

Ecological status for Ratapani wild life sanctuary, Raisen (MP) India

Abstract

The baseline study was conducted for the evaluation of the floral and faunal biodiversity of the terrestrial as well as aquatic environment of the study area, it comprises of total 5 reserved forest and 3 protected forest including Ratapani Wildlife Sanctuary falls Dist.-Raisen, Madhya Pradesh, India. It is strongly recommended to prepare the conservation plan for schedule -1 Fauna (listed 9 animals and 1 bird) and it is ensure to implement the conservation plan during construction and operation phase of railway track. Moreover, there is an urgent need of public awareness for the importance of wildlife, as illegal hunting, killing or capturing of wild animals was recorded from locals living in the forest and nearby villagers.

Keywords: faunal biodiversity, floral biodiversity, nature conservancy, reserve forest, wildlife sanctuary

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Introduction

Plants and animals are more susceptible to environmental stress. A change in the composition of biological communities is reflected by a change in the distribution pattern, frequency, density and abundance of natural species of flora and fauna existing in the ecosystem. These changes over a span of time can be quantified and related to the existing environmental factors. Natural flora and fauna are important features of the environment. They are organized into natural communities and are sensitive to outside influences. Integrating ecological thinking into the planning process is urgent need in the context of deterioration of natural environment, which is unwanted but direct consequence of development.

Methodology

Study area (10 km radius w.r.t. to railway track passing through

sanctuary) comprises of reserved and protected forest including wildlife sanctuary. There are five reserved forest and 3 protected forest including Ratapani Wildlife Sanctuary (Figure 1). The primary objective of survey was to describe the floral and faunal communities within the study area. The sampling plots for floral inventory were selected randomly in the suitable habitats.¹⁻⁶ The methodology adopted for faunal survey involve random survey, opportunistic observations, diurnal bird observation, active search for reptiles, faunal habitat assessment, active search for scats and foot prints, animal call, and review of previous studies. The aim was to set baselines in order to monitor and identify trends after the commissioning of the cargo handling activity. Emphasis has been placed on presence of endemic species, threatened species if any present in the study area. The qualitative study has been carried out only. The listed of villages covered for survey is presented in Table 1 and the detailed method and parameters covered for the said study has been highlighted in Table 2.

Table 1 Sensitivity of the study area

S. no.	Area/Track/Zone	Name of forest/hot spots	Remarks
1	Rail track	Railway Track (2 lines) of Length 26.70 km passing through wildlife sanctuary/reserve forest.	There is one more line (third) is proposed parallel to Existing (2 lines - up & down) railway track passing through Wildlife Sanctuary.
2	Obedullahganj	Chakla RF	
3	Obedullahganj	Diwattiaya PF	
4	Obedullahganj	Gohar Ganj RF	
5	Obedullahganj	Obedullahganj PF	Reserved and protected forest fall in the study area, majorly teak, open mixed, dense forest.
6	Obedullahganj	Obedullahganj RF	
7	Budani	Budani PF	
8	Budani	Budani RF	
9	Budani	Ramnagar RF	

Desktop literature review was conducted to identify the representative spectrum of threatened species, population and ecological communities listed by IUCN, WCMC, ZSI, BSI and Indian

Wild life Protection Act, 1972.^{3-6,13-24} The status of individual species was assessed using the revised IUCN/SSC category system.²⁵⁻³¹

Table 2 Mode of Data collection and Parameters considered during the Survey

S. no.	Aspect/s	Data	Mode of data collection	Parameters monitored	Remarks
1.	Terrestrial Ecology	Primary data collection	By Field Survey, Hutto et al., ⁷ Welsh, ⁸ Thomppson et al., ⁹ Welsh et al., ¹⁰ Allen et al., ¹¹ Misra, ¹²	<p>For Floral diversity, Vegetation measurements: Tree, Shrub, Herbs, Grasses, Climbers, Cultivated plants in the study area, Floristic composition of the study area, Medicinal plants of the study area, Status of the forest, their category in the study area, Rare and endangered flora in the study area. Endemic plants in the study area.</p> <p>For Fauna in the study area: -Reptiles, -Amphibians, -Birds, -Fresh water fishes -Mammals, -Butterflies. -Fungal species -Rare and Endangered fauna in the study area, -Endemic fauna in the study area, -Wild life and their conservation importance in the study area.</p>	Random survey, opportunistic observations, diurnal bird observation, active search for reptiles, faunal habitat assessment, active search for microhabitat, scats, foot prints, animal call, pug marks, debarking sign, Nesting, Claws, Dung, etc. and information from local villagers.
2.		Secondary data collection	<p>I. Barkhera Range and Budani Range Forest Division</p> <p>II. Data of Fisheries department.</p> <p>III. Literature like research papers, books published by research/ academic Institutions.</p>	<p>Interpretation of secondary data for Ecological Sensitive Areas such as national forests, wild life sanctuaries, lakes, ravines, hills, hillocks and reserve forest, vegetation, type, importance etc.</p> <p>Wild life importance, Floral Endemicity, Faunal Endemicity, State of Terrestrial vegetation, State of wet land vegetation, Mangrove vegetation, Conservation importance, Legal status (National park, Wild life sanctuary, Reserve forest, Wetlands, Agricultural lands) Lakes / reservoirs/dam, Natural lakes and Swamps, Breeding ground of Migratory and Residential birds.</p>	<p>Bentham & Hooker,¹³ Hunter,¹⁴ Dixit,³ Ghosh et al.,¹⁵ Lushington,¹⁶ Wilson & Reeder,¹⁷ Bird Life International,¹⁸ Bird Life International,^{19,20} Wilson & Reeder,⁴ Bird Life International,²¹ Kumar & Srivastava,²² Kumar,⁵ Kumar et al.,⁶ Kumar & Aggarwal.^{23,24} The status of individual species was assessed using the revised IUCN/SSC category system.²⁵⁻³¹</p>
3.	Evaluation of ecological sensitivity	Secondary	Review and Discussion		-

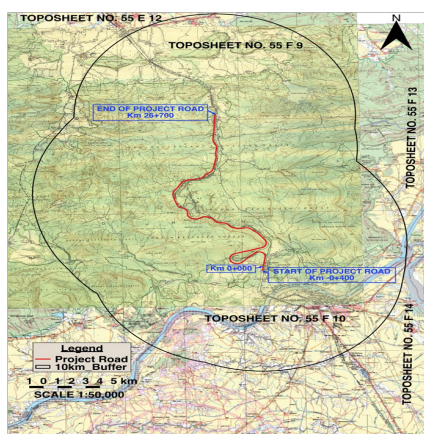


Figure 1 Study area Map on Toposheet (SOI).

Results and discussion

Terrestrial floral and faunal biodiversity

Biological diversity (biodiversity) encompasses the variety of life forms viz. fungus, algae, plants, animals, etc. Rock shelters increase/decrease in algal/fungal growth in the forest of Ratapani wildlife sanctuary. Agro-ecological regions by the National Bureau of Soil Survey & Land Use Planning (NBSS & LUP) have been delineated. Delineation of agro-climatic zones based on soil, water, rainfall, temperature etc. is the first essential step for sustainable production. The National Bureau of Soil Survey & Land Use Planning (NBSS & LUP) came up with twenty agro-ecological zones based on the growing period as integrated criteria of effective rainfall, soil groups, delineated boundaries adjusted to district boundaries with a minimal number of regions. Subsequently, these twenty agro-ecological zones were sub-divided into 60 sub-zones. As per the map provided in Figure

2, the study area fall under Central Highlands (Malwa, Bundelkhand and Eastern Satpura) which represents tropical dry deciduous forest cat 5 & 3 with hot sub humid climate with black and red soil (length of cropping period is 150-180 days) favorable for mustard, wheat, pulses. Vegetation in the Malwa Plateau is tropical dry forest, with scattered teak (*Tectona grandis* L. f.) forests. The other main trees are *Butea* spp., *Bombax* spp., *Anogeissus* spp., *Acacia* spp., *Buchanania* spp. and *Boswellia* spp. The shrubs or small trees include species of *Grewia* spp., *Ziziphus mauritiana* Lamk., *Casearia* spp., *Prosopis* spp., *Capparis* spp., *Woodfordia* spp., *Phyllanthus* spp., and *Carissa* spp.. The Malwa plateau is considered to be an extension of the Deccan Traps and was formed at the end of Cretaceous period. Black, Brown and Bhtatori or stony soil is abundant in the Malwa Plateau.

