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

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)

| 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          |         |
| 6      | Obedullahganj   | Obedullahganj RF          | Reserved and protected forest fall in the study area, majorly teak, open mixed, dense forest. |
| 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.© Rathoure. This is an open access article distributed under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution, and build upon your work non-commercially. © 2018 Biodiversity Int. J. 2018:2(2):179–196 The status of individual species was assessed using the revised IUCN/SSC category system.
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       | Primary data collection     | By Field Survey, Hutto et al., Welsh, Thompssom et al., Welsh et al., Allen et al., Misra, Allen et al. | For Floral diversity, Vegetation measurements:                                                                                                                         |
|       | Ecology           |                             |                                                                                        | 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. Study area. Endemic plants in the study area. | 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                 | I. Barkhera Range and Budani Range Forest Division                                      | 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. | Bentham & Hooker, Hunter, Dixit, Ghosh et al., Lushington, Wilson & Reeder, Bird Life International, Kumar & Srivastava, Kumar, Kumar et al., Kumar & Aggarwal. The status of individual species was assessed using the revised IUCN/SSC category system. |
|       |                   |                             | II. Data of Fisheries department                                                     | Wild life importance, Floral Endemcity, Faunal Endemcity, 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. | Wild life importance, Floral Endemcity, Faunal Endemcity, 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. |
| 3.    | Evaluation of     | Secondary                   | Review and Discussion                                                                  | Wild life importance, Floral Endemcity, Faunal Endemcity, 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. | Wild life importance, Floral Endemcity, Faunal Endemcity, 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. |

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 1.
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. The tree species, herbs, shrubs, climbers and major crops, were documented during this base line study. 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* 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).

