria Chouk ESL was 11326. Minimum (80) was during midnight and maximum (842) in evening hours. At Alkusa total traffic was 6058. Minimum (24) was during late evening and maximum (651) at 12noon hours. At Garga gate total traffic was 2623. Minimum (11) was during late night and maximum (434) was at 8.00 in the morning. Binod Bihari Chouk (Parbatpur-Bijulia Road) ESL total traffic was 4866. Minimum (0) was during night hours. and maximum (578) during evening hours. Binod Bihari Chouk (Plant/B. Binor- BB Chouk), ESL, total traffic was 2318. Minimum (064) was during late evening and maximum (240) in morning hours.

Noise Level

26. Various measures have been taken to reduce noise pollution including reduction of noise at source, provision of acoustic lagging for equipment and suction side silencers, vibration isolators, selection of low noise equipment, isolation of noisy equipment from working personnel. Working personnel are provided with personal protective equipment (PPE) such as ear muffs/ ear plugs and also the duration of exposure of the personnel will be limited as per the norms. The technological measures taken to control noise are Plugging leakages in high-pressure gas/air pipelines, reducing vibration of high speed rotating machines by regular monitoring of vibration and taking necessary steps, regular lubrication of machinery as per the manufacturers guidelines, design of absorber system for the shift office and pulpit operator's cabin, noise absorber systems in pump houses, Noise level at 1m from equipment is limited to 85 dB (A) and Fans and ductwork are designed for minimum vibration. All the equipment in different units are designed/operated in such a way that the noise level does not exceed 85 dB (A). These measures have effectively helped control noise pollution in and around the plant site. Baseline ambient noise monitoring has been carried out at various stations inside and around the plant site. From the noise level monitored, it was observed that noise levels adjacent to the plant boundary at all locations are within the norms for respective type of areas. High noise level is observed around the plant boundary, especially near the Rolling Mills in the East and near CPP. Due to the presence of thick vegetation between Bhagabandh Village and the plant boundary, a significant reduction in noise levels at nearby villages is observed in comparison to the noise levels at source (~85 dB(A)). Higher noise levels were observed at some locations in the 10 km study area. This is which is mainly due to road vehicular noise and commercial market present nearby to these locations. The Ambient noise level during winter season 2019-2020 were carried out and compared with the above prescribed MoEFCC norms. In both seasons noise monitoring was carried out by covering Residential, Commercial areas and Silence zone and values were found within limits. Among the eight locations of winter season 2019-2020, the location N2 (Bodro village market area) was considered as "Commercial area" whereas the remaining locations can be classified as "Residential areas". The mean day noise levels at all the ambient locations were in the range of 45.6

to 61.3 dB, while the night the mean noise levels ranged from 38.0 to 52.2 dB(A). Comparatively high values were observed only at Bodro Village (N2), since noise monitoring was carried out near the market /petrol pump area of the village. All the locations are having good green cover. Further, it is observed that mean noise levels inside near the plant boundary (NB) at all locations are within the norms for Industrial Areas. The mean noise levels are in the range of 50.3 to 67.1 dB (A).

Water Environment

27. Total make-up water requirement for the existing steel plant (1.5 MTPA crude steel stage) is about 1130 m³/hr. The water is being sourced from intake well located on Damodar River at about 10 Km North East of the Plant. A water reservoir along with raw water treatment facility has been constructed for storage of raw water within the plant boundary. The has ensured optimized water consumption and minimal negative impact on the existing water regime due to water use for plant purposes. Another aspect of environmental damage of the water resources is effluent discharge from the plant. Waste water generated from various units of the steel plant are pre-treated and recycled within the unit itself. The effluent samples inlet and outlet have been collected and the results of outlet (treated effluent) have been compared with CETP standards 2016 and found to be within norms. The outlet (treated effluent water) is used inside the plant for coke quenching, BF slag granulation, sprinkling, gardening, Duct iron pipe, sinter cooling process etc. purposes. No effluent was generated from coke oven, as the existing coke oven is non-recovery type coke oven plant.

Surface water samples were analysed for different parameters as required by CPCB's Water Quality Criteria for Surface Water and also with different parameters as per IS: 10500 (2012) Amendment No. 1, 2015. The results of analysis of Surface Water When compared with Water Quality Criteria specified by Central Pollution Control Board, the quality of all the surface water samples meet the criteria specified under Class E; i.e. all surface water could be used for Irrigation, Industrial Cooling, and Controlled Waste Disposal. The surface water quality was compared with CPCB norm for surface water. pH of water samples are in the range of 6.77 to 7.60 and the dissolved oxygen varied from 5.1 to 6.9 mg/l. The turbidity of SW4, SW5, SW6 and SW7 are higher than other samples.

The value of Al found to be high at raw water intake point at Damodar river location (SW7). Since the origin of Damodar river is naturally enriched with metallic and non-metallic minerals, especially Iron & Bauxite ore and the upper valley – Hazaribag & Giridih district supplies 90% of mica in India, the upstream part of Damodar river w.r.t. study area naturally carrying dissolved Al which in turn could be attributed to high concentration of Al at SW7. All the surface water quality results were found to be within the norms for Class B (Surface water for Organised Outdoor Bathing) except SW5 (Chandaha Pond water) and SW6 (Damodar River near Telmuchu bridge) which are under Class C (Surface water which can be used as drinking water source after conventional treatment and disinfection).

In absence of any specific norms for Ground Water Quality, the results have been compared with drinking water norms of IS: 10500 (2012), Amendment No. 1, 2015. Most of the parameters at all eight locations studied in the area are within the norms. Total Dissolved solids, Total Alkalinity and Total Hardness are exceeding the “Acceptable Limits” in all samples, except at Sabra village and Laghla village but these values are well within the “Permissible Limits” at respective locations. Values of Calcium (Ca) and Magnesium (Mg) at 3 locations are exceeding the “Acceptable Limits” but well within the “Permissible Limits”.

Solid and Hazardous Wastes Generation

28. The solid wastes generated during operation/ annual maintenance of units/shops like Flue dust from BF, BOF Gas Cleaning Plant sludge, Waste Refractories, iron & steel scrap etc are utilized appropriately within the plant. Agreement with cement industries have been signed to ensure 100 % Fly Ash and BFGSlag utilization. Fly ash generated in the CPP is sold to nearby cement plants and brick kilns. Hazardous wastes are sold to authorized recyclers or sent to TSDF facility.

Soil PH

29. It plays a very important role in the availability of nutrients. The composition of the soil microbial community is also dependent on the soil pH. In the study area, the soil pH varied from 6.20 - 6.98 and 5.6 - 7.13 during winter season 2019-2020 and post-monsoon 2020 respectively, indicating slightly acidic to neutral nature of the soil. The test results of pH from different locations indicate that there is no impact on soil due to the industrial activity. Organic carbon, Nitrogen and Phosphorus are limiting nutrients, especially Phosphorus. In the tested soil samples most of the nutrients are available in low to high concentration ranges. In most cases, organic carbon was found to be “High”. Available Phosphorus levels are found to be in “Low” in all samples. Available Nitrogen levels are found to be “Low” to “Medium”. Availability of Potassium is found to be “Low”. As the major nutrients are not showing any major deviation among the tested soil samples, it is indicating that there is no impact on nutrient contents of soil due to industrial activity.

6.0 BIODIVERSITY IMPACT ASSESSMENT

Biodiversity impact assessment consists of desk-based study of information on associated regulations (national and international), agreements and conventions and statutory Biodiversity and ecosystem service at site aimed at assigning the most appropriate biodiversity risk rating.

I. Desk-based study of information on associated regulations

Query 1- Restrictions on where industrial sites can be located

Answer-There is no such restrictions in the area where ESL is located at Bokaro.

Company has been allowed by Central and State government under laws of land by

Obtaining following permissions –

- a. EC
- b. CTE
- c. CTO
- d. Authorisation under hazardous waste Rules 2016 and practicing manifest system for disposal
- e. Authorisation for handling E waste rules 2016
- f. Authorisation under BMW rules 2016
- g. Authorisation under MSW rules 2016
- h. Land related permission
- i. R and R related compliance
- j. Permission from Aviation authorities for stack height
- k. Permission from water resources department of GOJ for water drawls from Damodar
- l. Factory license
- m. Stability certificate for building from factory inspectorate
- n. Forest clearance stage 1
- o. NOC from District fire officer

p. Company is also filing Compliance/ Returns as required under respective rules

Query 2 - Additional costs such as fees or penalties payable for operating in or near areas of importance for biodiversity

Answer-There is no such requirement to pay additional fee or penalties payable for operating in area where ESL is located. However, since site spreads over Govt/ private land and forest land, company may have to pay for compensatory afforestation and ecosystem services lost for diversion of forest land (184.23Ha) for non-forestry purpose required under Forest conservation act(1980) and its amendments and as directed in Forest clearance stage 1.

Query 3- Legal obligations for ESL to offset any impacts on biodiversity through the purchase of biodiversity offset land or credits.

Answer- No. There is no such legal obligations on ESL, Bokaro to comply and offset impacts on biodiversity through the purchase of biodiversity offset land or credits. However, company is obliged to compensate loss of forest by going for compensatory afforestation, if company goes for forest diversion to meet its land requirement.

Query 4- Management actions expected or required by regulators under local, regional or national biodiversity plans.

Answer- Yes. The Act provides for conservation of biological diversity, sustainable use of its components and fair and equitable sharing of the benefits arising out of the use of biological resources, knowledge and for matters connected therewith or incidental thereto. Accordingly, company is obliged to ensure and facilitate conservation of biological diversity in impact area.

Query 5- Role of company in Biodiversity conservation on the site and surrounding areas including the presence (permanent or temporary) of important or endangered species of plants or animals, as listed on the IUCN Red List or given in red list of Wild life protection act 1972.

Answer- Yes. Company is obliged to contribute towards Wild life and biodiversity conservation in 10 km impact area from battery limit of plant premises. This is to be

complied by identifying presence (permanent or temporary) of schedule I animals, important or endangered species of plants or animals as listed on the IUCN Red List and given in red list of Wild life protection act 1972. This is also required under EPA act 1986, Forest conservation act 1980. Company has initiated action in this regard by conducting EIA/EMP study (2008 and 2021) and Site specific wild life conservation plan (2021). Accordingly, it has documented objective and target for implementing EMPs and conservation plans. Actions in this regard has been initiated.

Query 6- Since India is party to the Convention on Biological Diversity will have National Biodiversity Strategies and Action Plans (NBSAPs). This may be reinforced by biodiversity action plans at regional or local level.

Answer- No such additional constraints on the operation of ESL site is in place including requirements planned under (NBSAPs) which is under making.

