

Baseline ecology and biodiversity assessment around a proposed integrated steel plant at Chattaud, Raipur, Chhattisgarh, India

Abstract

A baseline ecology and biodiversity assessment was conducted for a 10 km study area surrounding a proposed greenfield steel plant at Chattaud Village, Raipur district, Chhattisgarh, India. Field investigations were reported for March–May 2026, representing the pre-monsoon/summer period. The assessment covered habitat features, vegetation, avifauna, mammals, herpetofauna, fishes, aquatic invertebrates, insects and arachnids, with conservation interpretation against Indian wildlife legislation and global conservation databases. The study area comprised predominantly agricultural land, agro-forestry, scrub and industrial greenbelt vegetation. Jamuniya Nadi, the Mahanadi Canal and Kumhari Tank were identified as important nearby aquatic features, while Mohrenga and Khaulidabri Protected Forests occurred within the wider 10 km landscape. The report inventory comprised 99 taxa or taxonomic groups: 48 birds, 17 insects and arachnids, 11 mammals, 7 reptiles, 6 fishes, 5 amphibians, 3 molluscs and 2 crustaceans. The vegetation inventory contained 148 plant species, with high representation of cultivated plants, shrubs and medicinally useful taxa. The landscape was highly modified but retained ecological value through wetlands, agro-ecosystem linkages, protected fauna and ethnobotanical resources. The principal management priorities are prevention of wildlife road mortality, protection of water quality, dust and noise control, native-species greenbelt development, pre-clearing wildlife surveys and a legally compliant response plan for protected (schedule -I) species.

Keywords: avian diversity, biodiversity assessment, steel plant, Chhattisgarh, ecological baseline, protected fauna, ethnobotany, environmental management plan

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Introduction

Industrial development can alter habitat structure, movement routes, water quality and the availability of food and nesting resources. For this reason, biodiversity assessment in environmental impact assessment should integrate species inventories with habitat condition, ecological sensitivity, legal protection and practical mitigation. Case studies from India have shown that infrastructure and extractive projects may occur in landscapes that are already modified but still support important avifauna, aquatic biota and protected wildlife.¹⁻³

Rathoure and collaborators have also emphasized the value of biodiversity baselines for evaluating ecosystem services, environmental vulnerability and the cumulative effects of development and climate stressors.⁴⁻¹⁰

The present study covers the baseline status of flora and fauna around a proposed integrated steel plant at Chattaud Village, Raipur district, Chhattisgarh. The objectives were to: (i) describe the landscape and nearby sensitive ecological features; (ii) summarize the floral and faunal diversity; (iii) identify conservation and regulatory receptors; and (iv) interpret the findings into an evidence-based mitigation and monitoring framework.

Materials and methods

Study area and project setting

The proposed project is a greenfield integrated steel facility comprising two 350-ton-per-day direct-reduced-iron kilns, four 25-ton induction furnaces with a two-strand continuous casting machine, rerolled steel products, a galvanizing plant, slag crushing, a 35 MW captive power plant, a fly-ash brick plant and associated facilities. The

assessment area was defined as a 10 km radius around the project site at Chattaud Village, Raipur district, Chhattisgarh. The surrounding landscape was described as predominantly agricultural and rural, with sparse agro-forestry and scrub vegetation (Table 1).

Feature	Direction	Approximate distance
Jamuniya Nadi	West	1.6 km
Mahanadi Canal	West	4.5 km
Kumhari Tank	South-east	5.0 km
Mohrenga Protected Forest	South-east	6.4 km
Khaulidabri Protected Forest	South-east	8.5 km
Bilari Ghughua Reserved Forest	North-west	10.6 km
Bilari Reserved Forest	North-west	11.6 km

No National Park, Wildlife Sanctuary or notified eco-sensitive area was reported within the 10 km study area, and no forest land was reported within the proposed project footprint. These statements require confirmation from the competent authority and the final approved site plan.