**Table 3 Trees in the Study area (Natural Vegetation)**

| S. no. | Family         | Vernacular name | Botanical name               |
|--------|----------------|-----------------|------------------------------|
| 1.     | Anacardiaceae  | Chironji        | Buchanania lanjan           |
| 2.     |                | Aam             | Mangifera indica            |
| 3.     |                | Jhingan         | Lannea coromendelica        |
| 4.     |                | Ashok           | Polyalthia longifolia       |
| 5.     | Anonaceae      | Kari            | Saccopetalum tetragonoidum  |
| 6.     |                | Stofal          | Anana squamosa              |
| 7.     | Apocynaceae    | Dudhi/Karayja   | Wrightia laurea             |
| 8.     | Bignoniaceae   | Padar           | Sterospermum suaveolens     |
| 9.     | Bixa          | Kakai           | Flacourtia ramontchi        |
| 10.    |                | Galgal          | Croton alba                |
| 11.    | Boraginaceae   | Datraga         | Ehretia nivea               |
| 12.    |                | Lasoda          | Cardia myxa                |
| 13.    | Burseraceae    | Keked           | Garuga pinnata             |
| 14.    |                | Salia           | Boswellia serrata          |
| 15.    | Capparidaceae  | Barna           | Crotalaria unilocularis     |
| 16.    | Celastraceae   | Jamrasi         | Elaeodendron glaucum       |
| 17.    |                | Arjun           | Terminalia arjuna          |
| 18.    | Combretaceae   | Dhaada          | Anogeissus latifolium      |
| 19.    |                | Bahera          | Terminalia belerica        |
| 20.    |                | Kardhai         | Anogeissus pendula         |
| 21.    |                | Saj             | Terminalia tomentosa,      |
| 22.    | Cornaceae      | Akol            | Alangium lamarchii         |
| 23.    | Ebenaceae      | Tendu           | Diospyros malabarificus    |
| 24.    |                | Bhaktendu       | Diospyros cordifolia       |
| 25.    |                | Aanvla          | Emblica officinalis         |
| 26.    |                | Kasai           | Bridelia retusa            |
| 27.    | Euphorbiaceae  | Thuar           | Euphorbia nivaflica        |
| 28.    |                | Ratanjot        | Jatropha curcas            |
| 29.    |                | Roji            | Mallotus philippinensis    |
| 30.    |                | Sahand          | Euphorbia nivafica         |
| 31.    | Lauraceae      | Maida lakdi     | Latoa glutinosa            |
| S. no. | Family      | Vernacular name | Botanical name |
|-------|-------------|-----------------|----------------|
| 32.   | Lecythidaceae | Kumbhi/Kalindi  | Careya arborea |
| 33.   |             | Amaltas         | Cassia fistula |
| 34.   |             | Anjan           | Hanciwckia binata |
| 35.   |             | Asta            | Bauhinia racemose |
| 36.   |             | Imli            | Tamarindus indica |
| 37.   |             | Karanji         | Pongomia glabra |
| 38.   |             | Kachnar         | Bauhinia variegata |
| 39.   |             | Kalasiris       | Albizzia lebbeck |
| 40.   |             | Keyolar         | Bauhinia spp. |
| 41.   |             | Kheir           | Acacia catechu |
| 42.   |             | Khejra          | Prosopis julifera |
| 43.   |             | Gulmohar        | Delonix regia |
| 44.   |             | Chhekur         | Prosopis spicigera |
| 45.   | Fabaceae    | Chhichva        | Albizzia odoratissma |
| 46.   |             | Tinsa           | Ogenia dalbergiodes |
| 47.   |             | Dhowin          | Dolbergia paniculata |
| 48.   |             | Palas           | Butea monaprema |
| 49.   |             | Pagra           | Erythrina subsesia |
| 50.   |             | Babool          | Acacia nilotica |
| 51.   |             | Bijaasal        | Pterocarpus marsupium |
| 52.   |             | Renja           | Acacia leucophloea |
| 53.   |             | Safed siris     | Albizzia procera |
| 54.   |             | Safedkhair      | Acacia ferruginae |
| 55.   |             | Sehra           | Bauhinia retus |
| 56.   |             | Bhisom          | Delbergia latifolia |
| 57.   |             | Sissu           | Delbergia sisso |
| 58.   | Lythraceae  | Seja            | Lagerstroemia parviflora |
| 59.   | Malvaceae   | Pula            | Kypa calychna |
| 60.   |             | Kullu           | Sercula lanceolata |
| 61.   |             | Neem            | Azadiracta indica |
| 62.   | Meliaceae   | Bakain          | Melo azedarach |
| 63.   |             | Rohan           | Semylo febrifuga |
| 64.   |             | Gular           | Ficus glabrata |
| 65.   |             | Pakar           | Ficus infectio |
| 66.   |             | Paraspeepal     | Ficus retusa |
| 67.   | Moraceae    | Peepal          | Ficus religiosa |
| 68.   |             | Bargad/vad      | Raushangritha |
| 69.   |             | Bhahtoot        | Morus laevigates |
| 70.   | Moringaceae | Sahana          | Moringa pterygosperma |
| 71.   | Myrtaceae   | Jamun           | Syzygium cumini |
| 72.   |             | Gum tree        | Eucalyptus sp. |
| 73.   | Oleaceae    | Mokha           | Schnebera swietenioidas |
| 74.   | Arecaceae   | Khajoor         | Phoenix humilis |
| S. no. | Family          | Vernacular name | Botanical name            |
|--------|----------------|----------------|---------------------------|
| 75.    | Rhamnaceae     | Ghont          | *Zyphus xylopyra*         |
| 76.    | Rhamnaceae     | Ber            | *Zyphyus mauritana*       |
| 77.    | Aal            | Marinda tintoria |
| 78.    | Kem            | *Mitragyna parvifolia* |
| 79.    | Dikamali       | *Gardenia tasa* |
| 80.    | Tilwan         | *Wendlandia exarata* |
| 81.    | Rubiaceae      | Papra          | *Gardenia latifolia*      |
| 82.    | Feitara        | *Gardenia turgida* |
| 83.    | Bhawarsal      | *Hymenodictyon excelsum* |
| 84.    | Haldu          | *Adina cardifolia* |
| 85.    | Lokhandi       | *Ixora parviflora* |
| 86.    | Keth           | *Feronia Limonia* |
| 87.    | Bel            | *Aegle marmelos* |
| 88.    | Rutaceae       | Bilsena        | *Limonia Crenculata*      |
| 89.    | Meetheeneem    | *Murraya kaenjgi* |
| 90.    | Salmoloiaceae  | Semail         | *Salmola malabaricum*     |
| 91.    | Salvadoraceae  | Peelu          | *Salvadora oleoides*      |
| 92.    | Sapindaceae    | Kusum          | *Schleiehera trijuga*     |
| 93.    | Reetha         | *Sapindus lounifolius* |
| 94.    | Sapotaceae     | Mahuva         | *Madhuca indica*          |
| 95.    | Molsari        | *Murraya koelgi* |
| 96.    | Simaroubaceae  | Maharukh       | *Alkanthus indica*         |
| 97.    | Tilioceae      | Dhaman         | *Grewia tilaeflua*        |
| 98.    | Ulmaceae       | Chirol         | *Holoptelea integrifolia* |
| 99.    | Gamari         | *Grewia arborea* |
| 100.   | Verbenaceae    | Morpaye        | *Vetas peduncularis*      |
| 101.   | Sagaun/Teak    | Tectona grandis |