The black soil requires less irrigation because of its high capacity for moisture retention. The other two soil types are lighter and have a higher proportion of sand. Ratapani Wildlife Sanctuary contains 129 tree species, 73 herbs and shrubs species, 33 climbers and parasites, 35 grasses and bamboo species, 35 mammals, 205 birds, 14 fish, 33 reptiles and 10 species of amphibians have been recorded in Ratapani Wildlife Sanctuary. The major crop in the study area is Rabi (winter crops) and Kharif (summer crops); this cropping pattern depends on water from Narmada River. The forest land is involved in the railway track. There is no any major crop in the forest area, only maize was observed at some places where tribal living. The location of wildlife sanctuary shown in the map of Madhya Pradesh is shown in Figures 3-9.

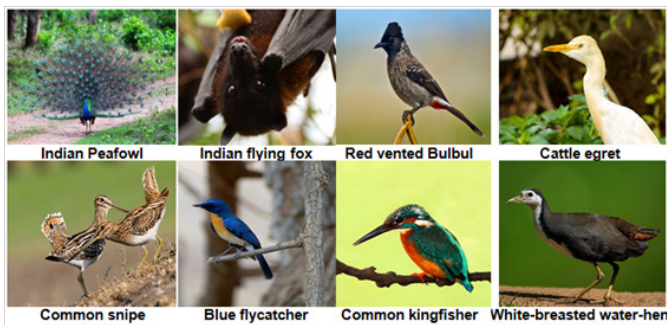


Figure 2 Avifauna in the study area.



Figure 3 Location of Wildlife Sanctuary in Map of Madhya Pradesh.



Figure 4 View of Rail Track passing through wild life sanctuary at different location.

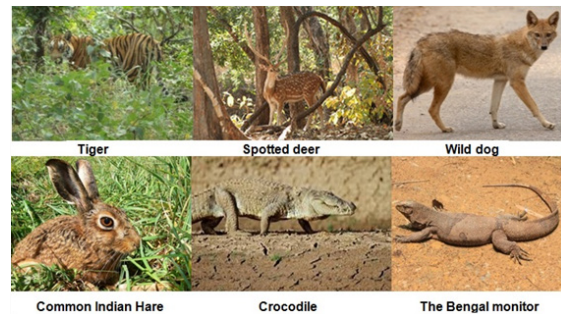


Figure 5 Wildlife Presence in the Forest (WLS).



Figure 6 Pug marks of Tiger Movement in Wildlife sanctuary.

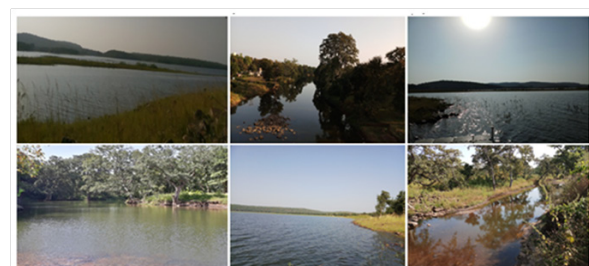


Figure 7 Aquatic Habitat of the Study Area.

Floral diversity of the study area

The objective of this floral inventory of the study area is to provide necessary information on floristic structure in the study area for formulating effective management and conservation measures. The climatic, edaphic and biotic variations with their complex interrelationship and composition of species, which are adapted to these

variations, have resulted in different vegetation cover, characteristic of each region.³² The tree species, herbs, shrubs, climbers and major crops, were documented during this base line study.^{33,34}

Trees and shrubs: A tree is a perennial plant with an elongated stem or trunk, supporting branches and leaves in most species. Trees tend to be long-lived, some reaching several thousand years old. While a shrub or bush is a small to medium-sized woody plant. They are

distinguished from trees by their multiple stems and shorter height and are usually less than 6 m (20 ft) tall. The dominant trees in the study area are *Tectona grandis* L.f. (Sagaun/teak), *Butea monosperma* (Lam.) Taub. (Palas), *Acacia nilotica* (ITIS) (Babool), *Mangifera indica*



Figure 8 Tree Distribution and pattern in the Forest.

L. (Aam), *Pongamia glabra* L. (Karanj), *Zizyphus mauritiana* (Lamk) (Ber). A total 101 species of trees belong to 37 families are enumerated from the study area (Table 3).



Figure 9 Glimpses of Local information and Confirmation from Locals/Villagers.

Table 3 Trees in the Study area (Natural Vegetation)

S. no.	Family	Vernacular name	Botanical name
1.		Chironji	<i>Buchanania lanjan</i>
2.	Anacardiaceae	Aam	<i>Mangifera indica</i>
3.		Jhingan	<i>Lannea coromandelica</i>
4.		Ashok	<i>Polyalthia longifolia</i>
5.	Anonaceae	Kari	<i>Saccopetalum tomentosum</i>
6.		Sitafal	<i>Anona squamosa</i>
7.	Apocynaceae	Dudhi/Karayja	<i>Wrightia tinctoria</i>
8.	Bignoniaceae	Padar	<i>Sterospermum suaveolens</i>
9.		Kakai	<i>Flacourtia ramontchi</i>
10.	Bixaceae	Galgal	<i>Cochlospermum religiosum</i>
11.	Boraginaceae	Datraga	<i>Ehretia laevis,</i>
12.		Lasoda	<i>Cardia myxa</i>
13.	Burseraceae	Keked	<i>Garuga pinnata</i>
14.		Salai	<i>Boswellia serrata</i>
15.	Capparidaceae	Barna	<i>Crataeva unilocularis</i>
16.	Celastraceae	Jamrasi	<i>Elaeodendron glaucum</i>
17.		Arjun	<i>Terminalia arjuna</i>
18.		Dhavada	<i>Anogeissus latifolia</i>
19.	Combretaceae	Bahera	<i>Terminalia belerica</i>
20.		Kardhai	<i>Anogeissus pendula</i>
21.		Saaj	<i>Terminalia tomentosa,</i>
22.	Cornaceae	Akol	<i>Ailangium lamarchii</i>
23.	Ebenaceae	Tendu	<i>Diospyros melanoxylon</i>
24.		Bhaktendu	<i>Diospyros cordifolia</i>
25.		Aanvla	<i>Emblica officinalis</i>
26.		Kasai	<i>Bridelia retusa</i>
27.	Euphorbiaceae	Thuar	<i>Euphorbia nerifolia</i>
28.		Ratanjot	<i>Jatropha curcus</i>
29.		Roli	<i>Mallotus philippinensis</i>
30.		Sahand	<i>Euphorbia nivulia</i>
31.	Lauraceae	Maida lakdi	<i>Litsea glutinosa</i>

S. no.	Family	Vernacular name	Botanical name
32.	<i>Lecythidaceae</i>	Kumbhi/Kalindi	<i>Careya arborea</i>
33.		Amaltas	<i>Cassia fistula</i>
34.		Anjan	<i>Hardwickja binata</i>
35.		Asta	<i>Bauhinia racemose</i>
36.		Imli	<i>Tamarindus indica</i>
37.		Karanj	<i>Pongamia glabra</i>
38.		Kachnar	<i>Bauhinia variegata</i>
39.		Kalasiris	<i>Albizzia lebbek</i>
40.		Keyolar	<i>Bauhinia spp.</i>
41.		Kheir	<i>Acacia catechu</i>
42.		Khejra	<i>Prosopis juliflora</i>
43.		Gulmohar	<i>Delonix regia</i>
44.		Chhekur	<i>Prosopis spicigera</i>
45.	<i>Fabaceae</i>	Chhichva	<i>Albizzia odoratissima</i>
46.		Tinsa	<i>Ougeinia dalbergiodes</i>
47.		Dhovin	<i>Dalbergia paniculata</i>
48.		Palas	<i>Butea monosperma</i>
49.		Pagra	<i>Erythrina suberosa</i>
50.		Babool	<i>Acacia nilotica</i>
51.		Bijasaal	<i>Pterocarpus marsupium</i>
52.		Renja	<i>Acacia leucophloea</i>
53.		Safed siris	<i>Albizzia procera</i>
54.		Safed khair	<i>Acacia ferruginae</i>
55.		Sehra	<i>Bauhinia retus</i>
56.		Bhisom	<i>Delbergia latifolia</i>
57.		Sissu	<i>Delbergia sissoo</i>
58.	<i>Lythraceae</i>	Seja	<i>Lagerstroemia parviflora</i>
59.	<i>Malvaceae</i>	Pula	<i>Kydia calycina</i>
60.		Kullu	<i>Sterculia lanceolata</i>
61.		Neem	<i>Azadirachta indica</i>
62.	<i>Meliaceae</i>	Bakain	<i>Melia azedarach</i>
63.		Rohan	<i>Soyimida febrifuga</i>
64.		Gular	<i>Ficus glomerate</i>
65.		Pakar	<i>Ficus infectoria</i>
66.	<i>Moraceae</i>	Paraspeepal	<i>Ficus retusa</i>
67.		Peepal	<i>Ficus religiosa</i>
68.		Bargad/vad	<i>Ficus bengalensis</i>
69.		Bhahtoot	<i>Morus laevigates</i>
70.	<i>Moringaceae</i>	Sahjana	<i>Moringa pterygosperma</i>
71.		Jamun	<i>Syzygium cuminii</i>
72.	<i>Myrtaceae</i>	Gum tree	<i>Eucalyptus sp.</i>
73.	<i>Oleaceae</i>	Mokha	<i>Schrebera swietenoidas</i>
74.	<i>Arecaceae</i>	Khajoor	<i>Phoenix humilis</i>