Survey period and field approach

The baseline survey was conducted during March–May 2026, corresponding to the pre-monsoon/summer season. Field documentation included location records, habitat descriptions, photographic evidence and field notes. The study designates random quadrat sampling for vegetation, transect and opportunistic observations for fauna, visual and auditory bird observations, active searches for reptiles and amphibians, searches for indirect evidence such as tracks, scat, pugmarks, calls and nests, and observations around local aquatic habitats. The equipment included handheld GPS,

binoculars, camera equipment, camera traps, audio recorders, quadrat frames, measuring tapes, DBH tapes, water-quality instruments and aquatic sampling gear.

Species identification was reported to use taxonomic references, field guides and expert consultation. Conservation interpretation was compared with the Wildlife (Protection) Act, 1972 as amended in 2022, the IUCN Red List, CITES resources, and regional institutional sources. The supplied report did not provide a complete georeferenced sampling design, effort by taxonomic group, abundance matrix, detection probabilities, or raw field sheets. Accordingly, this manuscript reports richness and habitat-level findings rather than estimating population size or statistically comparing habitats.^{1,2,11}

Results

Landscape and vegetation

The study area was characterized by a mosaic of cropland, scrub, agro-forestry, roadside and industrial greenbelt vegetation. The report listed 148 plant species. The largest functional categories were cultivated plants (36 species; 24.3%), shrubs (24; 16.2%), herbs (16; 10.8%), grasses and bamboos (10; 6.7%), epiphytes and parasites (10; 6.7%), and climbers (5; 3.3%). Fabaceae was described as the dominant family, followed by substantial representation of Poaceae, Moraceae, Combretaceae and Myrtaceae. The vegetation inventory included food, fodder, timber, ornamental and medicinally valued plants. No threatened plant taxon was reported, but this is a survey-based observation and not a definitive absence claim (Table 2).

Dominant species	Relative density	Relative frequency	Relative abundance	IVI
Pongamia pinnata	10.38	8.18	7.47	26.03
Balanites aegyptiaca	7.55	5.45	8.15	21.15
Albizia amara	7.55	6.36	6.98	20.90
Samanea saman	7.08	7.27	5.73	20.08
Vitex negundo	7.08	7.27	5.73	20.08
Acacia nilotica	6.61	6.37	6.09	19.08
Vachellia leucophloea	6.13	7.27	4.97	18.37

The core-zone community was dominated by planted or greenbelt species, including *Albizia*, *Eucalyptus*, *Delonix regia*, *Azadirachta indica* and *Syzygium cumini*, with ruderal herbs in the understory. The buffer zone comprised scattered trees and disturbance-tolerant shrubs and herbs. *Lantana camara*, *Parthenium hysterophorus*, *Argemone mexicana* and *Cassia tora* were interpreted as indicators of disturbance, while *Acacia*, *Calotropis* and *Ziziphus* were associated with dry scrub conditions.

Faunal richness and composition

Birds were the most diverse faunal group and represented wetland, agricultural, scrubland and settlement-associated guilds. Examples in the source inventory included kingfishers, egrets, herons, lapwings, cormorants, bee-eaters, shrikes, babblers, mynas, doves, parakeets and raptors. The Indian Peafowl (*Pavo cristatus*) was highlighted as a protected species. The report also listed mammals such as Indian Fox (*Vulpes bengalensis*), Jungle Cat (*Felis chaus*), Striped Hyena (*Hyaena hyaena*), Indian Crested Porcupine (*Hystrix indica*), Rhesus Macaque (*Macaca mulatta*), hare and small rodents. Reptile records included Indian Rock Python (*Python molurus*), Common Krait (*Bungarus caeruleus*), Indian Cobra (*Naja naja*), Russell's Viper and other snakes (Table 3).

Taxonomic group	Reported richness	Proportion of inventory
Avifauna	48	48.5%
Insects and arachnids	17	17.2%
Mammals	11	11.1%
Reptiles	7	7.1%
Fishes	6	6.1%
Amphibians	5	5.1%
Molluscs	3	3.0%
Crustaceans	2	2.0%
Total	99	100%

The aquatic component included six fish taxa, including *Catla catla*, *Labeo rohita*, *Cirrhinus mrigala*, *Oreochromis mossambicus*, *Puntius sp.* and *Clarias batrachus*. Five amphibians were associated with wetlands, paddy fields and forest margins. The freshwater crab and prawn, molluscs, grasshoppers, lac-associated predators and parasitoids, spiders and scorpions were also reported from study area. These records indicate ecological links between aquatic habitats, agricultural production and agro-forestry livelihoods, but they do not by themselves establish a complete or healthy food web.