**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       | *Strabilthes callous*     |
| 2.     | Aamaranthaceae    | Chirchita       | *Achyroanthes aspera*     |
| 3.     | Anacardiaceae     | Adusa           | *Adhatoda vasica*         |
| 4.     | Apocynaceae       | Karonda         | *Carissa spinarum*        |
| 5.     | Asciepiadaceae    | Kurchi          | *Holarrhena antidysenterica* |
| 6.     | Cactaceae         | Oak             | *Calotropis gigantea*     |
| 7.     | Berberidaceae     | Sarkata         | *Argemone mexicana*       |
| 8.     | Coccaceae         | Nagfani         | *Optuttia dilleni*        |
| 9.     | Capparidaceae     | Heens           | *Capparis horrida*        |
| 10.    | Capparidaceae     | Kareel          | *Capparis aphylla*        |
| 11.    | Celastraceae      | Bekal           | *Gynnospora montana*      |
| 12.    | Asteraceae        | Gokhuru         | *Xanthium aspera*         |
| 13.    | Euphorbiaceae     | Jhondharli      | *Antidesina ghoschilla*   |
| 14.    | Chakhetan         | *Flugcia microcarpa* |
| 15.    | Tarwars           | *Cassia auriculata* |
| 16.    | Fabaceae          | Chumui          | *Mimosa rubicula*         |
| 17.    | Chipti            | *Desmodium pulchellum* |
Creepers: Total 19 Creepers species belong 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 | Gymnema sylvestris | Gymnema sylvestris       |
| 2.     | Chikta       | Marsdenia tenacissima | Marsdenia tenacissima    |
| 3.     | Combretaceae | Combretum ovalifolium | Combretum ovalifolium    |
| 4.     | Peevarvel    | Combretum decandrum   | Combretum decandrum      |
| 5.     | Dioscoreaceae| Diacorea daemons     | Diacorea daemons         |
| 6.     | Kavach      | Mucuna pruriens      | Mucuna pruriens         |
| 7.     | Karanj      | Caesalpinia sepiaria  | Caesalpinia sepiaria     |
| 8.     | Gaanj       | Melletia auriculata   | Melletia auriculata      |
| 9.     | Rathi       | Abrus precatorius    | Abrus precatorius       |
| 10.    | Leguminosae | Acacia cassia        | Acacia cassia            |
| 11.    | Palas Bel   | Butea superba        | Butea superba            |
| 12.    | Mahul       | Bauhinia vahli       | Bauhinia vahli           |
| 13.    | Ravni       | Acacia pennata       | Acacia pennata           |
| 14.    | Nasbel      | Spatholobus roxburghii | Spatholobus roxburghii   |

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.     | Gramineae    | Kus             | Eragrostis nees       |
| 2.     |              | Kusal           | Heteropogon contortus |
| 3.     |              | Kunda           | Ischaemum pilosum     |
| 4.     |              | Kaus            | Saccharum spontaneum  |
| 5.     |              | Kush            | Desmostachya bipinnata|
| 6.     |              | Khas            | Vetiveria zizaniodes  |
| 7.     |              | Gararu          | Coix gigentea         |
| 8.     |              | Gadela          | Coix lacrymojobi      |
| 9.     |              | Guner           | Themeda quadrivalvis  |
| 10.    |              | Chikula         | Chrysopogon montanus  |
| 11.    |              | Chhir           | Imperata cylindrica   |
| 12.    |              | Dub             | Cynodon daclylon      |
| 13.    |              | Poniya          | Schima sulcatum       |
| 14.    |              | Phuli           | Apluda varis          |
| 15.    |              | Phusel          | Iseliema laxum        |
| 16.    |              | Phooli          | Apluda mutica         |
| 17.    |              | Baas            | Dendracalamus strictus|
| 18.    |              | Katang baas     | Bambusa bamboos       |
| 19.    |              | Basu            | Sarghun halpense      |
| 20.    |              | Bhurbushi       | Eragrostis tenella    |
| 21.    |              | Marvel          | Dichanthium annulatum |
| 22.    |              | Gather          | Bothriochloa pertusa  |
| 23.    |              | Sen             | Cenchrus ciliaris      |
| 24.    | Convolvolaceae| Amarbel         | Cuscuta reflexa       |
| 25.    | Orchidaceae  | Archid          | Vanda tesselata       |
| 26.    | Loranthaceae | Banda           | Vascum nepalense      |
| 27.    |              | Bada            | Dendrophthoe fokata   |