S. no.	Family	Vernacular name	Botanical name
75.	Rhamnaceae	Ghont	<i>Zyphus xylopyra</i>
76.		Ber	<i>Zizyphus mauratiana</i>
77.		Aal	<i>Morinda tintoria</i>
78.		Kem	<i>Mitragyana parvifolia</i>
79.		Dikamali	<i>Gardenia lica</i>
80.		Tilwan	<i>Wendlandia exserts</i>
81.	Rubiaceae	Papra	<i>Gardenia latifolia</i>
82.		Feitara	<i>Gardenia turgida</i>
83.		Bhawarsal	<i>Hymenodictyon excelsum</i>
84.		Haldu	<i>Adina cordifolia</i>
85.		Lokhandi	<i>Ixora parviflors</i>
86.		Keth	<i>Feronia Limonia</i>
87.	Rutaceae	Bel	<i>Aegle marmelos</i>
88.		Bilsena	<i>Limonia Crenclata</i>
89.		Meethneem	<i>Murrasya koenigii</i>
90.	Salmaliaceae	Semal	<i>Salmalia malabaricum</i>
91.	Salvadoraceae	Peelu	<i>Salvadora oleoides</i>
92.	Sapindaceae	Kusum	<i>Schleiehera trijuga</i>
93.		Reetha	<i>Sapindus laurifolius</i>
94.	Sapotaceae	Mahuva	<i>Madhuca indica</i>
95.		Molsari	<i>Mimusops elangi</i>
96.	Simaroubaceae	Maharukh	<i>Ailanthus excelsa</i>
97.	Tiliaceae	Dhaman	<i>Grewia tiliaefolia</i>
98.	Ulmaceae	Chirol	<i>Holoptelea integrifolia</i>
99.		Gamari	<i>Gmelina arborea</i>
100.	Verbenaceae	Morpaye	<i>Vitex peduncularis</i>
101.		Sagaun/Teak	<i>Tectona grandis</i>

Herbs: Total 37 herbaceous species belongs to 29 family (agricultural crops not included) were recorded from the study area enlisted in Table 4.

Table 4 List of Herbaceous species observed in the Study area

S. no.	Family	Vernacular name	Scientific name
1.	Acanthaceae	Maruadona	<i>Strobilanthes callosus</i>
2.	Amaranthaceae	Chirchita	<i>Achyranthes aspera</i>
3.	Anacardiaceae	Adusa	<i>Adhatoda vasica</i>
4.	Apocynaceae	Karonda	<i>Carissa spinarum</i>
5.		Kurchi	<i>Holarrhena antidysenterica</i>
6.	Asclepiadaceae	Oak	<i>Calotropdis gigantea</i>
7.	Berberidaceae	Sarkata	<i>Argemone mexicana</i>
8.	Cactaceae	Nagfani	<i>Optuttia dillenii</i>
9.	Capparidaceae	Heens	<i>Capparis horrida</i>
10.		Kareel	<i>Capparis aphylla</i>
11.	Celastraceae	Bekal	<i>Gymnosporta montana</i>
12.	Asteraceae	Gokhuru	<i>Xanthium aspera</i>
13.	Euphorbiaceae	Jhondharli	<i>Antidesina ghacsehilla</i>
14.		Chakhetan	<i>Fluggca microcarpa</i>
15.		Tarwar	<i>Cassia auriculata</i>
16.	Fabaceae	Chumui	<i>Mimosa rubicaulis</i>
17.		Chipti	<i>Desmodium pulchellum</i>

S. no.	Family	Vernacular name	Scientific name
18.	Fabaceae	Nirgud	<i>Indigolera pulchella</i>
19.		Tovara	<i>Cassia tora</i>
20.		Kala Bansa	<i>Colebrookea oppositifolia</i>
21.	Lamiaceae	Puwar	<i>Vitex negundo</i>
22.	Lythraceae	Kora	<i>Pogostemon plectranthoides</i>
23.		Dhawai	<i>Woodfordia floribunda</i>
24.	Malyaceae	Banakpas	<i>Thespesia lampus</i>
25.	Myrsinaceae	Babrang	<i>Embelia robusta</i>
26.	Myrtaceae	Jamun	<i>Eugenia heyncana</i>
27.	Rhamnaceae	Jharberi	<i>Zityphis rotundifolia</i>
28.	Rutaceae	Ratanjot	<i>Clausena pantaphylla</i>
29.	Salicaceae	Bansa	<i>Salix tetrasperama</i>
30.	Sapindaceae	Khareta	<i>Iodonoca viscosa</i>
31.	Sterculiaceae	Marorfali	<i>Helicteres isora</i>
32.	Tamaricaceae	Jhau	<i>Tamarix dioica</i>
33.	Tiliaceae	Gursakari	<i>Grewia hirsuta</i>
34.		Bandi	<i>Grewia scabrophylla</i>
35.	Verbenaceae	Harsingar	<i>Nyctanthes arbortristis</i>
36.	Vitaceae	Hathi kand	<i>Leea macrophylla</i>
37.	Zygophyllaceae	Hingota	<i>Balanites roxburghii</i>

Creepers: Total 19 Creepers species belongs to 7 families (agricultural crops not included) were recorded from the study area enlisted in Table 5.

Table 5 List of Creepers observed in the Study area

S. no.	Family	Vernacular name	Scientific name
1.	Asclepiadaceae	Gudmar	<i>Gymnema sylvestris</i>
2.		Chikti	<i>Marsdenia tenacissima</i>
3.	Combretaceae	Hathi Sandan	<i>Combretum ovalifolia</i>
4.		Peevarvel	<i>Combretum decandrum</i>
5.	Dioscoreaceae	Baichandi	<i>Dioscorea daemons</i>
6.	Leguminosae	Kavach	<i>Mucuna pruriens</i>
7.		Karanj	<i>Caesalpinia sepiaria</i>
8.		Ganj	<i>Melletia auriculata</i>
9.		Rathi	<i>Abrus precatorius</i>
10.		Gurar	<i>Acacia cassia</i>
11.		Palas Bel	<i>Butea superba</i>
12.		Mahul	<i>Bauhinia vahlii</i>
13.	Ravni	<i>Acacia pennata</i>	
14.	Nasbel	<i>Spatholobus roxburghii</i>	
S. no.	Family	Vernacular name	Scientific name
15.	Liliaceae	Agnishikha	<i>Gloriosa superba</i>
16.	Menispermaceae	Satavari	<i>Asparagus racemosa</i>
17.		Giloy	<i>Tinospora cordifolia</i>
18.	Rhamnaceae	Makoy	<i>Zizyphus oenoplia</i>
19.		Kevti	<i>Ventilago calyculata</i>

Grasses and parasitic plant: Total 22 grass species belongs to Gramineae family (agricultural crops not included) and four parasitic plants belongs to three families were recorded from the study area enlisted in Table 6.