II. Sensitive Biodiversity and ecosystem services of study area

Query 7- Land uses in and around the site

Answer- As we study land use of area in 10 km radius (314 sq. km area) vegetation occupies 18% , open scrub land 4.94%, water body 1.74%, Agriculture land 8.39% and grassland 7.29%. **Impact is medium for industries located in area and need conservation.** Land use and land cover during February 2021 are reproduced in table below-

Sl.no.	Land use and cover	Area(Sq.km)Feb 2021	Area (%) Feb 2021
1.	Vegetation patches	93.95	14.95
2.	Built up/Dry river bed/Dry land	14.34	4.57
3.	Water body	4.94	1.57
4.	Agricultural land	104.56	33.28
5.	Open scrub land	39.03	12.42
6.	Disturbed land	4.86	1.55

7.	Grass land	37.66	11.96
8.	Fallow land	13.61	4.33
9.	Pond eutrophication	1.29	0.41

Source: High resolution satellite image based data

Query 8. Wild life status in impact area

Answer- The wildlife habitat is not good in the nearby forest areas. The impact area is not the habitat of any important carnivores like Tigers, Leopards etc. it is also not the home of Elephants. Wild Animals Present /visiting the area are of general type consisting mainly of wild Pig, Jackal, Langur, Kobra, Ajar and karait. The Schedule I animals found in the study area are Indian Python and Indian Pangolin. Domesticated animals include Cow, Hen, Buffalo, Dog and Goat. There is no Biosphere Reserve, Ramsar Site, National Park, Wild Life Sanctuary, Tiger Reserve, Elephant Reserve or Wildlife Corridor in study area. **Impact can be high for industrial activity and other anthropogenic stresses and need conservation measures.**

Query 9. Sensitive areas as Schools in the area

Answer- The educational infrastructure has been evaluated with respect to some key infrastructural issues such as number of schools of various grades and schools with basic amenities such as tap water supply, toilet facilities and electricity. As per the District Education Officers Bokaro district the education facilities in the district in general and in particular in the blocks falling in study area is more or less adequate fulfilling the Government of India norms. One DY Patil International school (upto 10th standard) is fast coming up in area. It is located just about 6km distance from plant. Expected to start educational activity from coming session 2022-23. **Impact for industrial activity in area can be High. Therefore, firm conservation measures to be implemented in the interests of ambience of the school and the students.**

Query 10- Sensitive areas as Health care centres in the area

Answer- Given the severity of pollution and poor health conditions of people of the area the available health infrastructure, along with qualified health staff at the facilities is critical. Indian Public Health Standards (IPHS) stipulates the minimum requirements of these public health facilities. According to IPHS, in the rural areas

with plain grounds, there should be at least one sub-centre for every 5,000 people, one PHC per 30,000 people, and one CHC per 1,20,000 people. In Bokaro district, the numbers of CHCs when considered with regard to the corresponding rural or urban population are more or less as per the IPHS standards. Considering the rural population of the district, on an average, there is just one HSC per 14,000 people and one PHC per 98,000 people. **Impact of biodiversity loss vis a vis health management can be high and need conservation measures.**

Query 11- Habitations and villages

There are more 71 villages in study area. Here are about 217723 persons in the 10 km study area. There are about 919 females per 1000 males. Literacy rate is about 57 %. The population density up to 1-10 km is 693 persons/sq. km. The study area of 10 km radius consists of both rural and urban population but rural population is higher than urban. **Impact of biodiversity loss vis a vis habitations can be medium and need conservation measures.**

Query 12 - Vegetation of the area

Answer- There is presence of dense surrounded by less dense vegetation patches including forest patches all around the 10 km radius of the ESL Plant. These dense patches included plant and tree species with more or less semi-evergreen to evergreen nature of nature plant species occurring in the region. Further study clearly shows no distinctive defoliation and continuous corridor formation of these patches in a regular manner. The vegetation patches varies from (8.5-16) % of the total area interpreted during the four seasons. In February 2020 it ranged from 44 sq.km to 27 sq.km in May 2020, again to around 46 sq.km in November 2020 and around 50 sq. km. in February 2021. This clearly highlights that the lowest interpretation of around 8.5 % is during the peak summer season when trees and plants undergo defoliation and only the evergreen and semi- evergreen patches remain constantly green. **Impact can be medium and need conservation measures.**

Query 13- Water bodies in the area

Answer- Water body is mostly present in the form of rivers, lakes and ponds. In the north is *Damodar River* flowing from west to east. Just down south of the plant of

ESL steel Limited running parallel to its boundary lies the *Ijri Nadi*. Water bodies ranges from (0.4-2.5) % of the total area. Analysis of the area for the month of February 2020, 2021 indicated mostly clear water bodies showing less eutrophication followed by a constant increase in eutrophication in May and reaching the maximum levels during November. There are seasonal variations in water level, minimum being in Summer. Impact can be high for fragile nature of water body to external interventions such as untreated effluent discharges into the water body and other anthropogenic stresses. Accordingly, it needs conservation measures.

Query 14- Agriculture and fallow land

Answer- The entire area is dominant with agriculture land and fallow land (agriculture land devoid of crops due to harvesting or not sowing). Agriculture land occupies an area of around (33-58) % of the total area along with a variation of (4-13) % for fallow agriculture land. During the summer, there is an increase in the fallow land area. Major Kharif crops in the region includes paddy, maize, pigeon pea, groundnut, and pulses like arhar, urad and moong. During the winter the Rabi crops grown frequently are wheat, gram, mustard and linseeds. Apart from these crops seasonal vegetables are also grown in the region, both during Kharif and Rabi season. It is also observed that at some places tree plantation is practiced along the agricultural bunds. Impact can be moderate for nature of agricultural practices can be high to external interventions and will need conservation measures.

Query 15- Grassland

Answer- Surrounding these are plentiful patches of grassland with dominant tall and dwarf grasses. They occupy areas along the river bed, fringe areas of water bodies like lake /ponds. *Dendrocalamus strictus* is the only bamboo species found in the area. It is thinly distributed all over in the mixed forests and is absent in Sal forests. *Heteropogon contortus* dominates among the grasses. Other grasses are *Andropogon gerardii*, *Dicanthium annulatum*, *Bothriocloa pertusa*, *Cynodon dactylon* and *Panicum repens*. Impact can be low.

Query 16- Open Scrub Land

Answer- : Open scrub land area are characterized by presence of low trees and bushes (9-12%). Such area with least vegetation diversity is present in and around dry land areas with least productivity. Impact can be negligible.

Query 17- Built-up areas /Dry River Bed/Dry Land status in area

Answer- Built up areas are constructed buildings as villages, schools, Primary health centres. The dry river bed mostly contains exposed rocks and dry sands during summers and are mostly submerged into water post monsoon or during winters. The dry land mostly present in the southern part with occurrence of land areas with minimum water content and least of vegetation or top cover vegetation dominated by weeds in post monsoon. Rest of the year these areas or more or less dry and do not support any considerable vegetation in the region. These three forms together (built-up, dry river bed and dry land) constitute around (1-4.6) % of the total area. Landforms appear more exposed during late February. Impact can be negligible.

Query 18- Disturbed Land

Answer- The total area of disturbed land ranges from (1.26 - 1.5) % for all four seasons. The north eastern part of the area has a distinct patch of disturbed land evidently due to extraction/mining and later discarded or abandoned. The second area where disturbed land encountered is a region of off-loading sites along railway track. The third area is actually the ESL plant site and its North Western front which has huge dumps. All these areas are ecologically highly disturbed regions. In such regions or fringe area of disturbed land also promotes dominance of exotic weeds which adversely impact the local flora (natural and cultivable), fauna and biodiversity of area. These mainly include Parthenium hysterophorus, Lantana camara, Cynodon dactylon, Dicanthinum annulatum, Heteropogon contorts, Bothriocloa pertusa etc.

Impact can be high.

Query 19- Stakeholders who may be interested in the site.

Answer-Important stakeholders in the area include:

Local community- There are local communities residing in surrounding villages. They source their income from employment given by ESL, Agriculture and small business

activity. There is no conflict between biodiversity of area and communities interests.

Two are in harmony with each other and living together since long.

**NGO`s-** There are multiple NGO `s active in the area. Important ones are:

- a. Help People India, Non-profit organization in Bokaro Steel City, Jharkhand
- b. N.R.ASHIRWAD FOUNDATION, A Social services NGO in Jharkhand
- c. Mahila Janaswasthya Shishu Kalyan Kendra, Women's shelter in Bokaro Steel City, Jharkhand
- d. WHO NPSP SMO Unit Bokaro, Non-governmental organization in Bokaro Steel City, Jharkhand
- e. Mitra mandal parivar, a Social welfare center in Jharkhand
- f. Rah Society, a Non-profit organization in Bokaro Steel City, Jharkhand
- g. Samaj Hit Kalyan Samiti, Bokaro
- h. Nav Yuvak Samity, Charity in Bokaro Steel City, Jharkhand
- i. Adhikari foundation for nature conservation, an NGO dedicated to Elderly people
- j. Akhilbhartiya anand manav kalyan samiti, a NGO working for animal husbandry
- k. Ashadeep mahila evam bal vikas samiti, a NGO working for Education and literacy in the area

Academics

- a. Vinoba bhave university, Hazaribagh
- b. Binod bihari mahto koylanchal university, Dhanbad

Botany and zoology departments of the 2 university are active in research on the subject and have published good scientific papers both at national and international level journals flora, fauna and biodiversity of area.

Impact can be high for stake holder's interest. Implementation of definite conservation measures can only allay fears that may creep in for industrial activity in area.



SENSITIVE HABITATION - POSSIBLE REDUCTION IN AIR QUALITY FROM PARTICULATE EMISSION



SENSITIVE RIVER AND RIPARIAN ECO SYSTEM - POSSIBLE REDUCTION IN WATER QUALITY FROM WASTE WATER DISCHARGES



HABITAT FOREST PATCHES OF LOCAL CULTURAL SIGNIFICANCE – POTENTIAL FOR DISTURBANCE FROM NOISE AND VIBRATION



DISTURBED LAND – RAILWAY SIDING AND MINE

Fig No 10-. Site Map of Biodiversity and Sensitive Receptors

7.0 BIODIVERSITY RISK RATING

The Biodiversity risk rating has been undertaken for site-

1. Using IBAT which is a central database of globally recognised biodiversity information to map out the locations of important biodiversity areas, protected areas, and areas categorised by IUCN (International Union for Conservation of Nature) as significant for species of plants or animals
2. Desk based research findings from the biodiversity assessment conducted for Biodiversity risk and impact assessment.

Based on the information so available, the biodiversity risk category (High, Medium and Low) has been arrived that best describes the characteristics of the site. The category have been arrived based on guidelines given below-

HIGH

- The area supports vulnerable (fragile or non-adaptable) ecosystems that are likely to be sensitive to changes.
- The area has been assigned a status of natural, conservation or cultural significance by local, regional or national regulatory authorities or by recognised organisations such as international Institutions.
- There are current or soon to be implemented regulatory restrictions on industrial activities in the area for the protection of biodiversity or nature conservation.
- The area provides temporary, migratory or permanent habitat to species that are classified as vulnerable, endangered or critically endangered, as listed on the IUCN Red List.
- The area provides habitat for significant populations of a given species which defined 1% of the total global population of the species.
- The area provides habitat for species that have been identified as keystone species, i.e. species which play a disproportionately important role in their environment's structure relative to the size of the population
- The area supports ecosystem services that are perceived to be, or potentially are, of critical value to stakeholders.