Parasitic plant

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 eschelentus)
ii. Brinjal (Ringana Solanum melongena)
iii. Cabbage (Brassica ooraceae)
iv. Tomato (Lycopersicon lycopersicum)
v. Karela (Momordica charantia)
e. Pulses: The pulses cultivated in this region were Gram (Cicer arietinum); Mug (Vigna acontifolia), 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 Plants[33] and Red list of threatened vascular plants.[34]

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][42]

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 0.1% 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 plant species 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 releves 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 releve 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 releves 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 / DS4- 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 Gujrat 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), Sambar (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' 1' 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 thereunder 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.     | Bhopal     | Rabiyawad            |
| 2.     |            | Vurthi               |
| 3.     |            | Prabadhan            |
| 4.     |            | Stahphon             |
| 5.     |            | Punha                |
| 6.     |            | Banpur               |
| 7.     |            | Alampur              |
| 8.     |            | Amchha Kalan         |
| 9.     |            | Amchha Khurd         |
| 10.    |            | Ankalpur             |
| 11.    |            | Baheria              |
| 12.    |            | Bamhori              |
| 13.    |            | Bamuila              |
| 14.    |            | Bangsghan            |
| 15.    |            | Bari                 |
| 16.    |            | Bhiyanpur            |
| 17.    |            | Bineka               |
| 18.    |            | Biptanagar           |
| 19.    |            | Bithori              |
| 20.    |            | Borpani              |
| 21.    |            | Chora Kamraura       |
| 22.    |            | Damdongri            |
| 23.    |            | Dehgonon             |
| 24.    |            | Dhalla               |
| 25.    |            | Dimria               |
| 26.    |            | Ghana Kalan          |
| 27.    | Obedullahganj| Ghattpipaliya       |
| 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.   | Jamgarh |                 |
| 53.   | Madhamau|                 |
| 54.   | Padriya |                 |
| 55.   | Samnapur|                 |
| 56.   | Amargarh|                 |
| 57.   | Amdoh   |                 |
| 58.   | Babariakhal |     |
| 59.   | Bardha  |                 |
| 60.   | Barijhiri ka Pathar |   |
| 61.   | Budhni  |                 |
| 62.   | Imliya  |                 |
| 63.   | Johlapur|                 |
| 64.   | Sehore  |                 |
| 65.   | Kheri   |                 |
| 66.   | Malihar |                 |
| 67.   | Midghat |                 |
| 68.   | Nadiakeha|               |
| 69.   | Neemwilaheda |       |
| 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 lass 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, Part –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 IUCN and Bird Life International. 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.