Table 6 List of Grasses and parasitic plant observed in the Study area

S. no.	Family	Vernacular name	Scientific name
1.		Kus	<i>Eragrostis nees</i>
2.		Kusal	<i>Heteropogon contortus</i>
3.		Kunda	<i>Ischaemum pilosum</i>
4.		Kaus	<i>Saccharum spontaneum</i>
5.		Kush	<i>Desmostachya bipinnata</i>
6.		Khas	<i>Vetiveria zizanioides</i>
7.		Gararu	<i>Coix gigantea</i>
8.		Gadela	<i>Coix lacrymajobi</i>
9.		Guner	<i>Themada quadrivalvis</i>
10.		Chikula	<i>Chrysopogon montanus</i>
11.		Chhir	<i>Imperata cylindrica</i>
12.	Gramineae	Dub	<i>Cynodon dactylon</i>
13.		Poniya	<i>Schima sulcatum</i>
14.		Phuli	<i>Apluda varis</i>
15.		Phusel	<i>Iseilema laxum</i>
16.		Phooli	<i>Apluda mutica</i>
17.		Baas	<i>Dendracalamus strictus</i>
18.		Katang baas	<i>Bambusa bamboos</i>
19.		Basu	<i>Sorghum halepense</i>
20.		Bhurbushi	<i>Eragrostis tenella</i>
21.		Marvel	<i>Dichanthium annulatum</i>
22.		Gather	<i>Bothriochloa pertusa</i>
23.		Sen	<i>Cenchrus ciliaris</i>
Parasitic plant			
24.	Coonvolvulaceae	Amarbel	<i>Cuscuta reflexa</i>
25.	Orchidaceae	Archid	<i>Vanda tessellata</i>
26.		Banda	<i>Vasum nepalense</i>
27.	Loranthaceae	Bada	<i>Dendrophthoe fakata</i>

Cultivated plants in the study area

The prevalent cropping systems of this area are the cumulative results of past and present decisions by individuals; these decisions are usually based on experience, tradition, expected profit, personal preferences and resources, and so on. The crop occupying the highest percentage of the sown area of this region is taken as the major crop and all other possible alternative crops, which are sown in this region either as substitutes of the base crop in the same season or as the crops which fit in the rotation in the subsequent season, are considered as minor crop. It is observed that, the different parts of the study area were practicing different crop pattern based on the season and availability of irrigation facility. The general crop patterns practiced in the study area were maize, wheat and others.

Major horticultural crops: Plantation of Chikku (*Manilkara zapota*), Kela (*Musa sp.*) Papaya (*Carica papaya*), Amla (*Phyllanthus*

emblica) and mango trees (*Mangifera indica*) were observed at some localities. Mango trees (*Mangifera indica*) were observed adjacent to the residential area and also along the road side at almost all villages.

Major vegetable corps: The major vegetables grown in the study area were:

- i. Bhindi (*Abelmoschus esculentus*)
- ii. Brinjal (Ringana *Solanum melongena*)
- iii. Cabbage (*Brassica oleraceae*)
- iv. Tomato (*Lycopersicon lycopersicum*)
- v. Karela (*Momordica charantia*)

e. Pulses: The pulses cultivated in this region were Gram (*Cicer arietinum*); Mug (*Vigna aconitifolia*), Arhar (*Cajanus cajan*).

Rare and endangered flora in the study area: The International Union for Conservation of Nature (IUCN) Red List is the world's most comprehensive inventory of the global conservation status of plant and animal species. It uses a set of criteria to evaluate the extinction risk of thousands of species and subspecies. These criteria are relevant to all species and all regions of the world. With its strong scientific base, the IUCN Red List is recognized as the most authoritative guide to the status of biological diversity. Out of 17000 species of higher plants known to occur in India, nearly 614 higher plant species were evaluated by IUCN. Among them 247 species are under threatened category (IUCN, 2008). As per list of 2012, plants seemed to be the most threatened life form with 60 species being listed as Critically Endangered and 141 as Endangered in India. Among the enumerated flora in the study area, none of them were assigned any threat category by Red data book of Indian Plants³⁵⁻⁴⁰ and Red list of threatened Vascular plants.³¹

Endemic plants of the study area: De Candolle (1855), Swiss botanist, first used the concept of Endemic, which is defined as an area of a taxonomic unit, especially a species which has a restricted distribution or habitat, isolated from its surrounding region through geographical, ecological or temporal barriers. Out of 17000 species of known flowering plants of India nearly 5000 species are said to be endemic. Nearly 58 genera and 1932 taxa are found to be endemic to peninsular India.⁴¹⁻⁴⁹

The flora of India is one of the richest in the world due to the country's wide range of climate, topology, and environment. There are over 15,000 species of flowering plants in India which account for 6% of all plant species in the world. Many plant species are being destroyed, however, due to their prevalent removal. Roughly 1/4 of all plant species in the world are at risk of being endangered or going extinct. The combination of global warming and habitat destruction is the sole reason for the disappearance of many plants. Though there are thousands of interesting and unusual plants, here are some common plants which have become rare and endangered species in the past 30 years due to habitat destruction.

Among recorded plant species none can be assigned the status of endemic plant of this region. Tree community (Species-area) curves based on phytosociology fitted to the data may show unnatural shapes, with leveling-off or even decrease in sampling sizes higher than average. This distortion can be explained by the subjective, preferential method of field sampling used in phytosociology. When making relevés in species-poor vegetation, one probably tends to use larger plots in order to include more species. The reason for this may be that a higher number of species gives a higher probability of including presumed diagnostic species, so that the relevé can be more easily classified in the Braun-Blanquet classification system. This may have at least two consequences: in phytosociological data bases species-poor vegetation types are underrepresented or relevés are artificially biased towards higher species richness; the suitability of phytosociological data for species richness estimation is severely limited.

Status of the forest, their category in study area: According to the Champion and Seth, the forest tropical high deciduous of this region fall into the following categories:

- a. 5A / CIII- Southern tropical dry Deciduous Mixed Forest.
- b. 5A / DSI- Southern tropical dry Deciduous Scrub (Degradation Stage).

- c. 5 / DS4- Southern tropical dry Deciduous Forest (Degradation Stage).

Following are the forest (WLS/RF/PF) has been recorded for the study area.

- I. Ratapani Wild Life Sanctuary
- II. Chakla RF
- III. Diwattiaya PF
- IV. Gohar Ganj RF
- V. Obedullahganj PF
- VI. Obedullahganj RF
- VII. Budani PF
- VIII. Budani RF
- IX. Ramnagar RF

Ratapani wildlife sanctuary

Ratapani Wildlife Sanctuary spreads over an area of 1201.29 km² is located in Raisen District in the State of Madhya Pradesh. Ratapani Wildlife Sanctuary is extremely rich in flora and fauna and harbours a number of endemic species. Ratapani Wildlife Sanctuary is rich in biodiversity. These wildlife areas are classified into semi-arid wildlife zone - IV B Gujarat Rajputana under Roger and Pawar classification. The sanctuary is inhabited by all the usual animals of the region, such as tiger (*Panthera tigris*) leopard (*Panthera pardus*), wolf (*Canis lupus*), Jackal (*Canis aureus*), Indian fox (*Vulpes bengalensis*), Striped hyena (*Hyaena hyaena*) Sloth bear (*Melursus ursinus*) among carnivores and spotted deer (*Axis axis*), Sambhar (*Cervus unicolor*), Nilgai (*Boselaphus tragocamelus*), Chinkara (*Gazella bennetti*), wild pig (*Sus scrofa*), Chowsingha (*Tetracerus quadricornis*) and blackbuck (*Antelope cervicapra*), amongst herbivores. Apart from these, crocodiles/gharials can also be seen in Ratapani Wildlife Sanctuary. Ratapani Wildlife Sanctuary contains 129 tree species, 73 herbs and shrubs species, 33 climbers and parasites, 35 grasses and bamboo species, 35 mammals, 205 birds, 14 fish, 33 reptiles and 10 species of amphibians have been recorded in Ratapani Wildlife Sanctuary (Table 7 & Table 8).

Table 7 Coordinates for Ratapani Wildlife Sanctuary

Corners	Latitude (N)	Longitude (E)
A	23° 2' 21.742"	77° 20' 9.817"
B	22° 48' 58.759"	77° 25' 39.132"
C	23° 8' 30.593"	78° 16' 31.158"
D	23° 17' 47.545"	78° 12' 19.342"

Table 8 Coordinates for EcoSensitive Zone of Ratapani Wildlife Sanctuary

Corners	Latitude (N)	Longitude (E)
A	23° 2' 12.670"	77° 19' 2.020"
B	22° 48' 24.792"	77° 25' 38.686"
C	23° 8' 28.575"	78° 17' 7.044"
D	23° 18' 53.787"	78° 12' 43.135"

It is necessary to conserve and protect the area to the extent and boundaries of which is specified in paragraph 1 of this notification,

around the protected area of Ratapani Wildlife Sanctuary as Eco-sensitive zone from ecological, environmental and biodiversity point of view and to prohibit industries or class of industries and their operations and processes in the said Eco-sensitive Zone.