- The size or location of the area affected by the operation is significant in terms of maintaining the health of a wider ecosystem or the connections between habitats.

MEDIUM

- The habitat of area is of native, wild or natural processes.
- The habitat of area is composed of healthy assemblages of plant or animal species of largely native origin, and/or where human activity has not necessarily modified an area's historical natural processes and species composition.
- None of the high biodiversity risk criteria apply.

LOW

- Areas of modified habitat.
- It contains a large proportion of plant and/or animal species of non-native origin
- Human activity has substantially modified an area's historical natural processes and species composition. (e.g. agricultural land)
- None of the high biodiversity risk criteria apply.

The aim of Low and Medium risk sites is to achieve No Net Loss (NNL) of biodiversity. High risk sites aims to achieve Net Positive Gain (NPG) in biodiversity.

a) Based on above criterias, the area has been assigned **MEDIUM RISK category** for following reasons-

- There are only few small isolated forest patches(26 in number) in the study area.Wild Animals Present /visiting the area are of general type consisting mainly of wild Pig, Jackal, Langur, Kobra, Ajar and karait. The Schedule I animals found in the study area are Indian Python and Indian Pangolin described in Wild life (Protection) act, 1972. Domesticated animals include Cow, Hen, Buffalo, Dog and Goat.
- Damodar River is located within 10 km from battery limit of project boundary and Ijri river, a tributary of Damodar river is within > 50 M distance only.
- Many a villages (habitations) are located in close proximity of company (1 km-Bhagabandh to 18 km- Mohal).

- iv. Gaseous emission levels including secondary fugitive emissions from the blast furnace, sinter and other process plants will be generated. Guidelines / Code of Practice issued by the CPCB to be followed. The Ministry may revoke or suspend the clearance, if the implementation of any of above conditions is not satisfactory required under Air act, 1981 and EPA act, 1986.
- v. Integrated steel plant is categorised as hazardous process (Red category) under EPA Act 1986/Factory act 1948. Norms are stricter in this case and so the penalties.
- vi. As we surveyed overall terrestrial flora of the study area the BIODIVERSITY INDEX was found to be as high as (6.58), RICHNESS (D- 3.62) and the EVENESS (E- 5.11), a fairly high value. This means qualitatively the overall vegetation of the impact area is rich and uniform but quantitatively there is a great variation in plant species spread
- vii. On comparison of the BIODEVERSITY (H) between Trees, Shrub and Herb, maximum value was observed for Trees (5.94) followed by Shrub (3.94) and minimum was for Herb (3.87). All 3 categories showed maximum frequency Of 100. Abundance is maximum for trees < shrub and < herb). Density also showed similar trend.
- viii. Aquatic flora commonly reported from aquatic ecosystem namely River, Pond, Lake in the area are 28 number of species. Overall Biodiversity of Aquatic plants in study area is 3.68, Richness 0.79 and Evenness 0.36. As we do trend analysis between seasons, BIODEVERSITY index was maximum in post monsoon (3.71).
- ix. Aquatic fauna/zooplanktons commonly reported from aquatic ecosystem namely River, Pond, Lake in the area are 28 numbers of species. Among Zooplanktons Moina brachiate, Diaoptomus vulgares, Cyclops sp. dominate the aquatic bodies. Overall Biodiversity of Aquatic zooplanktons in study area is 2.40, Richness 0.62 and Evenness 0.37. BIODEVERSITY was maximum is in post monsoon (2.47) < pre monsoon (2.04) and minimum was during monsoon season (1.98).

- x. Here Biodiversity Management Plan (BMP) aims at maintaining biodiversity level at existing levels and prevent any further degradation.

The site does **NOT** fall into **HIGH RISK** category as area has not been notified as –

- i. There is no Biosphere Reserve, Ramsar Site, National Park, Wild Life Sanctuary, Tiger Reserve, Elephant Reserve or Wildlife Corridor in study area.
- ii. Protected area or area categorised in Red list by IUCN as significant to critically endangered species of plants or animals located there.
- iii. The habitat does not support globally significant concentration of migratory species.
- iv. Area is not classified as threatened/ and unique ecosystem
- v. Area is also not reported to be associated with any key evolutionary process

The site **NEITHER** fall into **LOW RISK** category as-

- i. It does not contain large proportion of plant and / or animal species of non-native origin
- ii. it does not host substantially modified area of historical natural processes and species composition.

Relative RISK rating

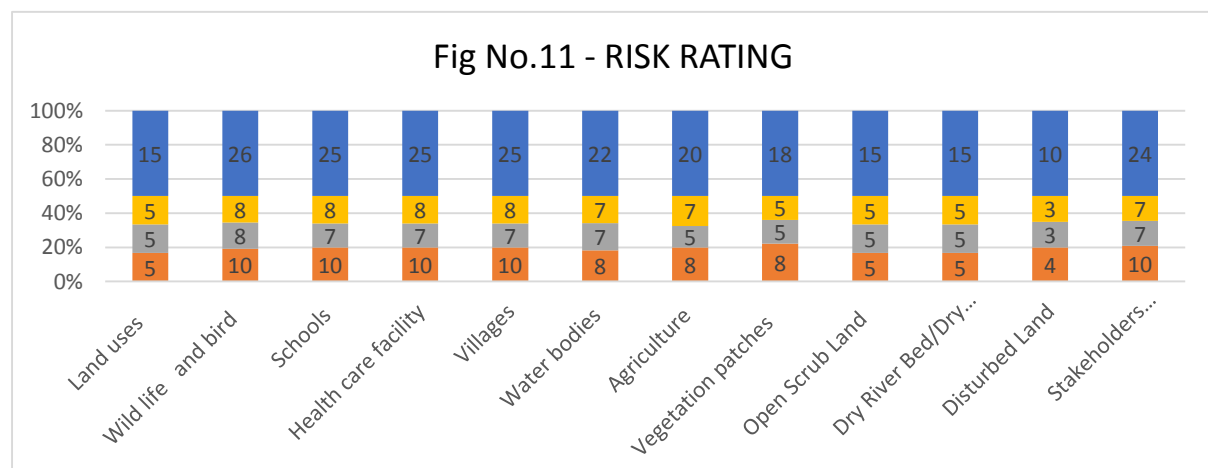
Risks have been identified based on assessment made and relative rates (Scale of 10) attributed to each of sensitive receptors for both flora and fauna present in study area. This Risk Rating (Table no. 16) is based on following assumptions-

- i. Company policy and legal requirement on Biodiversity management
- ii. Sensitivity of Receptor w r t steel making/industrial activities and other anthropogenic stresses
- iii. Response potential to conservation measures and
- iv. Natural instinct to survival/revival Same is described in table given below-

Table 16. Biodiversity RISK Rating and Risk Register of sensitive receptors vis a vis steel making/industrial activities and other anthropogenic stresses

No	Particulars	Company policy and legal requirement On Biodiversity management	Sensitivity of Receptor	Response potential to conservation measures	Natural instinct to survival/revival	Rating
1	Land use	Yes	05	05	05	15
2	Wild life and bird		10	08	08	26
3	Schools		10	07	08	25
4	Health care facility		10	07	08	25
5	Habitation & Villages		10	07	08	25
6	Water bodies		08	07	07	22
7	Agriculture		08	05	07	20
8	Vegetation patches		08	05	05	182
9	Open Scrub Land		05	05	05	15
10	Dry River Bed/Dry Land		05	05	05	15
11	Disturbed Land		04	03	03	10
12	Stakeholders interests		10	07	07	24

Rating- on scale of 10 in all 3 categories



8.0 BIODIVERSITY MANAGEMENT PLAN

1. Promoting awareness

It is about biodiversity and its conservation through pamphlet distribution, Nukkad Natak in local language, organising wall painting, Slogans, Poster competition besides celebrating world environment day, wildlife week, World elephant day and World water day. Organising the events such as running for wildlife, Painting and Essay competition etc in collaboration and direction from DFO, Bokaro to be organised regularly. 15 minutes short film to be made and shown in all villages of area on forests and wildlife such as wild Pig, Jackal, Monkey, Indian Python and Indian Pangolin and other species of area by a professional team with focus on Buffer zone. The movie will be shown at quarterly interval in affected villages.

2. Preventing degradation of ecosystem and restore habitat

This will be achieved by planting fodder/ grass land/ fruit bearing trees in impact area. This includes bamboo trees, Ficus, Banana and other palatable sp. such that Biodiversity, Ecosystem and Ecosystem services are sustainable on long term basis. Wildlife habitat protection by planting native/useful trees and improving water regime and its maintenance will go long way in biodiversity management of the area.

3. Prevent poaching and Protection of forest from illicit felling

a. Anti-depredation team to be equipped with Digital camera, drone, night vision binocular, GPS and motorcycle further to add punch to the activity. A reward to be given for providing information and thus helping the forest department.

b. Illicit felling of trees shakes the ecological balance that needs to be maintained for sustainable development of ecosystem. Tree cover provides an adequate shelter as well. A lumpsum amount is proposed for the protection of forest against illicit felling inside the buffer area, poaching, theft, etc.



Information

Watch tower

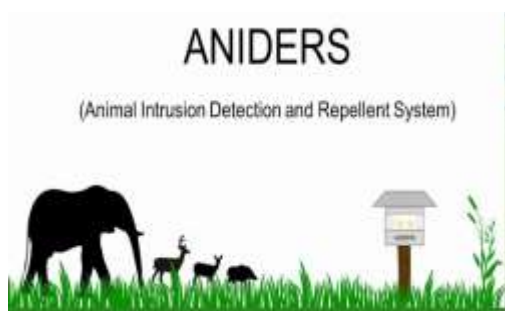
4. **Reunion of Fragmented area** – An attempt is to be done to try to connect the fragmented wild habitat in the region. It is to be done on experimental basis. Land to be taken from villagers on rent and develop fodder/ grass land/ fruit bearing trees in those areas. Development of the land rented from the villagers for fodder needs, planting fruit bearing trees etc. in order to unite the fragmented wildlife habitat is proposed. This is to be done on the basis of consultation with villagers, their needs and forest department.
5. **Deployment of Fire Fighting Squad** : Forest fire is occurring every year in Impact area forests, Government land and Rayat land and destroys the regeneration badly year after year. Thus, one Fire Fighting Squad with 05 persons duly trained in Fire Fighting and handling modern fire fighting equipments as Fire blower, Bush cutter, Fire proof suit etc will be deployed. They will be engaged for 5 months from February to June every year with hired vehicle.
6. **Model check naka and Naka Building** - It is proposed to construct one building equipped with wash room, electricity and water supply. The Naka building shall have one room for operating Forest Check post remotely and one waiting room/Resting place for the Guard having duty at Naka. The building to be powered by way of Solar Panels. A provision of 8 KW Solar panel to be installed at chowk with sufficient capacity to have interrupted power supply and running of CCTV and monitoring

system 24 /7. CCTV cameras are to be installed at the naka to record the movement across the naka.