**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.     | Accipitridae    | Black-winged kite            | Elanus caeruleus (Desfontaines, 1789)    | R      |
| 2.     | Black kite      | Mimus migrans (Boddaert, 1783)|                                          | R      |
| 3.     | Shikra          | Accipiter badius (Gmelin, 1788)|                                          | V      |
| 4.     | Changeable hawk-eagle | Nisaetus cirrhatus (Gmelin, 1788)|                                      | O      |
| 5.     | Tawny eagle     | Aquila rapax (Temminck, 1828) |                                          |        |
| 6.     | Crested serpent eagle | Spilornis cheela (Latham, 1790)|                                      |        |
| 7.     | Alaudidae       | Ashy-crowned sparrow-lark    | Eremopterix griseus (Kaup, 1836)         | R      |
| 8.     | Pied kingfisher | Ceryle rudis (Linnaeus, 1758) |                                          | R      |
| 9.     | Alcedinidae     | Common kingfisher            | Alcedo atthis (Tucker and Health 1994)  | R      |
| 10.    | White-throated kingfisher | Halcyon smyrnensis (Linnaeus, 1758)|                  | V      |
| 11.    | Black-capped kingfisher | Halcyon pileata (Boddaert, 1783)|                  | R      |
| 12.    | Eurasian teal   | Anas creca (Linnaeus, 1758)  |                                          | O      |
| 13.    | Northern shoveller | Anas clypeata (Linnaeus, 1758)|                  | O      |
| 14.    | Cotton teal     | Nettaius coronatellus (Gmelin, 1789) |                  | R      |
| 15.    | Knob-billed duck | Sarkidiornis melanotos (Pennant, 1769) |                  | R      |
| 16.    | Apodidae        | Alpine swift                 | Tachymarptis melba (Linnaeus, 1758)     | R      |
| 17.    | Little swift    | Apus affinis (JE Gray, 1830) |                                          | R      |
| 18.    | Grey Heron      | Ardea cinerea (Linnaeus, 1758)|                                          | R      |
| 19.    | Indian pond heron | Ardeola greyii (Sykes, 1832)|                  | R      |
| 20.    | Ardeidae        | Cattle egret                 | Bubulcus ibis (Linnaeus, 1758)          | R      |
| 21.    | Little egret    | Egretta garzetta (Linnaeus, 1766)|                  | R      |
| 22.    | Large egret     | Egretta garzetta(Linnaeus, 1766) |                  | R      |
| 23.    | Artamidae       | Ashy woodswallow             | Artamus fuscus (Vieillot, 1817)          | V      |
| 24.    | Small minivet   | Pericrocotus cinnamomeus (Linnaeus, 1766)|                | W      |
| 25.    | Campephagidae   | Scarlet minivet              | Pericrocotus speciosus (Latham, 1790)   | V      |
| 26.    | Black-faced cuckoo-shrike | Coracina novaehollandiae (Gmelin, JF, 1790)|                | V      |
| 27.    | Caprimulgidae   | Indian nightjar              | Caprimulgus asiaticus(Linnaeus, 1790)   | R      |
| 28.    | Charadriidae    | Red-wattled lapwing          | Vanellus indicus (Boddaert, 1783)       | R      |
| 29.    | Chloropseidae   | Blue-winged leafbird         | Chloropsis cochinchinensis (Gmelin, JF, 1789)|      | R      |
| 30.    | Ciconiidae      | White stork                  | Ciconia ciconia (Swinhoe, 1873)         | W      |
| 31.    | Cisticolidae    | Ashy prinia                  | Prinia socialis (Sykes, 1832)            | V      |
| 32.    | Grey-fronted quail-dove | Geotrygon caniceps (Gundlach, 1852)|                  | R      |
| 33.    | Yellow-footed green pigeon | Trenan phoenicoptera (Latham, 1790)|                  | R      |
| 34.    | Columbidae      | Rock pigeon                  | Columba livia (Gmelin, 1789)            | R      |
| 35.    | Eurasian collared dove | Streptopelia decaocto (Frivaldsky, 1838)|                  | R      |
| 36.    | Spotted dove    | Spilopelia chinensis (Scopoli, 1786) |                  | R      |
| 37.    | Coraciidae      | Indian roller                | Coracias benghalensis (Linnaeus, 1758)  | R      |
| 38.    | Corvidae        | Jungle crow                  | Corvus macrorhynchos (Wagler, 1827)     | R      |
| S. No. | Family     | Vernacular name                        | Scientific name                        | Status |
|-------|------------|----------------------------------------|----------------------------------------|--------|