Extent and boundaries of eco-sensitive zone: The extent of Eco-sensitive Zone is one kilometer in the revenue area and two kilometer in the surrounding forest area from the boundary of Ratapani Wildlife Sanctuary. The area of Eco sensitive Zone is 546.52 km² which has 72 villages (Table 9).

Activities prohibited or to be regulated within the Eco-sensitive Zone

All activities in the Eco sensitive Zone shall be governed by the provisions of the Environment (Protection) Act, 1986 (29 of 1986) and the rules made there under including the Coastal Regulation Zone (CRZ), 2011 and the Environmental Impact Assessment (EIA) Notification, 2006 and other applicable laws including the Forest (Conservation) Act, 1980 (69 of 1980), the Indian Forest Act, 1927 (16 of 1927), the Wildlife (Protection) Act 1972 (53 of 1972), and amendments made thereto and be regulated in the manner specified.

Prohibited activities in eco sensitive zone

Commercial mining: All new and existing (minor and major minerals), stone quarrying and crushing units are prohibited with immediate effect except for meeting the domestic needs of bona fide local residents including digging of earth for construction or repair of houses and for manufacture of country tiles or bricks for housing and for other activities. The mining operations shall be carried out in accordance with the order of the Hon'ble Supreme Court dated 4th August, 2006 in the matter of T.N. Godavarman Thirumulpad vs. UOI in W.P.(C) No.202 of 1995 and dated 21.04.2014 in the matter of Goa Foundation Vs. UOI in W.P.(C) No.435 of 2012.

Setting of industries causing pollution (water, air, soil, noise, etc.): No new industries and expansion of existing polluting industries in the Eco-sensitive zone shall be permitted. Only non-polluting industries shall be allowed within ESZ as per classification of Industries in the Guidelines issued by Central Pollution Control Board in February 2016, unless so specified in this notification. In addition, non-polluting cottage industries shall be promoted.

Establishment of major hydroelectric project: Prohibited (except as otherwise provided) as per applicable laws.

Use or production or processing of any hazardous substances: Prohibited (except as otherwise provided) as per applicable laws:

Discharge of untreated effluents in natural water bodies or land area: Prohibited (except as otherwise provided) as per applicable laws:

Setting of new saw mills: No new or expansion of existing saw mills shall be permitted within the Eco-sensitive Zone.

Setting up of brick kilns: Prohibited (except as otherwise provided) as per applicable laws.

Use of polythene bags: Prohibited (except as otherwise provided) as per applicable laws.

Commercial use of firewood: Prohibited (except as otherwise provided) as per applicable laws.

New wood based industry: Prohibited (except as otherwise provided) as per applicable laws.

Fishing: Prohibited (except as otherwise provided) as per applicable laws.

Table 9 List of Villages on Eco Sensitive Zone of Ratapani Wildlife Sanctuary

S. no.	Division	Village
1.		Rabiyawad
2.		Vurthi
3.	Bhopal	Prabadhan
4.		Stahphan
5.		Punha
6.		Banpur
7.		Alampur
8.		Amchha Kalan
9.		Amchha Khurd
10.		Ankalpur
11.		Baheria
12.		Bamhori
13.		Bamuila
14.		Bansgahan
15.		Bari
16.		Bhiyanpur
17.		Bineka
18.		Biptanagar
19.		Bithori
20.		Borpani
21.		Chora Kamraura
22.		Damdongri
23.		Dehgaon
24.		Dhabla
25.		Dimria
26.		Ghana Kalan
27.	Obedullahganj	Ghatpipaliya
28.		Ghoti
29.		Goripura
30.		Jalkhera
31.		Jatanpur
32.		Jet
33.		Karakbani
34.		Karitalai
35.		Kesalwara
36.		Khari
37.		Kumhariya
38.		Kumri
39.		Mahwakheri
40.		Mokalwara
41.		Nishankhera
42.		Nishankhera
43.		Niwari
44.		Panagar
45.		Ratanpur
46.		Tajpura
47.		Thanwari Ghatkheri
48.		Udayagiri
49.		Umariya

Table Continued..

S. no.	Division	Village
50.		Bandral
51.		Jaipura
52.	Raisen	Jamgarh
53.		Madhamau
54.		Padariya
55.		Samnapur
56.		Amargarh
57.		Amdoh
58.		Babariakhal
59.		Bardha
60.		Barijihiri ka Pathar
61.		Budhni
62.		Imaliya
63.		Johliapur
64.	Sehore	Karkadehri
65.		Kheri
66.		Maljhar
67.		Midghat
68.		Nadiakheda
69.		Neemwalakheda
70.		Patni
71.		Sirwara
72.	Yaarnagar	

Faunal biodiversity of study area

For the documentation of the faunal biodiversity of the study area with respect to birds, reptiles, amphibians, and butterfly species, a baseline survey had been conducted.

Birds: The sighting of bird species was very less during the study period. The most commonly spotted bird species of this area were Eurasian Collared-Dove, Cattle Egret, Red-wattled Lapwing, Intermediate Egret, Rock Pigeon, Chestnut-headed Bee-eater, Bank Myna and Common Myna. Water birds are common near to Ratapani Lake. The Indian Peafowl was observed which is listed as schedule -I as per IWPA, 1972 and others listed as schedule IV as per IWPA, 1972.

Total 1,224 bird species reliably recorded from India, together with their status categories. In total there are 1219 extant native species including migrants and vagrants (but excluding 3 species now known to be extinct in the country and 2 introduced species). There are 923

breeding species (911 residents, plus 12 suspected residents). IUCN evaluated 1254 bird species from India and categorized 77 species as threatened (13 species as critically endangered, 10 species as Endangered and 54 species as Vulnerable). No one sighted birds were evaluated as near threatened by IUCN²⁵ and Bird Life International.¹⁵ A taxon is Near Threatened, when it has been evaluated against the criteria but does not qualify for Critically Endangered, Endangered or Vulnerable categories, but is close to qualifying or is likely to qualify for a threatened category in the near future. List of schedule -I as per Wild life Protection Act 1972, species is given in the Table 10. Systematic account of the birds in the study area with the status of occurrence is given in the Table 11.

Table 10 Schedule -I Bird(s) of Study Area

Species	As IWPA 1972	IUCN	CITES
Indian Peafowl (<i>Pavo cristatus</i> , Linnaeus, 1758)	Schedule I; Part -III; I I	Least Concern ver 3.1	Not listed

Butterflies from the study area: Butterflies from three families observed during the present study are documented in the Table 12.

Herpetofauna: In amphibian group, the toads were sighted during the study period. The reptiles Common Garden Lizard, House Gecko, Fan-Throated Lizard, Common rat Snake, Indian Monitor, Crocodile, etc. were observed in the region is given in the Table 13.

Mammals: The wild mammals observed other than the domesticated ones are given in the Table 14.

Domestic Animals: The domestic animals viz. dog, cow, buffalo, goat, sheep and chicken observed in the study area.

Insects like Wasps, Honeybees and Signature spider was also recorded.

Fisheries: Narmada River is Major River in the study area, one lake i.e. Ratapani Water Lake and Natural Drain (Gadariya Nala) are the water bodies in the study area. The fishes observed in study area are listed in Table 15.

Rare and endangered fauna of study area: The IUCN Red List is the world's most comprehensive inventory of the global conservation status of plant and animal species. It uses a set of criteria to evaluate the extinction risk of thousands of species and subspecies. These criteria are relevant to all species and all regions of the world. With its strong scientific base, the IUCN Red List is recognized as the most authoritative guide to the status of biological diversity. IUCN, (2008) has evaluated 1976 animal species from India, among them 313 have in recognized as threatened species. Among them one species is considered as extinct, while 44 species are in critically endangered (CR) category, 88 is in endangered category (EN), while 181 is considered as vulnerable (VU). Wild Life (Protection) Act, 1972, amended on 17th January 2003, is an Act to provide for the protection of wild animals, birds and plants and for matters connected therewith or ancillary or incidental thereto with a view to ensuring the ecological and environmental security of the country. Total 10 species of the sighted fauna were given protection under Schedule -I by the Indian Wild Life (Protection) Act, 1972 listed in Table 16 (Figure 10).