Check Naka and Naka Building

7. **Aniders-** An Animal Intrusion Detection & Repellent System is proposed to be installed to effectively solve Human-Wildlife Conflict. It works as a smart Scarecrow. It is energy efficient as it uses solar power and uses infrared sensors and alarm system to repel. It also makes multiple sound and light pattern and uses GSM for real time communications. It is proposed to Install such system for 18 KMs (1 Km per Forest Fringe village Boundary); 6 active system and 6 passive system per km.



Mitigative measures to protect wildlife and avoid Human- Wildlife Conflict

8. Provision for Drone camera, Motor Cycle and solar street lights

a.Modern technology is to be used for better forest, Wildlife Management & Monitoring. In order to keep a vigil eye on their wild life movement, it is proposed to deploy one drone camera for monitoring wild animals in stress in forest area.The Field staffs are required to move in very narrow path / Forest terrain in course of wildlife management & related duty.

b. To facilitate their duty, it is proposed to provide 02 number of Motor Cycle to the division Installation of Solar street lamp in affected villages within buffer zone of 10 Km around the plant area is proposed. It will keep wild animals away from the area.

9. **Livelihood improvement of and capacity building** to local people in Duckery, fishery, honey bee keeping and mushroom cultivation. Distribution of Sal pattal making machine, Mahua and fruit collection net, grain bins and Bamboo craft making will further add to villagers income. Distribution of seed money for implementation of micro plans will further improve the group income. These will also improve income of people and in turn livelihood.

10. Conservation of plants and wild life

a. Nursery for conservation of threatened and endangered plant species- It is proposed to raise Nursery for conservation of threatened and endangered plant species. The saplings thus raised will be used for distribution to public and gap plantation by User agency in its own area Conservation of Schedule I animals

- i. The Indian python (*Python molurus*) is classified as Near Threatened on the IUCN Red List and schedule I of WLPA 1972 due to a likely population decline of ~30% over the decade 2010-2020. The Indian python have long been hunted for their skins, which are made into fashionable accessories, and trapped for the pet trade. People also kill large out of fear. Additionally, this species of snake is threatened by shrinking habitat caused by deforestation. Indian pythons are considered a vulnerable species and are now protected, along with other python species by CITES I, which prohibits trade in live pythons and python products. Poaching is still a major threat, though. India has established many wildlife reserves where Indian pythons are technically protected, but the borders of these reserves are difficult to patrol.



- ii. The species Indian Pangolin (*Manis crassicaudata*) occurs in various types of tropical forests as well as open land, grasslands and degraded habitats, including in close proximity to villages. The species adapts well to modified habitats, provided its ant and termite prey remains abundant. Major threats to pangolins in India are hunting and poaching for local consumptive use (e.g. as a protein source and traditional medicine) and international trade, for its meat and scales in East and South East Asian countries, particularly China and Vietnam.



11. **Conservation of birds-** A bird survey is proposed periodically including migratory birds aimed at taking time necessitated steps in direction of their conservation. The survey to be done in Year 1, Year 2, Year 5, Year 6. All such study to be organically linked, changes to be noted and new study shall build upon the previous one.
12. **Promoting Rescue centre** in the area in consultation with forest department can prove to be a milestone in wild life conservation. The Rescue centre will be complete with trained wild animal rescue team equipped with rescue vehicle, cage besides provision of crackers etc is key for conservation of wild life in the area. It is also proposed to provide a double barrel dart gun, Portable cage, Nylon net, Stretcher, First aid Kit for Staff and Medicine for Tranquilization. Four/Five Forest guards to be certified for use of Dart Gun and other equipment and other qualified volunteers nominated by Forest department. The rescue team shall include services of one Veterinary Doctor, one Paramedics and two daily wage workers under the supervision of DFO, Bokaro during the life of plant. Specially trained snake charmers equipped with snake catching equipment are also to be deployed as a key conservation tools.

13. Monitoring of wildlife and wildlife expert

a. Appropriate steps need to be taken to monitor the impact of the project on the existing wildlife at the project site and impact area. It is proposed to outsource an outside agency for the purpose of monitoring of wildlife such as wild Pig, Jackal, Monkey, Kobra, Ajgar and karait. A comprehensive report with due consultation of field staff is to be submitted every year.

b. The area is rich in faunal and floral biodiversity. For periodic assessment and cataloguing the diversity of the area, ONE (01) Wildlife expert is proposed to be kept at division office. It will enhance the capability of the division office to take better cognizance of the biodiversity of the region.

14. Green belt developed in project area

Green belt has inside premises been developed in > 123 Ha(33%) out of 374.81 Ha of project area. Top 10 species constituted 77% of total trees planted. These include *Senna siamea* figured the maximum numbers (14830). It was followed by *Alstonia scholaris* (13624). *Butea monosperma* was minimum with 24 no of trees surviving. Shannon-Weiner biodiversity index for project site showed a value of 4.60. This shows good biodiversity index at site. Any index value above 3 shows good biodiversity of area and an indicator of health of environment. This has also helped reduce pollution load as also improve aesthetics of area. As we studied abundance *Senna siamea* showed maximum abundance of 3707, followed by *Alstnoia scholaris* at 1946. Minimum was for *Acacia auriculiformis* with 1644. In case of frequency, 5 species namely *Alstonia scholaris*, *Terminalia arjuna*, *Milletia pinnata*, *Delonix regia* and *Acacia auriculoformis* was present in all 7 zones studied. *Gmelina arborea* and *Artocarpus heterophyllus* occurred only in 43% of zones. Shannon-Weiner biodiversity index for project site showed a value of 4.59. This shows good biodiversity index at site. Any index value above 3 shows good biodiversity of area and and an indicator of health of environment. Habit of *Senna siamea*, the most dominant sp. a medium-size, evergreen tree with a crown that is dense and rounded when young, later becoming irregular and spreading with drooping branches. It grows up to 18 metres tall a short, straight bole that is up to 30cm in diameter. The

tree is particularly valued for firewood and agroforestry. In case of 2nd dominant sp. *Alstonia scholaris*, it is evergreen glabrous tree and grows up to 40 m tall. Leaves grow in whorls of 3-10 ten leaflets. The least dominant *Butea monosperma* grows to 15 m tall. Leaves are pinnate, 8–16 cm long petiole and 3 leaflets. Tree plantation done along roads are liner, growing well but are normally in single row only. Plantation done in Oxygen plant and clean water tank area are taken care of and are growing well. Growth of plantations done in RMHS and CHP area are marred by dusts generated from process plants.

15. Management of Air Pollution in project area

Pollution Sources	Mitigation Measures
Sponge Iron Plant:	
Loading / Unloading of Raw Materials and Finished Products	Sprinklers / Fogging / Mist
Raw Material Handling System for DRI Plant	Bag Filters
Product handling during discharge and intermediate and product bins	Bag Filters
DRI Kiln off Gases	Electro Static Precipitator
Steel Melting Shop	
Raw material handling system for Steel Melting Section	Bag Filters
IF & LF off Gases	Fume Extraction System with Bag Filters
Rolling Mill	
Fume from Pickling/Galvanizing Line	Fume Extraction System , Scrubber with Stack
Spent Acid (HCL)	Acid Recovery System

Pellet Plant	
Raw material handling system	Bag Filter
Flue gas from Pellet Plant	Electrostatic Precipitator (ESP)
Coke oven	
Raw material handling s like conveyor transfer towers, crushing and screening house etc	Dry fogging (DF)system
Coke cooling	Wet quenching system has been envisaged.
The oven gas	After het extraction gas is vented into the atmosphere through tall stack of appropriate height
Captive Power Plant	
Unloading of Raw Material	Sprinkler / Fogging / Mist
Raw Material Handling System for Power Plant	Bag Filters
Boiler Flue Gases	ESP
Ash Handling Area	Fixed and Mobile water Sprinkler
Raw Material Handling Area	
Loading & Unloading of Material & Finished Product	Sprinkler / Dry Fog System

All the major stacks have been provided with online continuous monitoring system (CEMS) to ensure the desired efficiency of the respective control systems. Emission is monitored for PM, SO₂ and CO. Besides, 4 no. of CAAQMS have been commissioned located in 4 corner of the premises. This continuously monitors and reports Air quality in the area. Ambient air quality is monitored for PM₁₀, PM_{2.5}, SO₂, NO_x and CO

16. Management of Noise

The work zone noise is mostly from the rotary equipment and machinery like fans, blowers, compressors and pumps. The noise level in some of the machine is 90 dB (A). Such machines have been housed in acoustic enclosure so that the work zone noise level remains within the limits. Operator are stationed in the noise free control room, there is minimum chance of exposure to high noise levels. Drivers operating Fork lifts and other material shifting vehicles occupy glass enclosure A/C fitted noise free driver cabin. The workers exposed to the high noise level have been provided with high quality applicable PPEs include ear muff/ ear plugs. High noise areas are kept unmanned as far as practical. Rotation of duty have been ensured to keep TTS within norms. Noise is monitored regularly both within and outside premises at monthly interval.

17. Wastewater Management

The prevention and control of water pollution aims at conserving make-up water by recycling the waste water after treatment. The waste water is generated from

- Underflow from Raw Water Clari flocculator
- Backwash Waste from Filtration Plant
- Run-off water from Raw Material Storage Yards
- Cooling Tower & Boiler Blow-down
- Canteen Effluents

Sludge from Raw Water Clari flocculator and Backwash from Filtration Plant is taken to a thickener for removing suspended solids. The overflow from the thickener is reused in the plant water system. The Sludge from the thickener is dried and dumped. Boiler blow down and Cooling Tower blow down from various recirculation systems is cascaded for reuse in gardening and dust suppression. The rain water harvesting system in the plant is in place for the purpose. Run-off water from the office areas, shop roofs is collected and stored for use.

The plant has been designed as a zero discharge plant for process effluents. The water is recirculated through cooling and treatment. No plant effluent is discharged outside the plant premises. The entire waste water is recycled for use in process and secondary applications such as gardening, dust suppression.

Domestic effluent from the various buildings / sheds of the plant is conveyed through separate modular STPs. Toilet /bathroom waste water is routed through the septic tank and is disposed through soil percolation by providing dispersion trenches / soak pits.

Both influents and Effluents are monitored for parameters like pH, TSS, TDS and Oil & Grease at monthly interval to ensure compliance of norms. Scheduled monitoring of influent and effluent of wastewater treatment plants is followed for parameters like pH, TSS, TDS and Oil & Grease.

18. Solid Wastes Management

The main solid waste generated from the process units are DRI dolochar, boulders, nut coke, coke breeze, flue dust, slag, sludge etc. Most of these solid by-products are reused within the plant. BF slag is sold to the cement plants. Zn dust to authorized agencies. BOF slag generated is partly used in the process and the balance is used for land filling. Besides, there is generation of sludge from ETP & STP. Used/Spent Oil is produced in very small quantity. Used oils removed from machineries, gear boxes, compressors etc are collected in drums and temporarily stored in specifically earmarked area. They are disposed through the authorised agencies from JSPCB.

19. Sustainability Cell

A separate environment management cell is in place headed by a senior executive reporting directly to the Chief Executive and is suitably staffed. The environment monitoring lab is well equipped with state of art monitoring kits. Same is upgraded periodically.