| 39.   | Cuculidae  | Common hawk-cuckoo                     | Hierococcyx varius (Vahl, 1797)        | R      |
| 40.   |            | Koel                                   | Eudynamys scolopaceus (Linnaeus, 1758) | R      |
| 41.   | Dicaeidae  | Greater coucal                         | Centropus sinensis (Stephens, 1815)    | R      |
| 42.   |            | Fire-breasted flowerpecker             | Dicaeum ignipectus (Blyth, 1843)       | V      |
| 43.   |            | Fork-tailed drongo                     | Dicrurus adsimilis (Bechstein, 1794)   | R      |
| 44.   | Dicruridae | White-bellied drongo                   | Dicrurus caerulescens (Linnaeus, 1758) | R      |
| 45.   |            | Greater racket-tailed drongo           | Dicrurus paradiseus (Linnaeus, 1766)   | R      |
| 46.   | Estrildidae| Red avadavat                           | Amandava amandava (Horsfield, 1821)    | V      |
| 47.   |            | Tricoloured munia                      | Lanchura malacca (Linnaeus, 1766)      | O      |
| 48.   | Gruidae    | Common crane                           | Grus grus (Linnaeus, 1758)             | R      |
| 49.   |            | Sarus crane                            | Grus Antigone (Linnaeus, 1758)         | R      |
| 50.   | Hirundinidae| Wire-tailed swallow                   | Hirundo smithi (Leach, 1818)           | S      |
| 51.   | Laniidae   | Long-tailed shrike                     | Lanius schach (Linnaeus, 1758)         | R      |
| 52.   | Leiothrichidae | Jungle babbler                      | Turdoides striata (Dumont, 1823)       | R      |
| 53.   | Megalaimidae| Crimson-fronted barbet                | Megalaima rubricapilla (Gmelin, 1788)  | R      |
| 54.   | Meropidae  | Green bee-eater                        | Merops orientalis (Latham, 1801)       | R      |
| 55.   |            | Blue-tailed bee-eater                  | Merops philipinus (Linnaeus, 1767)     | R      |
| 56.   |            | Grey wagtail                           | Motacilla cinerea (Tunstall, 1771)     | R      |
| 57.   | Motacillidae| White wagtail                          | Motacilla alba (Linnaeus, 1758)        | R      |
| 58.   |            | White-browed wagtail                   | Motacilla maderaspatensis (Gmelin, 1789) | R      |
| 59.   |            | Western Yellow Wagtail                 | Motacilla flav (Linnaeus, 1758)        | V      |
| 60.   | Pipridae   | Tickell's blue flycatcher              | Cynips tickelliae (Blyth, 1843)        | R      |
| 61.   |            | Black redstart                         | Phoenicurus ochruros (Gmelin, 1774)    | S      |
| 62.   | Muscicapidae | African stonechat                   | Saxicola torquatus (Shelley, 1885)    | W      |
| 63.   |            | Pied bush chat                         | Saxicola caprata (Linnaeus, 1766)      | R      |
| 64.   |            | Blue-capped rock thrush               | Mantola cinclorhyncha (Vigors, 1831)  | R      |
| 65.   |            | Oriental magpie-robin                  | Copyschus salutaris (Linnaeus, 1758)  | R      |
| 66.   |            | Indian robin                           | Saxicolaides fulicatus (Linnaeus, 1766) | R      |
| 67.   | Nectariniidae| Purple sunbird                      | Cinnyris asiaticus (Latham, 1790)      | R      |
| 68.   | Oriolidae  | Eurasian golden oriole                | Oriolus oriolus (Linnaeus, 1758)       | O      |
| 69.   | Passeridae | House sparrow                          | Passer domesticus (Linnaeus, 1758)     | R      |
| 70.   | Phalacrocoracidae| Little Cormorant                   | Phalacrocorax niger (Vieillot, 1817)  | V      |
| 71.   |            | Large Cormorant                        | Phalacrocorax carbo (Linnaeus, 1758)   | V      |
| 72.   | Black Partridge       | Francolinus francolinus (Linnaeus, 1766) | R      |
| 73.   | Grey francolin        | Francolinus pondicerianus (Gmelin, JF, 1789) | V      |
| 74.   | Phasianidae | Jungle bush quail                     | Perdicularia asiatica (Latham, 1790)   | R      |
| 75.   | Red spurfowl          | Gallipeda spadicea (Gmelin, JF, 1789)  | R      |
| 76.   | Red junglefowl        | Gallus gallus (Linnaeus, 1758)         | O      |
| 77.   | Indian peafowl        | Pavo cristatus (Linnaeus, 1758)        | R      |
Table 12 Butterflies in the Study Area