Table 11 Systematic Lists of Birds in the Study Area with Status

S. No.	Family	Vernacular name	Scientific name	Status
1.		Black-winged kite	<i>Elanus caeruleus</i> (Desfontaines, 1789)	R
2.		Black kite	<i>Milvus migrans</i> (Boddaert, 1783)	R
3.	Accipitridae	Shikra	<i>Accipiter badius</i> (Gmelin, 1788)	V
4.		Changeable hawk-eagle	<i>Nisaetus cirrhatus</i> (Gmelin, 1788)	O
5.		Tawny eagle	<i>Aquila rapax</i> (Temminck, 1828)	E
6.		Crested serpent eagle	<i>Spilornis cheela</i> (Latham, 1790)	E
7.	Alaudidae	Ashy-crowned sparrow-lark	<i>Eremopterix griseus</i> (Kaup, 1836)	R
8.		Pied kingfisher	<i>Ceryle rudis</i> (Linnaeus, 1758)	R
9.	Alcedinidae	Common kingfisher	<i>Alcedo atthis</i> (Tucker and Health 1994)	R
10.		White-throated kingfisher	<i>Halcyon smyrnensis</i> (Linnaeus, 1758)	V
11.		Black-capped kingfisher	<i>Halcyon pileata</i> (Boddaert, 1783)	R
12.		Eurasian teal	<i>Anas crecca</i> (Linnaeus, 1758)	O
13.	Anatidae	Northern shoveller	<i>Anas clypeata</i> (Linnaeus, 1758)	O
14.		Cotton teal	<i>Nettapus coromandelianus</i> (Gmelin, 1789)	R
15.		Knob-billed duck	<i>Sarkidiornis melanotos</i> (Pennant, 1769)	R
16.	Apodidae	Alpine swift	<i>Tachymarptis melba</i> (Linnaeus, 1758)	R
17.		Little swift	<i>Apus affinis</i> (JE Gray, 1830)	R
18.		Grey Heron	<i>Ardea cinerea</i> (Linnaeus, 1758)	R
19.		Indian pond heron	<i>Ardeola grayii</i> (Sykes, 1832)	R
20.	Ardeidae	Cattle egret	<i>Bubulcus ibis</i> (Linnaeus, 1758)	R
21.		Little egret	<i>Egretta garzetta</i> (Linnaeus, 1766)	R
22.		Large egret	<i>Egretta garzetta</i> (Linnaeus, 1766)	R
23.	Artamidae	Ashy woodswallow	<i>Artamus fuscus</i> (Vieillot, 1817)	V
24.		Small minivet	<i>Pericrocotus cinnamomeus</i> (Linnaeus, 1766)	W
25.	Campephagidae	Scarlet minivet	<i>Pericrocotus speciosus</i> (Latham, 1790)	V
26.		Black-faced cuckooshrike	<i>Coracina novaehollandiae</i> (Gmelin, JF, 1789)	V
27.	Caprimulgidae	Indian nightjar	<i>Caprimulgus asiaticus</i> (Latham, 1790)	R
28.	Charadriidae	Red-wattled lapwing	<i>Vanellus indicus</i> (Boddaert, 1783)	R
29.	Chloropseidae	Blue-winged leafbird	<i>Chloropsis cochinchinensis</i> (Gmelin, JF, 1789)	R
30.	Ciconiidae	White stork	<i>Ciconia ciconia</i> (Swinhoe, 1873)	W
31.	Cisticolidae	Ashy prinia	<i>Prinia socialis</i> (Sykes, 1832)	V
32.		Grey-fronted quail-dove	<i>Geotrygon caniceps</i> (Gundlach, 1852)	R
33.		Yellow-footed green pigeon	<i>Treron phoenicoptera</i> (Latham, 1790)	R
34.	Columbidae	Rock pigeon	<i>Columba livia</i> (Gmelin, 1789)	R
35.		Eurasian collared dove	<i>Streptopelia decaocto</i> (Frivaldszky, 1838)	R
36.		Spotted dove	<i>Spilopelia chinensis</i> (Scopoli, 1786)	R
37.	Coraciidae	Indian roller	<i>Coracias benghalensis</i> (Linnaeus, 1758)	R
38.	Corvidae	Jungle crow	<i>Corvus macrorhynchos</i> (Wagler, 1827)	R

Table Continued..

S. No.	Family	Vernacular name	Scientific name	Status
39.		Common hawk-cuckoo	<i>Hierococcyx varius</i> (Vahl, 1797)	R
40.	<i>Cuculidae</i>	Koel	<i>Eudynamis scolopaceus</i> (Linnaeus, 1758)	R
41.		Greater coucal	<i>Centropus sinensis</i> (Stephens, 1815)	R
42.	<i>Dicaeidae</i>	Fire-breasted flowerpecker	<i>Dicaeum ignipectus</i> (Blyth, 1843)	V
43.		Fork-tailed drongo	<i>Dicrurus adsimilis</i> (Bechstein, 1794)	R
44.	<i>Dicruridae</i>	White-bellied drongo	<i>Dicrurus caerulescens</i> (Linnaeus, 1758)	R
45.		Greater racket-tailed drongo	<i>Dicrurus paradiseus</i> (Linnaeus, 1766)	R
46.		Red avadavat	<i>Amandava amandava</i> (Horsfield, 1821)	V
47.	<i>Estrildidae</i>	Tricoloured munia	<i>Lonchura malacca</i> (Linnaeus, 1766)	O
48.		Common crane	<i>Grus grus</i> (Linnaeus, 1758)	R
49.	<i>Gruidae</i>	Sarus crane	<i>Grus Antigone</i> (Linnaeus, 1758)	R
50.	<i>Hirundinidae</i>	Wire-tailed swallow	<i>Hirundo smithii</i> (Leach, 1818)	S
51.	<i>Laniidae</i>	Long-tailed shrike	<i>Lanius schach</i> (Linnaeus, 1758)	R
52.	<i>Leiothrichidae</i>	Jungle babbler	<i>Turdoides striata</i> (Dumont, 1823)	R
53.	<i>Megalaimidae</i>	Crimson-fronted barbet	<i>Megalaima rubricapilla</i> (Gmelin, 1788)	R
54.		Green bee-eater	<i>Merops orientalis</i> (Latham, 1801)	R
55.	<i>Meropidae</i>	Blue-tailed bee-eater	<i>Merops philippinus</i> (Linnaeus, 1767)	R
56.		Grey wagtail	<i>Motacilla cinerea</i> (Tunstall, 1771)	R
57.		White wagtail	<i>Motacilla alba</i> (Linnaeus, 1758)	R
58.	<i>Motacillidae</i>	White-browed wagtail	<i>Motacilla maderaspatensis</i> (Gmelin, 1789)	R
59.		Western Yellow Wagtail	<i>Motacilla flava</i> (Linnaeus, 1758)	V
60.		Tickell's blue flycatcher	<i>Cyornis tickelliae</i> (Blyth, 1843)	R
61.		Black redstart	<i>Phoenicurus ochruros</i> (Gmelin, 1774)	S
62.		African stonechat	<i>Saxicola torquatus</i> (Shelley, 1885)	W
63.	<i>Muscicapidae</i>	Pied bush chat	<i>Saxicola caprata</i> (Linnaeus, 1766)	R
64.		Blue-capped rock thrush	<i>Monticola cinclorhyncha</i> (Vigors, 1831)	R
65.		Oriental magpie-robin	<i>Copsychus saularis</i> (Linnaeus, 1758)	R
66.		Indian robin	<i>Saxicoloides fulicatus</i> (Linnaeus, 1766)	R
67.	<i>Nectariniidae</i>	Purple sunbird	<i>Cinnyris asiaticus</i> ((Latham, 1790)	R
68.	<i>Oriolidae</i>	Eurasian golden oriole	<i>Oriolus oriolus</i> (Linnaeus, 1758)	O
69.	<i>Passeridae</i>	House sparrow	<i>Passer domesticus</i> (Linnaeus, 1758)	R
70.	<i>Phalacrocoracidae</i>	Little Cormorant	<i>Phalacrocorax niger</i> (Vieillot, 1817)	V
71.		Large Cormorant	<i>Phalacrocorax carbo</i> (Linnaeus, 1758)	V
72.		Black Partridge	<i>Francolinus francolinus</i> (Linnaeus, 1766)	R
73.		Grey francolin	<i>Francolinus pondicerianus</i> (Gmelin, JF, 1789)	V
74.	<i>Phasianidae</i>	Jungle bush quail	<i>Perdica asiatica</i> (Latham, 1790)	R
75.		Red spurfowl	<i>Galloperdix spadicea</i> (Gmelin, JF, 1789)	R
76.		Red junglefowl	<i>Gallus gallus</i> (Linnaeus, 1758)	O
77.		Indian peafowl	<i>Pavo cristatus</i> (Linnaeus, 1758)	R

Table Continued..