Conservation and ecological sensitivity

Most recorded taxa were reported as Least Concern, with four taxa identified in the source inventory as Near Threatened: *Vulpes bengalensis*, *Hyaena hyaena*, *Python molurus* and *Oreochromis mossambicus*. The report summarized 11 species in Schedule I, 46 in Schedule II and one in Schedule IV under the 2022 amendment framework, with the remaining taxa not scheduled. Because taxonomy, IUCN assessments and Indian legal schedules as per wildlife protection act 1972 amended in 2022 (w.e.f 01.04.2023) can change. The combination of protected fauna and nearby aquatic habitats means absence of ecological risk due to the absence of National Park, Wildlife Sanctuary or forest land in the footprint.

Discussion

The baseline describes an anthropogenic landscape rather than intact wilderness. Cropland, scrub and greenbelt vegetation can nevertheless support birds, pollinators, reptiles, small mammals and aquatic organisms. The presence of water bodies within 5 km of the site increases the importance of controlling sediment, effluent, thermal discharge, accidental spills and metal-bearing dust. The documented aquatic invertebrates and amphibians are particularly relevant as biological receptors, although water-quality conclusions require laboratory measurements and repeated seasonal sampling.

The findings are consistent with Indian biodiversity assessments showing that infrastructure corridors and industrial landscapes may retain conservation value when habitat mosaics, water bodies and movement routes are maintained. They also support the broader environmental assessment perspective that biodiversity loss is driven by interacting pressures rather than by a single project activity.^{2-7,10,11}

The strongest result for project planning is the coexistence of three conditions: a highly modified landscape, legally protected fauna and nearby aquatic systems. Construction disturbance, vehicle movement and night-time activity may create direct risks to snakes, foxes, cats and other mobile fauna. During operation, particulate emissions and fugitive dust may affect crops and greenbelt vegetation, while uncontrolled wastewater or runoff could affect the Jamuniya Nadi,

canal and tank. The mitigation hierarchy should therefore prioritize avoidance and prevention, followed by minimization, restoration and only then compensatory measures (Table 4).¹⁰⁻¹⁴

Table 4 Evidence-based mitigation and monitoring framework

Project pressure	Main receptor	Risk interpretation	Priority response
Site clearing and earthworks	Scrub, herbs, small fauna	Localized loss; low-moderate if footprint is minimized	Phase-wise clearing; retain vegetation; topsoil reuse; native replanting
Construction traffic	Protected reptiles and small mammals	High legal and mortality risk	Speed limit; wildlife signage; night-traffic restriction; pre-clearing rescue survey
Dust and emissions	Crops, greenbelt, vegetation	Moderate to high if uncontrolled	Water sprinkling; covered transport; ESP/bag filters; crop-health monitoring
Effluent, runoff and thermal pollution	River, canal, tank and aquatic biota	High because aquatic receptors are connected	Effluent treatment; zero-liquid-discharge controls; spill response; seasonal water monitoring
Noise and night lighting	Birds, mammals and nocturnal fauna	Disturbance and displacement risk	Daytime scheduling; directional low-glare lighting; barriers near sensitive areas
Human-wildlife encounters	Workers, villages and protected fauna	Potential conflict and legal consequences	Training; response protocol; no trapping or translocation without authorization

Conclusion

The proposed steel plant is situated in a modified agricultural-scrub landscape with nearby rivers, canal and tank habitats and protected forests in the wider landscape. The supplied baseline inventory reports 148 plant species and 99 faunal taxa or taxonomic groups, with birds as the dominant faunal component. The site does not include any forest land, a National Park or a Wildlife Sanctuary within the 10 km assessment radius; however, the presence of protected fauna, amphibians, aquatic invertebrates and fish means that ecological risk is not negligible. Project viability should therefore be linked to strict implementation of wildlife-safe construction traffic,

pre-clearing surveys, protected-species response procedures, dust and emission controls, native greenbelt design, and continuous protection of aquatic habitats.

Data availability

The manuscript is based on the primary survey conducted by author & its team.

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Conflict of interest

The author declares no conflict of interest.

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