| Family      | Scientific Name | Common name          | Relative abundance |
|-------------|-----------------|----------------------|--------------------|
| Papilionidae| Papilio polytes Linnaeus | Common Mormon | Common             |
| Pieridae    | Eurema hecabe Linnaeus | Common Grass yellow | Very Common        |
| Nymphalidae | Danaus chrysippus Linnaeus | Plain Tiger | Common             |
|             | Danaus genutia Cramer | Striped Tiger | Common             |
|             | Hypolimnas misippus Linnaeus | Danaid egg fly | Common             |
|             | Mycalesis perseus Fabricius | Common Leopard | Fairy Common       |
|             | Cynthia cardui Linnaeus | Painted Lady | Uncommon           |
|             | Junonia hiero Fabricius | Yellow pansy | Common             |
|             | Junonia orithya 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      | Agamida  | Common Garden Lizard         | Calotes versicolor (Cuvier, 1817) | Not listed             |
| 2      |          | Fan-Throated Lizard          | Sitana ponticeriana (Cuvier, 1817) | Not listed             |

Citation: Rathoure AK. Ecological status for Ratapani wild life sanctuary, Raisen (MP) India. Biodiversity Int J. 2018;2(2):179–196. DOI: 10.15406/bij.2018.02.00058
### Table 14 Mammals in Study Area

| S. No. | Family          | Scientific name                          | Common name         | Status as per IWPA 1972 |
|--------|-----------------|------------------------------------------|---------------------|-------------------------|
| 1.     | Antilopinae     | Antilope cervicapra (Linnaeus, 1758)     | Black buck          | Schedule – I; Part – I; 2 |
| 2.     | Antilopinae     | Boselaphus tragocamelus (Pallas, 1766)    | Blue bull           | Schedule-III            |
| 3.     | Antilopinae     | Tetracerus quadricornis (de Blainville, 1816) | Four horned Antelope | Schedule – I; Part – I; 8A |
| 4.     | Cervidae        | Cervus unicolor (Kerr, 1792)             | Sambhar             | Schedule - III          |
| 5.     | Bovidae         | Gazella bennettii (Sykes, 1831)          | Chinkara            | Schedule – I; Part – I; 5B |
| 6.     | Bovidae         | Canis aureus (Linnaeus, 1758)            | Jackal              | Schedule - II           |
| 7.     | Bovidae         | Vulpes benghalensis (Shaw, 1800)         | Indian fox          | Schedule - II           |
| 8.     | Canidae         | Canis alpines (Pallas, 1811)             | Wild Dog/Dhole      | Schedule - II           |
| 9.     | Canidae         | Canis aureus (Linnaeus, 1758)            | Jackal              | Schedule - II           |
| 10.    | Canidae         | Vulpes benghalensis (Shaw, 1800)         | Indian fox          | Schedule - II           |
| 11.    | Canidae         | Hyaena hyaena (Linnaeus, 1758)           | Siberian Tiger      | Schedule - I; Part- I; 39 |
| 12.    | Canidae         | Lepus nigricollis (F. Cuvier, 1823)      | Common Hare         | Schedule IV              |
| 13.    | Canidae         | Lepus nigricollis (F. Cuvier, 1823)      | Common Hare         | Schedule IV              |
| 14.    | Canidae         | Hystrix indica (Kerr, 1792)              | Common Porcupine    | Schedule IV              |
| 15.    | Canidae         | Lepus nigricollis (F. Cuvier, 1823)      | Common Hare         | Schedule IV              |
| 16.    | Canidae         | Lepus nigricollis (F. Cuvier, 1823)      | Common Hare         | Schedule IV              |
| 17.    | Canidae         | Hystrix indica (Kerr, 1792)              | Common Porcupine    | Schedule IV              |
| 18.    | Canidae         | Lepus nigricollis (F. Cuvier, 1823)      | Common Hare         | Schedule IV              |
| 19.    | Canidae         | Lepus nigricollis (F. Cuvier, 1823)      | Common Hare         | Schedule IV              |
| 20.    | Canidae         | Lepus nigricollis (F. Cuvier, 1823)      | Common Hare         | Schedule IV              |
| 21.    | Canidae         | Lepus nigricollis (F. Cuvier, 1823)      | Common Hare         | Schedule IV              |
| 22.    | Canidae         | Lepus nigricollis (F. Cuvier, 1823)      | Common Hare         | Schedule IV              |
| 23.    | Canidae         | Lepus nigricollis (F. Cuvier, 1823)      | Common Hare         | Schedule IV              |
| 24.    | Canidae         | Lepus nigricollis (F. Cuvier, 1823)      | Common Hare         | Schedule IV              |
| 25.    | Canidae         | Lepus nigricollis (F. Cuvier, 1823)      | Common Hare         | Schedule IV              |
| 26.    | Canidae         | Lepus nigricollis (F. Cuvier, 1823)      | Common Hare         | Schedule IV              |
| 27.    | Canidae         | Lepus nigricollis (F. Cuvier, 1823)      | Common Hare         | Schedule IV              |
| 28.    | Canidae         | Lepus nigricollis (F. Cuvier, 1823)      | Common Hare         | Schedule IV              |