78.	<i>Picidae</i>	Black-rumped flameback	<i>Dinopium benghalense</i> (Linnaeus, 1758)	R
79.		Yellow fronted pied woodpecker	<i>Leiopicus mahrattensis</i> (Latham, 1801)	R
80.	<i>Pittidae</i>	Indian pitta	<i>Pitta brachyuran</i> (Linnaeus, 1766)	R
81.	<i>Ploceidae</i>	Baya weaver	<i>Ploceus philippinus</i> (Linnaeus, 1766)	R
82.		Alexandrine parakeet	<i>Psittacula eupatria</i> (Linnaeus, 1766)	R
83.	<i>Psittacidae</i>	Rose-ringed parakeet	<i>Psittacula krameri</i> (Scopoli, 1769)	R
84.		Blossom-headed parakeet	<i>Psittacula roseate</i> (Biswas, 1951)	R
85.	<i>Pycnonotidae</i>	Red-vented bulbul	<i>Pycnonotus cafer</i> ((Linnaeus, 1766)	R
86.	<i>Recurvirostridae</i>	Black-winged stilt	<i>Himantopus himantopus</i> (Linnaeus, 1758)	R
87.	<i>Rhipiduridae</i>	White-browed fantail	<i>Rhipidura aureola</i> (Lesson, 1831)	W
88.	<i>Rostratulidae</i>	Greater painted-snipe	<i>Rostratula benghalensis</i> (Linnaeus, 1758)	R
89.		Common redshank	<i>Tringa tetanus</i> (Linnaeus, 1758)	R
90.	<i>Scolopacidae</i>	Common snipe	<i>Gallinago gallinago</i> (Linnaeus, 1758)	W
91.	<i>Sittidae</i>	Indian nuthatch	<i>Sitta castanea</i> (Lesson, 1830)	S
92.		Eurasian eagle-owl	<i>Bubo bubo</i> (Linnaeus, 1758)	O
93.	<i>Strigidae</i>	Jungle owlet	<i>Glaucidium radiatum</i> (Tickell, 1833)	O
94.		Chestnut-tailed starling	<i>Sturnia malabarica</i> (Gmelin, JF, 1789)	V
95.		Brahminy starling	<i>Sturnia pagodarum</i> ((Gmelin, JF, 1789)	V
96.	<i>Sturnidae</i>	Pied myna	<i>Gracupica contra</i> (Linnaeus, 1758)	R
97.		Jungle myna	<i>Acridotheres fuscus</i> (Wagler, 1827)	R
98.		Common myna	<i>Acridotheres tristis</i> (Linnaeus, 1766)	R
99.	<i>Threskiornithidae</i>	White Ibis	<i>Eudocimus albus</i> (Linnaeus, 1758)	R
100.	<i>Timaliidae</i>	White-browed scimitar babbler	<i>Pomatorhinus schisticeps</i> (Hodgson, 1836)	R
101.	<i>Upupidae</i>	Hoopoe	<i>Upupa epops</i> (Linnaeus, 1758)	R

Table 12 Butterflies in the Study Area

Family	Scientific Name	Common name	Relative abundance
<i>Papilionidae</i>	<i>Papilio polytes</i> Linnaeus	Common Mormon	Common
	<i>Eurema hecabe</i> Linnaeus	Common Grass yellow	Very Common
<i>Pieridae</i>	<i>Ixias Marianne</i> Cramer	White orange tip	Common
	<i>Danaus chrysippus</i> Linnaeus	Plain Tiger	Common
	<i>Danaus genutia</i> Cramer	Striped Tiger	Common
	<i>Phalantha phalantha</i> Drury	Common Leopard	Fairy Common
<i>Nymphalidae</i>	<i>Hypolimnas misippus</i> Linnaeus	Danaid egg fly	Common
	<i>Mycalasis perseus</i> Fabricius	Common bush brown	Uncommon
	<i>Cynthia cardui</i> Linnaeus	Painted Lady	Uncommon
	<i>Junonia hierta</i> Fabricius	Yellow pansy	Common
	<i>Junonia orithya</i> Linnaeus	Blue pansy	Fairy Common

Table 13 Reptiles and Amphibian in the Study Area

S. no.	Family	Common Name	Scientific name	Schedule as IWPA, 1972
1		Common Garden Lizard	<i>Calotes versicolor</i> (Cuvier, 1817)	Not listed
2	<i>Agamidae</i>	Fan-Throated Lizard	<i>Sitana ponticeriana</i> (Cuvier, 1817)	Not listed

Table Continued..

S. no.	Family	Common Name	Scientific name	Schedule as IWPA, 1972
3	Bufonidae	Toad	<i>Bufo bufo</i> (Gray 1825)	Not listed
4	Chamaeleonidae	Indian chameleon	<i>Chameleon calcaratus</i> (Rafinesque, 1815)	Schedule II
5	Colubridae	Common Rat Snake	<i>Ptyas mucosus</i> (Linnaeus, 1758)	Schedule II
6	Crocodylidae	Crocodile	<i>Crocoble crocodylus</i> (Cuvier, 1807)	Schedule I; Part II ID
7	Elapidae	Common Indian Krait*	<i>Bungarus caeruleus</i> (Schneider, 1801)	Schedule II
8		Indian Cobra*	<i>Naja naja</i> (Linnaeus, 1758)	Schedule II
9	Gekkonidae	House Gecko	<i>Hemidactylus flaviviridis</i> (Ruppell, 1835)	Not listed
10	Pythonidae	Rock Python	<i>Python molurus</i> (Linnaeus, 1758)	Schedule II
11	Scincidae	Brahminy Skink*	<i>Mabuya carinata</i> (Schneider, 1801)	Not listed
12	Varanidae	Indian Monitor	<i>Varanus benghalensis</i> (Daudin, 1802)	Schedule II
13	Viperidae	Russel Viper*	<i>Vipera russelli</i> (Shaw & Nodder, 1797)	Schedule II

Table 14 Mammals in Study Area

S. No.	Family	Scientific name	Common name	Status as per IWPA 1972
1.	Antilopinae	<i>Antilope cervicapra</i> (Linnaeus, 1758)	Black buck	Schedule – I; Part –I; 2
2.		<i>Boselaphus tragocamelus</i> (Pallas, 1766)	Blue bull	Schedule-III
3.		<i>Tetracerus quadricornis</i> (de Blainville, 1816)	Four horned Antilope	Schedule – I; Part –I; 8A
4.		<i>Cervus unicolor</i> (Kerr, 1792)	Sambhar	Schedule - III
5.	Bovidae	<i>Gazella bennetti</i> (Sykes, 1831)	Chinkara	Schedule – I; Part –I; 5B
6.	Canidae	<i>Canis aureus</i> (Linnaeus, 1758)	Jackal	Schedule - II
7.		<i>Vulpes benghalensis</i> (Shaw, 1800)	Indian fox	Schedule - II
8.		<i>Cuon alpinus</i> (Pallas, 1811)	Wild Dog/Dhole	Schedule - II
9.		<i>Axis axis</i> (Erxleben, 1777)	Spotted deer	Schedule - III
10.	Circopithecidae	<i>Macaca mulata</i> (Zimmermann, 1780)	Rhesus macaque	Schedule - II
11.	Cotobidae	<i>Presbytis entellus</i> (Dufresne, 1797)	Common Languor	Schedule - II
12.	Einaceidae	<i>Hemiechinus auratus</i> (Gmelin, 1770)	Hedgehog	Schedule - IV
13.	Felidae	<i>Panthera tigris</i> (Linnaeus, 1758)	Tiger	Schedule - I; Part-I; 39
14.		<i>Panthera pardus</i> (Linnaeus, 1758)	Panther/Leopard	Schedule - I; Part-I; 16B
15.		<i>Felis chaus</i> (Schreber, 1777)	Common Jungle cat	Schedule - II
16.		<i>Herpestes edwardsii</i> (É. Geoffroy Saint-Hilaire, 1818)	Common Mongoose	Schedule - II
17.	Hyaenidae	<i>Hyaena hyaena</i> (Linnaeus, 1758)	Striped hyena	Schedule - III
18.	Hystricidae	<i>Hystrix indica</i> (Kerr, 1792)	Common Indian Porcupine	Schedule IV
19.	Leporidae	<i>Lepus nigricollis</i> (F. Cuvier, 1823)	Common Indian Hare	Schedule IV
20.	Manidae	<i>Manis crassicaudata</i> (É. Geoffroy, 1803)	Scaly ant eater	Schedule-I; Part-I; 28
21.	Muridae	<i>Bandicota benghalensis</i> (Gray, 1835)	Field Rat	Not listed
22.		<i>Golunda ellioti</i> (Gray, 1837)	The Indian bush rat	Not listed
23.	Mustelidae	<i>Mellivora capensis</i> (Schreber, 1776)	Indian Ratel/Honey Badger	Schedule-I; Part-I; 29
24.	Pteropodidae	<i>Cynopterus sphinx</i> (Vahl, 1797)	Shot nosed fruit bat	Schedule V
25.		<i>Pteropus giganteus</i> (Brünnich, 1782)	Indian Flying fox	Schedule IV
26.	Sciuridae	<i>Funambulus Pennanti</i> (Wroughton, 1905)	Common 5 Striped Squirrel	Schedule IV
27.	Suidae	<i>Sus scrofa</i> (Linnaeus, 1758)	Wild Boar	Schedule - II
28.	Ursidae	<i>Melursus ursinus</i> (Shaw, 1791)	Sloth Bear	Schedule-I; Part-I; 31C