9.0 BIODIVERSITY MONITORING AND REPORTING

Monitor and report the progress of biodiversity management in terms of:

- a. Progress in implementing the biodiversity management measures detailed in the Biodiversity Management Plan
- b. Performance measured according to Biodiversity Performance Indicators (KPI) given in Commitment register and KPI defined in Annexure 2

ROLE AND RESPONSIBILITIES

Sustainability Manager is responsible for:

- Ensuring that the activities for biodiversity risk management are undertaken effectively including employing external biodiversity experts to undertake the activities as necessary
- Accurately monitoring and reporting performance in relation to biodiversity management
- Identifying when the BMP needs to be updated or maintained (according to changing external conditions or operational activities that were not previously accounted for within the BMP) and ensuring that this is done appropriately and
- Ensuring that biodiversity-related risks, issues, dependencies and management actions are integrated into core operational plans and documents as appropriate. This includes Operation's risk register, land acquisition plans, stakeholder engagement plans.

Unit head is responsible for

- Reviewing the operation's performance in relation to biodiversity management
- Monitoring KPIs and ensuring appropriate reporting of performance to Company and Ensuring that sufficient and competent resources (time, effort and people) are committed to biodiversity risk management activities

Sustainability Manager at Corporate level is responsible for

- Biodiversity risk screening
- Reviewing the site performance in relation to biodiversity management
- Monitoring KPIs and ensuring appropriate reporting of performance to Company
- Taking necessary actions to take compliance to next level

10.0 KEY FINDING AND LEARNING

1. The Bokaro district is part of Chotanagpur Plateau. It is hilly and highly undulating all over the district. The regional slope of the district is towards east and is controlled by the alignment of the tributaries of Damodar river. The hill ranges trends WNW - ESE. The average elevation of the plain is between 150 - 350 m above MSL. The northern and western part of the district is having hilly ranges. The highest hill prominent block is Gomia. Chas and Chandankiyari are low upland where cultivation is practiced. Administrative Divisions of the District include Blocks (09), Panchayat (249) and villages (635).
2. Geographical Area of Bokaro is 2883 Sq. km. Total population is 20,62,330 (2011 census) persons. Main tribe in the area is Oraon, Chero, Korwa and Parahiya. ST population is 2,18,600, languages spoken are Hindi & Oraon. Population per Sq Km 715 person. Sex ratio 922, Climate is Humid & Sub-tropical climate, important minerals include Coal, CBM, Limestone, Stone, Quartzite, Sand, Bricks.
3. The area and the Bokaro district experiences humid and sub-tropical climate. It is characterized by hot summer from March to May (42°C to 46°C). There is well distributed rainfall during southwest monsoon from June to September (1363.57mm is average rainfall). Predominant wind direction is from south-west. The mean annual humidity is nearby 60 %. Relative humidity is generally lower in the afternoons than in the mornings. During summer and winter month's sky is generally clear or slightly clouded. During monsoon months sky is heavily clouded to overcast.
4. ESL Steel Limited (formerly Electrosteel Steels Limited) has set up an Integrated Steel Plant located in villages Siyaljori, Bhagabandh, Budhibinor, Alkusha, Dhandabar, Bandhdih and Hutupathar of Bokaro District of Jharkhand. The present plant is spread over 374.81 ha of land including the approach road to the plant. The project has adopted steel making through Blast Furnace route and primarily consist of a Sinter Plant, Coke Oven, Blast Furnace, Basic Oxygen Furnace, Billet Caster, Wire Rod Mill, Bar Mill, DI Pipe Plant and Power Plant. The plant has been designed to produce bars, wire rods, DI pipes, pig iron and billets. Presently, ESL is operating an integrated

steel plant with capacity of 1.5 MTPA crude steel along with 0.22 MTPA ductile iron pipe production. The finished products include Pig iron, Wire rods, Rebars and DI pipes.

5. Land use of study area (314 sq km area) using high resolution satellite image says (Feb 2021) vegetation occupies 29.91% , open scrub land 12.42%, water body 1.57%, Agriculture land 33.28% and grassland 11.96%. A large part of district (about 25%) is under forest cover.
6. The main vegetation is composed of the dry peninsular Sal forest. Composition Of forest in the top and middle stories are *Shorea robusta*, *Terminalia tomentosa*, *Madhuca indica*, *Pterocarpus marsupium*, *Adina cordifolia* and *Diospyros melenozylon*. The shrubs consist of *Holorrhina antidysentrica*, *Nyctanthes arbortrities*, *Zizyphus* and *phoenix sylvestris*. The grasses consist of *Heteropogon contortus*, *Dicanthinum annulatum* *Cynodon dactylon* etc. The climber is mainly dominated by *Bauhinia variegata*, *Asparagus racemosus*, *Acacia pinnata*, etc.
7. The miscellaneous vegetation/forests are observed on relatively drier areas having poor soil and moisture condition. This is classified as northern dry mixed deciduous forests. The trees in the top storey are generally open. It includes *Boswellia serrata*, *Artocarpus integrifolia*, *Lagerstroemia parviflora*, *Diospyros melanoxylon*, *Pterocarpus marsupium*, *Adina cordifolia*, *Syzygium cumini*, *Madhuca indica*, *Emblia officinales* and *Lagerstromia parviflora*. *Acacia katechu* is found in scattered patches in eroded areas. The scrub mostly consists of *woodfordia fruticosa*. *Nyctanthes* is and other scarce. The middle storey consists of frequent and extensive bamboo breaks of *Dendrocalamus stricutus* for better soil conditions. The area contain miscellaneous shrubs as *Ixora parviflora* and *Lantana camara* and a very little mesh of climbers like *Bauhinia vahlii*, *Smilax zeylanica*, *Combretum decandrum* etc and. Scattered *Bombax malbaricum* trees are found in moist localities while *Boswellia serrata* are found on ridges and drier localities.
8. Grass growth in area is plentiful. *Dendrocalamus stricutus* is the only bamboo species found in the area. Clumps of same are congested and malformed. It is thinly distributed all over in the mixed forests and is absent in Sal forests . *Heteropogon contortus* dominates among the grasses. Other prevalent ones are *Andropogon*

gerardii, Dicanthinum annulatum, Bothriocloa pertusa, Cynodon dactylon and Panicum repenes.

9. There is presence of Dense Vegetation Patches all around the 10 km radius of the ESL Plant. These dense patches included plant and tree species with more or less semi-evergreen to evergreen nature of nature plant species occurring in the region. Main plant species occurring in these patches include *Azadirachta indica, Pongamia pinnata, Mangifera indica, Syzigium cumini, Ficus benghalensis, Albizzia lebbek, Zizyphus mauritiana, Clerodendron sp, Nyctanthes arbo rtistis, Lantana camara* etc. Dense patches appear in a regular manner and it varies from (8.5-16) % of the total area during the four seasons. In February 2020 it ranged from 44 sq.km to 27 sq.km in May 2020, again to around 46 sq.km in November 2020 and around 50 sq. km. In February 2021 8.5 % is during the peak summer season when trees and plants undergo defoliation and only the evergreen and semi- evergreen patches remain constantly green. Uniformity in vegetation is nearly achieved in the post monsoon November image which indicates parallel growth of under shrubs in opening areas.
10. Relatively less dense are present on the fringe areas of dense vegetation patches and on agricultural bunds. it occupies nearly (36 to 43) sq. km. of area of the total encompassing about (11-13.8) % of the total area. These regions are e more species rich and diverse w.r.t. number of species occurring in the region. Some of the species dominant in the area include *Dalbergia sissoo, Cassia fistula, Albizzia lebbek, Leucaena leucocephala* etc.
11. The Aquatic plants present in impact area mainly include *Pteridophytes* dominated by *Azolla pinnata, Marsilia quadrifolia* and *Salvinia natans*, *Angiosperms* by *Nymphaea cristata, Hydrilla verticillata, Eichornia crassipes* while *Phytoplanktons* are dominated by *Rivularia elegans, Spirulina major, Oscillatoria principes*. Overall Biodiversity of Aquatic plants in study area is 3.65, Richness 0.79 and Evenness 0.36. As we do trend analysis between seasons, BIODEVERSITY index was maximum in post monsoon (3.69) signifying maximum eutrophication leading to *Azolla* blooms etc. The entire area of 314 sq km has many ponds (villages have one pond each) and closed water bodies. It ranges from (0.4-2.5) % of the total area. Analysis of the area for the month of February 2020, 2021 indicated mostly clear water bodies less

eutrophication, followed by a constant increase in eutrophication in May and reaching the maximum levels during November. Biodiversity value further diminished during < Post Monsoon (3.69) and least was shown in pre monsoon (3.16). These are direct indicators of stagnant water bodies with less flow of fresh water into it. RICHNESS of aquatic plants was also maximum in pre monsoon season (1.66) < monsoon (1.44) and was least in post monsoon season (1.14). In case of Evenness, it was maximum of 0.36 in post monsoon < monsoon season (0.34) and least was in pre monsoon season 0.31. Maximum frequency of 100 was observed in all seasons. Abundance and density is maximum of 48.78. Water bodies range about (1.4 – 2.6) % of the total area of interest. There are seasonal fluctuations in water availability in the region.

12. In the entire area of interest there are 3 distinct separate disturbed regions. The total area of disturbed land ranges from (1.26 - 1.5) % for all four seasons. The north eastern part of the area has a distinct patch of disturbed land evidently due to extraction/mining and later discarded or abandoned. The second area where disturbed land was observed is a region for off-loading/handling site along railway track. The third area is the ESL plant site and it's North Western. It has huge dumps and its handling by Hyvas/trucks etc. All these areas are ecologically disturbed regions. These disturbed lands also promote dominance of exotic weeds which may adversely impact the local flora (natural and cultivable) and fauna. These mainly include *Parthenium hysterophorus*, *Lantana camara*, *Cynodon dactylon*, *Dicanthium annulatum*, *Heteropogon contorts*, *Bothriocloa pertusa* etc.
13. Built-up/Dry River Bed/Dry land Built-up categories are areas with settlements around in the form of villages and also a cluster of villages aligned either in circular fashion and also distributed along roads in a linear fashion.
14. The other land forms seen are dry river bed. It mostly contains exposed rocks and dry sands. These dry river beds are exposed during summers and are mostly submerged into water post monsoon or during winters. Further, dry land mostly occurring in the southern part of the image with occurrence of land areas with minimum water content and least of vegetation or top cover vegetation. This is a variant of disturbed land where weeds dominating these areas post monsoon. Rest

of the year these areas are more or less dry and do not support any considerable vegetation in the region. All three forms (built-up, dry river bed and dry land) constitute around (1-4.6) % of the total area. Landforms appear more exposed during late February as it can be visually seen in the images of February 2021.