**Note:** Some mammals are not listed in Schedule as per IWPA 1972.
Table 15 List of Fishes reported from the Study area

| S. no. | Family     | Common name | Scientific name                      |
|------|------------|-------------|---------------------------------------|
| 1    | Bagridae   | Singhad     | Mystus seenghala (Nelson 2006)        |
| 2    |            | Aur         | Mystus aur (Hamilton, 1822)           |
| 3    | Bagridae   | Bleekeri*   | Mystus bleakeri (Day, 1877)           |
| 4    | Caviidae   | Cavacius    | Mystus cavasius (Hamilton, 1822)      |
| 5    | Gengra*    |             | Ritta ritta (F. Hamilton, 1822)       |
| 6    | Sannval (Saul) | Sannval     | Channa marulius (F. Hamilton, 1822)   |
| 7    | Chanidae   | Sannval (Kabra) | Channa striata (Bloch, 1793)      |
| 8    | Chanidae   | Sannval**   | Channa punctatus (Bloch, 1793)       |
| 9    |             | Karra*      | Channa gachua (F. Hamilton, 1822)    |
| 10   | Cyprinidae | Katla       | Labca maha (Heckel, 1843)            |
| 11   |             | Rohu        | Channa gachua (F. Hamilton, 1822)    |
| 12   |             | Mrigal      | Cirrhasia mregalo (Bloch, 1795)      |
| 13   | Siluridae  | Padin       | Vallago attu (Bloch & Schneider, 1801) |
| 14   | Siluridae  | Gangarwar (Pabda)* | Ompok biyculatus (Bloch, 1794) |
| 15   | Sisoridae  | Andus*      | Bagarius bagarius (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     | Panthera tigris | Tiger       | Schedule-I; Part-I; 39      | Endangered A2abc; C1 ver 3.1 | Appendix I |
| 2     | Manis crassicaudata | Scaly ant eater | Schedule-I; Part-I; 28 | Endangered A3d+4d ver 3.1 | Appendix I |
| 3     | Panthera pardus | Panther/Leopard | Schedule-I; Part-I; 16B | Vulnerable A2cd ver 3.1 | Appendix I |
| 4     | Melursus ursinus | Sloth Bear | Schedule-I; Part-I; 31C | Vulnerable A3c ver 3.1 | Appendix I |
| 5     | Tetracerus quadricornis | Four horned Antelope | Schedule-I; Part-I; 8A | Vulnerable C2a(i) ver 3.1 | Appendix III |
| 6     | Gazella gazella | Chinkara    | Schedule-I; Part-I; 5B     | Least Concern ver 3.1 | Appendix III |
| 7     | Antelope cervicapra | Black buck | Schedule-I; Part-I; 2 | Least Concern ver 3.1 | Appendix III |
| 8     | Mellivora capensis | Indian Ratel | Schedule-I; Part-I; 29 | Least Concern ver 3.1 | Appendix III |
| 9     | Pavo cristatus | Indian Peafowl | Schedule-I; Part-III; 11 | Least Concern ver 3.1 | Not listed |
| 10    | Crocodile crocodylus | Crocodile | Schedule-I; Part II 1D | Not Assessed yet | Not listed |

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 bennettii*), 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 -I as per Wildlife Protection Act 1972. Panthera pardus (Leopard), Melursus ursinus (Sloth Bear) and Tetracerus quadricornis (Four-horned Antilope) are vulnerable species listed by IUCN and protected under Schedule -I. Other species protected under schedule -I are Gazella gazellabennetti (Chinkara), Antilope cervicapra (Black buck), Mellivora capensis (Indian Ratel), Crocodile crocodilus (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 money 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 -I 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.05,06

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Conflict of interest

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

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