Table 15 List of Fishes reported from the Study area

S. no.	Family	Common name	Scientific name
1		Singhad	<i>Mystus seenghala</i> (Nelson 2006)
2		Aur	<i>Mystus aor</i> (Hamilton, 1822)
3	<i>Bagridae</i>	Bleekeri*	<i>Mystus bleekeri</i> (Day, 1877)
4		Cavacius	<i>Mystus cavacius</i> (Hamilton, 1822)
5		Gengra*	<i>Rita rita</i> (F. Hamilton, 1822)
6		Samval (Saul)	<i>Channa marulius</i> (F. Hamilton, 1822)
7	<i>Channidae</i>	Samval (Kabra)	<i>Channa striata</i> (Bloch, 1793)
8		Samval*	<i>Channa punctatus</i> (Bloch, 1793)
9		Karra*	<i>Channa gachua</i> (F. Hamilton, 1822)
10		Katla (Komal, Bhakhar)	<i>Catla catla</i> (Heckel, 1843)
11	<i>Cyprinidae</i>	Rohu	<i>Labco rohita</i> (F. Hamilton, 1822)
12		Mrigal (Narain)	<i>Cirrhosis mregala</i> (Bloch, 1795)
13	<i>Siluridae</i>	Padin	<i>Wallago attu</i> (Bloch & Schneider, 1801)
14		Gangarwar (Pabda)*	<i>Ompok bimaculatus</i> (Bloch, 1794)
15	<i>Sisoridae</i>	Andus*	<i>Bagarius bagarius</i> (Hamilton, 1822)

*not seen directly

Table 16 List of Schedule –I Fauna observed During the Survey. Colors are indicating the state of conservation in accordance with IUCN

S. no.	Scientific name	Common name	Schedule as per (WPA, 1972)	IUCN category	CITES listing
1	<i>Panthera tigris</i>	Tiger	Schedule-I; Part-I; 39	Endangered A2abcd; C1 ver 3.1	Appendix I
2	<i>Manis crassicaudata</i>	Scaly ant eater	Schedule-I; Part-I; 28	Endangered A3d+4d ver 3.1	Appendix I
3	<i>Panthera pardus</i>	Panther/Leopard	Schedule-I; Part-I; 16B	Vulnerable A2cd ver 3.1	Appendix I
4	<i>Melursus ursinus</i>	Sloth Bear	Schedule-I; Part-I; 31 C	Vulnerable A3c ver 3.1	Appendix I
5	<i>Tetracerus quadricornis</i>	Four horned Antelope	Schedule-I; Part-I; 8A	Vulnerable C2a(i) ver 3.1	Appendix III
6	<i>Gazella gazellabennetti</i>	Chinkara	Schedule-I; Part-I; 5B	Least Concern ver 3.1	Appendix III
7	<i>Antelope cervicapra</i>	Black buck	Schedule-I; Part-I; 2	Least Concern ver 3.1	Appendix III
8	<i>Mellivora capensis</i>	Indian Ratel	Schedule-I; Part-I; 29	Least Concern ver 3.1	Appendix III
9	<i>Pavo cristatus</i>	Indian Peafowl	Schedule-I; Part-III; 1 I	Least Concern ver 3.1	Not listed
10	<i>Crocoble crocodylus</i>	Crocodile	Schedule I; Part II 1D	Not Assessed yet	Not listed

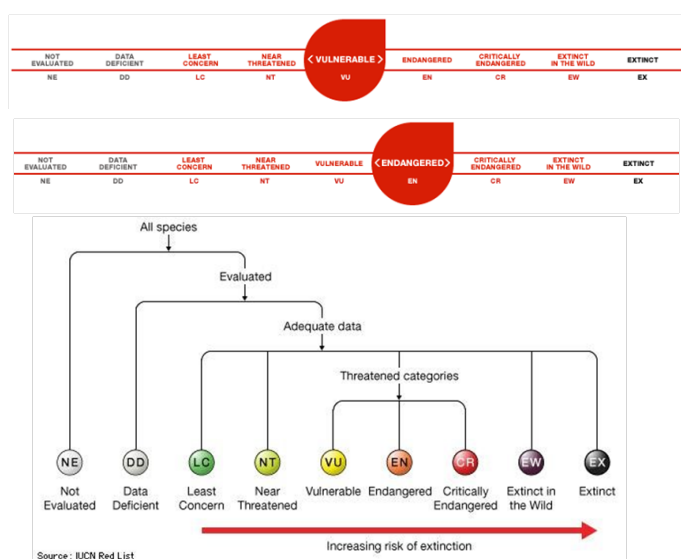


Figure 10 Representation of Risk of Extinction as per IUCN.

Recommendations and conclusion

The study area is ecologically sensitive having protected and reserved forest and notified wildlife sanctuary. The railway track is passing through Ratapani Wildlife Sanctuary which has rich biodiversity and endangered species. These wildlife areas are classified into semi-arid wildlife zone-IVB Gujarat Rajputana under Roger and Pawar classification. The sanctuary is inhabited by all the usual animals of the region, such as tiger (*Panthera tigris*) leopard (*Panthera pardus*), wolf (*Canis lupus*), Jackal (*Canis aureus*), Indian fox (*Vulpes bengalensis*), Striped hyena (*Hyaena hyaena*) Sloth bear (*Melursus ursinus*) among carnivores and spotted deer (*Axis axis*), Sambhar (*Cervus unicolor*), Nilgai (*Boselaphus tragocamelus*), Chinkara (*Gazella bennetti*), Wild pig (*Sus scrofa*), Chowsingha (*Tetracerus quadricornis*) and Blackbuck (*Antelope cervicapra*), amongst herbivores. Apart from these, crocodiles/gharials can also be seen in Ratapani Wildlife Sanctuary. Ratapani Wildlife Sanctuary contains 129 tree species, 73 herbs and shrubs species, 33 climbers and parasites, 35 grasses and bamboo species, 35 mammals, 205 birds, 14 fish, 33 reptiles and 10 species of amphibians have been recorded in Ratapani Wildlife Sanctuary.

Panthera tigris (Tiger) and *Manis crassicaudata* (Scaly ant eater) are endangered species listed by IUCN and protected under Schedule -1 as per Wildlife Protection Act 1972. *Panthera pardus* (Leopard), *Melursus ursinus* (Sloth Bear) and *Tetracerus quadricornis* (Four horned Antelope) are vulnerable species listed by IUCN and protected under Schedule -1. Other species protected under schedule -1 are *Gazella gazellabennetti* (Chinkara), *Antelope cervicapra* (Black buck), *Mellivora capensis* (Indian Ratel), *Crocodile crocodylus* (Crocodile) and one bird *Pavo cristatus* (Indian Peafowl). The illegal tree cutting by villagers and contractors was observed during study. The 8 tiger death was reported by RFO last year (2016-17) on Railway track. The major reason was in search of food i.e. Monkey. The people travelling in train are disposing food items and people working in pantry are also used to dispose the waste food in the forest. The food item attract to monkeys and they are killed by running train on railway track, the blood and meat of monkey attract to tigers/panthers and also they were killed by running train on railway track mostly in night.

It is strongly recommended to prepare the conservation plan for schedule -1 Fauna (listed 9 animals and 1 bird) and it is ensure to implement the conservation plan during construction and operation phase of railway track. Moreover, there is an urgent need of public awareness for the importance of wildlife, as illegal hunting, killing or capturing of wild animals was recorded from locals living in the forest and nearby villagers. People coming from outside are giving the greed of money and other necessary provision to villagers for hunting. It's an environmental crime against the natural resources.⁵⁰⁻⁶⁰

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Conflict of interest

Authors declare there is no conflict of interest in publishing the article.

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