15. **Agriculture Land and Fallow Land:** The entire area is dominant with agriculture land and fallow land. Agriculture land occupies an area of around (33-58) % of the total area along with a variation of (4-13) % for fallow agriculture land esp during the summers. . Major Kharif crops in the region includes; paddy, maize, pigeon pea, groundnut, and pulses like arhar, urad and moong. During the winter the Rabi crops grown frequently are wheat, gram, mustard and linseeds. Apart from these crops seasonal vegetables are also grown in the region, both during Kharif and Rabi season. It is also observed that at some villages tree plantation is practiced along the agricultural bunds.
16. **Open Scrub Land and Grassland:** Open scrub land area are characterized by presence of low trees and bushes. Such area with least vegetation diversity is present in and around dry land areas with least productivity. Around (9-12) % of the area is characterized by such area. Surround these are patches of grassland with dominant tall and dwarf grasses. They occupy areas where water availability is not a major problem, like areas along the river bed, fringe areas of water bodies like lake /ponds. Some of the characteristic species growing in open scrub land includes *Zizyphus mauritiana*, *Sida ecardifolia*, *Ichnocarpus frutescens*, *Cortaderia selloana*, *Desmostachya bipinnata*, *Cymbopogon citratus* etc.
17. **Overall BIODIVERSITY INDEX** of terrestrial flora was as high as (6.58). The RICHNESS (3.62) and the EVENESS (5.11) also showed high values. On comparison of the BIODIVERSITY (H) between Trees, Shrub and Herb maximum value was observed for Trees (5.94) followed by Herb. RICHNESS values had high values for Trees < Shrub < followed by herb. But EVENESS showed opposite trend i.e maximum (48.23) for herb < followed by shrub (12.39) and < minimum is for tree (5.20). All 3 categories of flora showed maximum frequency Of 100. Abundance is maximum for trees (7.10)< shrub (2.50) and herb(2.40). Density also showed same trend with Tree (7.1), < Shrub (2.50) < Herb (2.40).This signifies qualitatively the overall

vegetation of the impact area is rich and uniform. Quantitatively there is great variation in species spread in the study area. The area is dominated (Density 2.80) by *Shorea robusta*. Frequency of (60) and Abundance (4.67) was observed same. The other evergreen and semi evergreen trees are far and few in number and noticed mostly during summer season as leaves fall off from deciduous trees.

18. On comparison of the BIODEVERSITY (H) between Trees, Shrub and Herb maximum value was observed for Trees (5.94). RICHNESS also showed similar trend where it was maximum for trees (3.13) followed by shrub and herb. But EVENESS is maximum (48.23) for herb followed by shrub (12.39) and minimum is for tree (5.20). All 3 categories of flora showed maximum frequency Of 100. Abundance is maximum for trees (7.10) < shrub (2.50) and herb (2.43). Density also showed same tend Tree (7.1), < Shrub (2.50) < Herb (2.40).
19. Above findings are also substantiated from satellite based study of images of various land use and land cover forms in the area. Three distinct zones (grids) have been diagnosed and prioritized from such a study. In first type, regions have characteristically high compactness (Intactness) of dense or less dense vegetation. This indicates high species abundance in this area. Here, conservation strategies should aim at retaining these compact vegetation patches and increase the area and connectivity of patches through conservation measures like plantation of native and economically important tree species in the area having higher turn over time. . Second type denotes 2 types of high stress area. One due to transportation of coal to the ESL Plant and the other due to abandoned mines located in the north eastern part of the region. An immediate actionable intervention needs to be planned in these regions to restore water bodies and maintain vegetation intactness. .Reclamation of abandoned mines should be prioritized in consultation with Government agencies. The third types are potential conservation areas. These areas mainly constitutes plantation areas of natively grown and planted trees especially Sal, Butea, Phonex species etc. This area helps in establishing a continuous patch or greenness in the region as also they help in restoring the perturbed ecosystem.
20. Aquatic flora commonly reported from aquatic ecosystem namely River, Pond, Lake in the area are 28 number of species. The Aquatic plants present in impact area

mainly include *Pteridophytes* dominated by *Azolla pinnata*, *Marsilia quadrifolia* and *Salvinia natans*, *Angiosperms* by *Nymphaea cristata*, *Hydrilla verticillata*, *Eichornia crassipes* while *Phytoplanktons* are dominated by *Rivularia elegans*, *Spirulina major*, *Oscillatoria principes*. Overall Biodiversity of Aquatic plants in study area is 3.68, Richness 0.79 and Evenness 0.36. As we do trend analysis between seasons, BIODEVERSTY index was maximum in post monsoon (3.69) signifying maximum eutrophication leading to *Azolla* blooms etc. Eutrophication further diminishes the dissolved oxygen content in the water bodies negatively affecting flora and fauna. The entire area of 314.16 sq.km has many ponds and closed water bodies. It ranges from (0.4-2.5) % of the total area. Analysis of the area for the month of February 2020, 2021 indicated mostly clear water bodies less eutrophication, followed by a constant increase in eutrophication in May and reaching the maximum levels during November. Satellite image analysis of successive seasons clearly gives us the pictorial evidence for same.

21. Biodiversity value further diminished during < Monsoon (3.39) and least was shown in pre monsoon (3.16). These are direct indicators of stagnant water bodies with less flow of fresh water into it. RICHNESS of aquatic plants was also maximum in pre monsoon season (1.66) < monsoon (1.44) and was least in post monsoon season (1.14). In case of Evenness, it was maximum of 0.36 in post monsoon < monsoon season (0.34) and least was in pre monsoon season 0.31. Maximum frequency of 100 was observed in all seasons. Abundance and density is maximum of 48.78. Satellite image study also show eutrophication of ponds and water bodies in area substantiating our observations from field study. Pollutants stress ecosystem and may reduce or eliminate population of sensitive species. Chemicals added in the ecosystem by human action have profound effect on the ecosystem. Eutrophication of aquatic system (ponds, lakes, rivers) due to runoff of fertilizers from agriculture, increased nitrogen runoff due to acid precipitation or of nutrients and organic matter from sewage leads to *Azolla* blooms. These further results in depletion of oxygen from water bodies leading to a completely changed aquatic condition which may affect the natural flora and fauna of wetlands.

22. Aquatic fauna/zooplanktons commonly reported from aquatic ecosystem namely River, Pond, Lake in the area are 28 numbers of species. Among Zooplanktons *Moina brachiate*, *Diaoptomus vulgares*, *Cyclops sp.* dominate the aquatic bodies. Overall Biodiversity of Aquatic zooplanktons in study area is 2.42, Richness 0.62 and Evenness 0.38. As we do trend analysis between seasons BIODEVERSTY maximum is in post monsoon (2.49) < pre monsoon (2.03) and minimum was during monsoon season (1.59). RICHNESS was also maximum in pre monsoon season(1.85)< monsoon(1.43) and was least in post monsoon season (0.74) . In case of Evenness maximum was 0.39 in post monsoon<pre monsoon season (0.31) and least was in monsoon season 0.25. Maximum frequency is 100, abundance 33.89 and density 33.89.
23. Use of plant parts for treating various ailments based on traditional knowledge base is quite common practise. Plants/parts popularly used to treat ailments include Neem, Harjor, Tulsi, Amarsankar, Lal Pata and Shive pata. Trees worshipped by villagers are Pipal, Bargad, Tulsi and Mahua.
24. The entire land area is interspersed with forest and agriculture land/fallow land. Agriculture land occupies around (33-58) % of the total area along with a variation of (4-13) % for fallow agriculture land. Agriculture productivity in area is very poor as it is mainly dependent on monsoon rains besides wells and canals to meet its water demand. During the summers, there is an increase in the fallow land area. Major Kharif crops in the region includes paddy, maize, pigeon pea, groundnut, and pulses like arhar, urad and moong though it is in small patches. During the winter the Rabi crops grown are wheat, gram, mustard and linseeds. Apart from these crops seasonal vegetables are also grown in the region, both during Kharif and Rabi season. It is also observed that at some places tree plantation is practiced along the agricultural bunds.
25. Pisces (Fishes) commonly reported from village Pond and nearby river are 06 species. It primarily includes Rohu, Katla, Silver cup and Golden cup. Mammals reported are 05 species and mainly comprise Indian hare, Golden jackal (Indian fox), Pangolins (Scaly anteater), Indian flying fox (Indian fruit bat). Reptiles are 12 species and

primarily include Common Indian krait, Cobra (Kharish), Russell's viper, Banded Krait, Python (Ajar), Rat snake Garden lizard, striped skink, Bengal monitor lizard (Goh). 05 species of insects were observed and include Cockroach, praying mantis, seven-spot ladybird, ladybird, blister beetle, Holotrichia. There are 06 species of Amphibians in area and mainly include Indian bull frog, Common Indian Toad, Balloon frog, Common eastern froglet Painted Kaloula.

26. Birds commonly reported from forest, village and nearby areas are 111 no. of species. It mainly include *Bubulcus ibis*, *Black-crowned night Heron*, *Bronze-winged jacana*, *Lesser Whistling-duck*, *Northern Pintail*, *Little Grebe*, *White-breasted Water hen*, *Black kite*, *Rose-ringed Parakeet*, *Little Swift*, *Coppersmith Barbet*, *House Crow*, *Scaly-breasted Munia*, *House Sparrow*, *Paddyfield Pipit*, *Common Swallow*, *Streak-throated Swallow*, *Red-vented Bulbul*, *Jungle Babbler*. Overall Biodiversity of birds in study area is 6.45, Richness 1.58 and Evenness 14.13. As we do trend analysis between seasons BIODIVERSITY maximum is in pre monsoon (7.01) followed by post monsoon (6.15) and minimum was during monsoon season (6.08). RICHNESS of Birds was also maximum in pre monsoon season (2.55) only followed by post monsoon (2.39) and was least in monsoon season (2.27). In case of Evenness same trend about occurrence of Birds in area has been observed where again maximum value was 7.49 in pre monsoon season followed by 7.41 in monsoon and least was in post monsoon season 7.04. This change in diversity with change in season may be because during pre-monsoon birds remain active to find their suitable mate. As the monsoon season starts nesting starts so they incubate and become less active and so they are less visible. In post monsoon with completion of nesting the young ones are added. So, the number is increased. Frequency of birds varies between 33.33 to 100.00, Abundance 1.00 to 55.33 and Density 0.67 to 55.33 as same is compared during trend analysis between seasons.

27. The area has been assigned MEDIUM RISK category for following reasons-

- i. There is no Biosphere Reserve, Ramsar Site, National Park, Wild Life Sanctuary, Tiger Reserve, Elephant Reserve or Wildlife Corridor in study area.
- ii. Protected area or area categorised in Red list by IUCN as significant to critically endangered species of plants or animals located there.

- iii. The habitat does not support globally significant concentration of migratory species.
 - iv. Area is not classified as threatened/ and unique ecosystem
 - v. Area is also not reported to be associated with any key evolutionary process
 - vi. There are only few small isolated forest patches(26 in number) in the study area. Wild Animals Present /visiting the area are of general type consisting mainly of wild Pig, Jackal, Langur, Kobra, Ajar and karait. The Schedule I animals found in the study area are Indian Python and Indian Pangolin described in Wild life (Protection) act, 1972. Domesticated animals include Cow, Hen, Buffalo, Dog and Goat.
 - vii. Damodar river is located within 10 km from battery limit of project boundary and Ijri river, a tributary of Damodar river is within > 50 M distance only.
 - viii. Many a villages (habitations) are located in close proximity of company(1km-Bhagabandh to 18 km- Mohal).
 - ix. Gaseous emission levels including secondary fugitive emissions from the blast furnace, sinter and other process plants to be e generated. Guidelines / Code of Practice issued by the CPCB to be followed. The Ministry may revoke or suspend the clearance, if the implementation of any of above conditions is not satisfactory required under Air act, 1981 and EPA act, 1986.
 - x. Integrated steel plant is categorised as hazardous process (Red category) under EPA Act 1986/Factory act 1948
28. It is about biodiversity and its conservation through pamphlet distribution, Nukkad Natak in local language, organising wall painting, Slogans, Poster competition besides celebrating world environment day, wildlife week, World elephant day and World water day. Organising the events such as running for wildlife, Painting and Essay competition etc in collaboration and direction from DFO, Bokaro to be organised regularly. 15 minutes short film to be made and shown in all villages of area on forests and wildlife such as wild Pig, Jackal, Monkey, Kobra, Ajar and karait. and other species of area by a professional team with focus on Buffer zone. The movie will be shown at quarterly interval in affected villages.

29. Restoration and preventing degradation Promoting awareness to improve biodiversity conservation of Ecosystems. This is to be achieved by planting Develop fodder/ grass land/ fruit bearing trees in impact area. This includes bamboo trees, Ficus, Banana and other palatable sp. such that Biodiversity, Ecosystem and Ecosystem services are sustainable on long term basis. Wildlife habitat protection by planting native/useful trees and improving water regime and its maintenance will go long way in biodiversity management of the area.
30. The wildlife habitat is not good in the nearby forest areas. The impact area is not the habitat of any important carnivores like Tigers, Leopards etc. it is also not the home of Elephants. There is no Biosphere Reserve, Ramsar Site, National Park, Wild Life Sanctuary, Tiger Reserve, Elephant Reserve or Wildlife Corridor in study area Wild Animals Present /visiting the area are of general type consisting mainly of wild Pig, Jackal, Langur, Kobra, Ajar and karait. The Schedule I animals found in the study area are Indian Python and Indian Pangolin. Domesticated animals include Cow, Hen, Buffalo, Dog and Goat.
31. The Indian python (*Python molurus*) and Indian Pangolin (*Manis crassicaudata*) are animals need prioritized conservation measures as they belong to schedule I animal.
- i. The Indian python (*Python molurus*) is classified as Near Threatened on the IUCN Red List and schedule I of WLP 1972 due to a likely population decline of ~30% over the decade 2010-2020. The Indian python have long been hunted for their skins, which are made into fashionable accessories, and trapped for the pet trade. People also kill large out of fear. This species of snake is threatened by shrinking habitat caused by deforestation. Poaching is still a major threat. Actions like preventing poaching besides habitat restoration to help conserve species and multiply their number.
 - ii. The species Indian Pangolin (*Manis crassicaudata*) occurs in various types of tropical forests as well as open land, grasslands and degraded habitats, including in close proximity to villages. Major threats to pangolins in India are hunting and poaching for local consumptive use such as a protein source and traditional medicine and international trade for its meat and scales. The species adapts well to modify habitats provided its ant and termite prey remains abundant.

32. A bird survey is proposed periodically including migratory birds aimed at strengthening conservation efforts. All such study to be organically linked, changes to be noted and conservation efforts to be implemented accordingly.

11.0 CHALLENGE AND OPPORTUNITY

Challenge 1

SENSITIZE and ENGAGE all stakeholders such as Management, employee, contract employee and villagers alike to achieve the BIODIVERSITY GOAL in the impact area.

Opportunities

- a. Arrange field visits and periodically launch campaigns to SENSITIZE all stakeholders and interrelationship between BIOLOGICALS WELL BEING vs. BIODIVERSITY vs. ECOLOGY of area.
- b. Making of Theme parks such as Biodiversity Park, Medicinal Park. Endangered and threatened species park will go long way in educating people about importance of Ecology, Ecosystem and Ecosystem services provided free of cost by nature vis a vis Biodiversity and the Human interests.
- c. Use tools as Nukad natak, Video display, Bill distribution to spread the message.
- d. Contribution by one and all in Biodiversity conservation to be acknowledged during public functions.
- e. Own, adopt and sponsor Biodiversity well being of Forest/Village/Aquatic ecosystem will go long way in managing biodiversity of the impact area.
- f. Sponsor a Site/ Biodiversity Park, Medicinal Park, Endangered and threatened species park, Tree, Lawn

Challenge 2- RAISING state of art NURSERY at site only

Opportunities

- a. Identify 2.5 acres of land near water source away in a cool, green and dust free environment and deploy skilled manpower on the job.
- b. Procure good quality seed and saplings.
- c. Groom Nursery mostly of native plant species.

Challenge 3 SELECT only native Plant species for plantation

- a. Select native and tolerant sp. for plantation.
- b. Use available local knowledge

- c. Take help of professionals, research institutions and universities for the purpose.

Challenge 4- Source, Develop and **HIRE** only **COMPETENT** vendors and deliver quality jobs aimed at promoting Biodiversity richness in the impact area.

Opportunity

- a. Source local village lads having required basic knowledge and penchant to learn and grow.
- b. Hire and engage experts from Corporates, Universities, and Colleges equipped with training skills and kits to mentor young enthusiasts for honing the skill in a time bound fashion on the subject.
- c. Adopt a structured module for need based skilling commensurate with site specific requirement.
- d. Provide dedicated training hall cum conference room equipped with necessary tools.

Challenge 5—OPTIMIZE availability of water network in dry areas.

- a. Identify dry areas where water ponds/holes can be made
- b. Harvest Rain water in the structures to max during rains and minimize leakage. This will make area a water surplus zone.
- c. This in turn will improve biodiversity of area.

Challenge 6- Provide protection against grazing and nursing for 1st 3 years.

Opportunity

- a. Coordinate actively with forest department in protecting newly planted saplings against grazing/drying.
- b. Deploy skilled and dedicated team for nursing
- c. Mortality replacement in the early monsoon

Challenge 7- Promote wild life conservation in the area.

Opportunity

- a. Coordinate actively with forest department in protecting wildlife against poaching
- b. Restore degraded wildlife Deploy skilled and dedicated team for nursing
- c. Aware local residents about significance of wild life vis a vis human life.

Challenge 8 - Provide protection against grazing .

Opportunity

- a. Coordinate actively with forest department in protecting newly planted saplings and grassland against grazing
- b. Restore fragile ecosystem
- c. Deploy skilled and dedicated team for the purpose
- d. Aware local residents about significance of Flora vis a vis human life

Challenge 9 - INSTITUTIONSALISE and UPGRADE **REWARD & **PENALTY** system in place.**

Opportunity

- a. Institutionalise reward and penalty system (RNP) in place on significant contribution/damage in developing and maintaining Biodiversity and propagate system in place.
- b. Make RNP system dynamic as you review system annually based on contemporary experiences.

Challenge 10 - REDUCING pollution load to keep Biodiversity vibrant and healthy as it has finite carrying capacity against pollution.

Opportunities

- a. Optimize performance of existing Pollution control equipment including noise by implementing SOP on operation and maintenance. Special care to be taken in Coal handling, RMHS, Sinter plant, SMS etc. such that pollution load is well below carrying capacity of trees planted for them to grow and flourish. This will add to their efficiency and act as ameliorant.
- b. Selectively develop trees based on source or receptor models and help improve its performance.
- c. Heavy traffic for material handling adversely affect distribution of animals as they prefer non interfering and calm places their habitat. As they move to distant area restricting their population.

12.0 CHEERS FOR BIODIVERSITY CONSERVATION INITIATIVES

1. We appreciate Management of M/s ESL Steel Limited, Bokaro for making sincere and planned efforts to promote and conserve Biodiversity in and around (10KM radius) company area as part of company policy.
2. The present study is aimed at drawing Biodiversity management plan for the impact area by identifying critical habitats and endangered and threatened species. The exercise will help nullify risk both to business and biodiversity and the resulting ecosystem services. This is in short and long term interest of society, business and nation at large.
3. The plan specifies site objective of biodiversity management in terms of Biodiversity and ecosystem services through use of mitigation hierarchy including planned actions such as No net loss (NNL), Net positive gain (NPG) or offset according to risk rating of site.
4. We appreciate the commitment, efforts and ownership shown by ESL team in its plans of raising green belt in 33% of project area in time bound fashion keeping Biodiversity as central theme as they selected plant species for plantation within campus . Commitment shown and beginning made in the direction of managing biodiversity is very much in place and is evident. CSR efforts through direct intervention into surrounded villages also help consolidate the gain on good work done by core team of company on the subject.
5. Company further showed their keen concern for promoting and conserving Biodiversity and wildlife in the impact zone in consultation with forest department beyond legal compliance. This is exemplified as they distributed tree saplings among villagers and other interested parties during monsoon, facilitated them by giving tips on successful plantation as the expert team also visited nearby villages to monitor and suggest improvement measures.
6. Company also shows concern and engages with forest department drives launched periodically for conservation of Biodiversity and wildlife in the area in more than one ways.

13.0 RECOMMENDATION AND ACTION POINT

1. The ESL Steel plant, Bokaro has its own dedicated Sustainability services department at corporate level and an Environment, Biodiversity and Climate change department at Local level. The team include Environmental engineer, Ecologist, Civil engineer, Chemist, Social scientists etc. This multidisciplinary team at local level works in coordination with corporate cell for better understanding, protect, monitor and improve sustainability and environmental performance of the buffer and core area. Company need to strengthen and empower department for effective discharge of its responsibilities by providing competent professionals and adequate budget.
2. Sensitizing stakeholders about importance of flora, fauna, air, water, land, natural resources, humans and their interrelationship can prove to be an eye opener and a mile stone in realizing objectives of the Biodiversity conservation vis a vis company well being since interests of both are overlapping.
3. Raise well landscaped hygienic nursery in > 2.5 acres complete with automated micro irrigation system, glass house, green net and training cum conference hall for feeding sapling requirement in the area. Nursery works should begin October – November so that planting stock is ready by June next. Pits should be ready by March-April itself. Plantation to begin in June/July after few initial showers. Sweet soil should be uniformly used for bed preparation supplemented with rich organic manure. Saplings for plantations to be sourced from in house nursery, forest department and other reliable only. This cuts heavily on quality, quantity just on time availability besides adding big costs as same is purchased from outside sources.
4. Strengthen core area environmental performance by controlling pollution at source. ESP, Bag houses, fogging and sprinkling system attached to different processes to run to its capacity to control air pollution. Stabilization efforts of solid waste Dumps by grading and benching, tree planting, grass turfing, coir matting besides growing hedges at the edge of dumps to prevent erosion need to be revisited to improve compliances.

5. Strengthen rain water and process water channelization and collection system in suitably designed collection ponds. Reuse the 2 types of water after suitable treatment and reduce load on external fresh water sources for use in process, irrigation of plantations and other secondary applications. This will reduce not only dependency on external sources of water but also control water pollution originating from process that may affect water bodies in impact area and their uses by HUMANS and WILDLIFE ALIKE .
6. The wildlife habitat is not good in the nearby forest areas. The impact area is not the habitat of any important carnivores like Tigers, Leopards etc. it is also not the home of Elephants. There is no Biosphere Reserve, Ramsar Site, National Park, Wild Life Sanctuary, Tiger Reserve, Elephant Reserve or Wildlife Corridor in study area Wild Animals Present /visiting the area are of general type consisting mainly of wild Pig, Jackal, Langur, Kobra, Ajar and karait. The Schedule I animals found in the study area are Indian Python and Indian Pangolin. The Indian python (*Python molurus*) is classified as Near Threatened on the IUCN Red List and schedule I of WLPA 1972 due to a likely population decline of 30% over the decade 2010-2020. The Indian python have long been hunted for their skins, which are made into fashionable accessories, and trapped for the pet trade. People also kill large out of fear. This species of snake is threatened by shrinking habitat caused by deforestation. Poaching is still a major threat. Actions like preventing poaching besides habitat restoration to help conserve species and multiply their number. The species Indian Pangolin (*Manis crassicaudata*) occurs in various types of tropical forests as well as open land, grasslands and degraded habitats, including in close proximity to villages. Major threat are hunting and poaching for local consumptive use such as a protein source and traditional medicine and international trade for its meat and scales. The species adapts well to modify habitats provided its ant and termite prey remains abundant.
7. A bird survey to be conducted periodically including migratory birds aimed at strengthening conservation efforts. All such study to be organically linked, changes to be noted and conservation efforts to be implemented accordingly.

8. Restore habitat by plantation and improve water regime, prevent habitat degradation, as also prevent fire and grazing etc in the area.
9. The vegetation present on riparian slopes of aquatic bodies including village ponds need to be re strengthened to prevent soil erosion and the water pollution.
10. Initiate actions to remove exotic harmful weeds like Lantana camara, Parthenium hysterophorus, Leonotis nepetefolia, and Ageratum conyzoides. Area cleared to be planted and revegetated with useful native fruit and other trees.
11. Species recommended for plantation include fodder/ grass land/ fruit bearing trees in those areas. These include *Ficus religiosa*, *Melia azadirachta*, *Tectona grandis*, *Ficus benghalensis*, *Mangifera indica*, *Nyctanthes arbor-tristis*, *Milettia pinnata*, *Zizyphus jujube*, *Diospyros melanoxyla*, *Bougainvillea sp.*, *Dalbergia sissoo*, *Senna siamea*
12. Qualified and experienced persons in horticulture science in suitable numbers is a grey area with defined role and responsibility and accountability.
13. Structured training program and module is to be in place for training of employees engaged in the activity.
14. Cultivate habit of GREEN GIFTING among employees on all small and big occasions of items such as flowers, saplings, Air purifying plants, Mosses etc. all grown within campus. Same to be gifted to village and forest dwellers of area.
15. EDUCATION and APPRECIATION is not mapped to your BIODIVERSITY OBLIGATION so far. ROI and DESPERATION index guides your DECISIONS in this regard. So is OUTCOME.

14.0 THE GAME CHANGER AND FUTURE STRATEGY

1. Biodiversity and its maintenance is very important as it holds ecological, economic and evolutionary significance besides this is key to sustaining life on earth. This becomes all the more important vis a vis ESL steel making process as local villages/habitations dependence on BIODIVERSITY is high for meeting their daily need as source of food, cleaning, purifying and recycling water and nutrients, sources of energy, shelter materials, income and livelihoods and recreational and cultural benefits in the area.
2. The impact of company operation and other anthropogenic stresses on Biodiversity of area is negligible .This is evident from Shanna Biodiversity Index of terrestrial flora (6.56) and Birds (6.45) obtained from study against the popular norm (3.0).
3. The Project and its 10 km buffer area falls under MEDIUM RISK category. Accordingly, Biodiversity Management Plan drawn aims at maintaining Biodiversity in the area at existing levels and prevent any further degradation. Company playing an anchor role by promoting HABITAT RESTORATION and BIODIVERSITY CONSERVATION in consultation with Forest department and local populace is real answer to COUNTER BUSINESS RISKS that may crop up from Steel Making activities in the area.
4. Setting a SUSTAINABLE DEVELOPMENT GOALS (SDGs) and a set of core linked indicators, allows company to measure its biodiversity performance. These are aimed at sustainability teams, managers and other company staff whose roles include strategic planning and reporting related to biodiversity. The focus is on a full-cycle, results-based management approach (not just risk analyses, goal setting or indicator development), since assessing pressures on biodiversity, and planning and developing measurable goals, are key prerequisites for monitoring.

5. Responsible behaviour by proactively promoting Biodiversity Conservation by planting trees and protecting existing vegetation adds to CLIMATE ACTION. Adoption of technology and artificial intelligence techniques will further accelerate pace of filling gap between preventing and reversing prevailing CLIMATE TRENDS. Further, this also make us compliant to Paris agreement 2015, an important obligation on the country and the company.
6. Beyond compliance is new MANTRA at ESL steel limited, Bokaro. Here company believes BIODIVERSITY does not belong to us only, all living creatures have to grow together and the SUSTAIBLE WORLD is the need of hour. Working for biodiversity conservation is a simple work that has potential of extraordinary results. Accordingly, action plan for biodiversity conservation has been put in place. 3 times Pulitzer award winner Mr THOMAS L. FREEDMAN shares same concern.
7. These actions are apt to realize dream tag for company, the GREEN, CLEAN and HEALTHY ESL steel limited. This also sets new benchmark for BIODIVERSITY CONSERVATION in steel sector for others to follow.

15.0 FREQUENTLY ASKED QUESTIONS (FAQs)

Q1. WHAT IS BIODIVERSITY

Ans- It is the variability among living organisms from all sources, including Terrestrial, Marine and Other aquatic ecosystems and the ecological complexes of which they are part. This definition is given in Convention on Biological Diversity signed during RIO Earth summit, 1992. It is applicable in both natural as well as artificial ecosystems. The term biodiversity was coined in 1985.

Q2. THE IMPORTANCE OF BIODIVERSITY

Ans- Biodiversity (biological diversity) is the diversity of living organisms (plants and animals), the habitats they live in and the ecosystems (ecological systems) in which they interact with each other and with their environment. It encompasses the variety of life on Earth and is critical for supporting life itself. Biodiversity and ecosystems provide a number of benefits to society, including Sources of food, Cleaning, purifying and recycling water and nutrients, Sources of energy, Shelter materials, home and livelihoods, Recreational and Cultural benefits besides acting as cause of Evolution.

Q3. What is Biodiversity management plan

Ans- This is key tool for managing biodiversity at site throughout the lifetime of an operation. The Biodiversity management plan describes approach used to the level of biodiversity, outlines risks to biodiversity, undertakes biodiversity risk assessment and specifies biodiversity management goals. It also defines actions and responsibilities for managing or offsetting impacts on biodiversity.

Q4. What is Ecosystem service

Ans- We, as society derive multiple benefits from healthy Ecosystems called Ecosystem services. The services offered free of cost by nature are –

1. Supporting services- These are necessary for the production of all other ecosystem services. Some examples include biomass production, production of atmospheric oxygen, soil formation and retention and nutrient cycling
2. Provisioning services- Food and water, regulation of floods, soil erosion and disease outbreaks.
3. Regulating services- Essential processes such as purification of air so that we can

breathe freely and clean drinking water so that we do not go hungry, pollination of crops, decomposition of wastes, and generation and renewal of soils, as well as by moderating environmental conditions by stabilising climate, sequester carbon for climate regulation and reducing the risk of health etc. without costly infrastructure.

4. Cultural services- It also includes non-material benefits such as recreational and spiritual benefits in natural areas

Q.5 How changes in Biodiversity can affect Business

Ans- The company activities can result in Habitat loss or alteration, Species extinction, introduction of invasive/ non-native species, changes in the way natural systems function and changes in their ability to support species and people and loss of benefits for people that depend on biodiversity and ecosystems. This becomes a source of business risk when stakeholders raise concerns about real or perceived impacts that have occurred, or may occur in future.

Q6 What is Monitoring and reporting biodiversity management

Ans- This is monitoring and reporting program in place at the site. This includes how and how often monitoring occurs, the methodology used and who conducts the assessment. It also describes the methodology for how this is compared to the baseline survey results to ascertain the level of impact the operation has had. This also describe reporting requirements and KPIs.

Q7. What is critical habitat?

Ans- Critical Habitats are areas on the planet where the significance of biodiversity conservation is high. It may include areas where particular species or habitats are threatened or rare. These include habitat of significant importance to critically endangered and/or endangered species (as defined in the IUCN Red List), habitat of significant importance to unique species and/or species which occupy a small geographical area, Habitat supporting globally significant concentrations of migratory species and/or species for which an important portion of the world population gathers in one place in a stage of their life cycle, highly threatened and/or unique ecosystems and areas associated with key evolutionary processes.

Q8. What is No Net Loss (NNL) in Biodiversity

Ans- It is the point where biodiversity gains from targeted conservation activities *match* the losses of biodiversity due to the impacts of a specific development project, so that there is no net reduction overall in the type and amount of biodiversity present, over space and time.

Q 9 What is Net Positive Gain (NPG) in Biodiversity

Ans- It means that biodiversity gains from targeted conservation activities *exceed* the losses of biodiversity due to the impacts of a specific development project, so that there is a net gain in the type and amount of biodiversity present, over space and time

Q 10. What is Wild life management plan

Ans- Wildlife management plans are simply written guides for how, when, and where to implement habitat improvement practices. Developing a management plan personally, or contracting a natural resource professional to develop a plan for forest or farm land, is a wise investment of time and money

Q11. What are threats to wild life

Ans- Practice of protecting wild species and their habitats in order to prevent species from extinction and to preserve natural ecosystem. Main threats to wildlife include habitat destruction, degradation, fragmentation, overexploitation, poaching, pollution and climate change.

Q 12.What are 4 types of endangered species

Ans- The four categories of endangered species are vulnerable, endangered, critically endangered, and extinct in the wild.

Q13 Name 1# most endangered species in India

Ans- Javan rhinoceros. Once the most widespread of Asian rhinos, Javan rhinos are now listed as critically endangered. With only one known population in the wild, it is one of the world's rarest large mammals.

Q 14.What is legal provision about Wild life conservation plan

Ans- It is required to be drawn by individual user agency made and is covered under following laws-

- a. Environmental Clearance dated 19.04.2005 and 22.12.2008 under EIA notification 2006 and amendments
- b. Consent to establish vide JSPCB letter dated 17.04.2004 and 11.10.2007
- c. Consent to operate vide JSPCB letter dated 31.12.2019
- d. GOJ guidelines regarding making of Site specific wild life conservation plan date 15.03.2015
- e. Indian Forest Act, 1927
- f. Wildlife (Protection) Act 1972 and amendments
- g. Forest (Conservation) Act 1980 and amendments
- h. Environment (Protection) Act 1986

Q 15 Important wild life of the area

Ans- It includes following fauna- Striped Hyena, Macaque, Langur, Nilgai, Sloth bear, Leopard, Wild pig and Jackal, Indian Python and Indian Pangolin. Important flora of the region are Sal, Palash, Mahua, kusum, and Khair is present.

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