



Implementing the Central Asian Flyway National Action Plan with special focus on preparing a site-specific activity plan and developing a bird sensitivity map

Landscape – Jaisalmer, Thar Desert

Sites – 1) DNP; 2) Deg Rai Mata Oran; 3) Pokhran; 4) Western part of the Thar Desert;

Additional site – 5) Khichan, Jodhpur

July 2021

Bombay Natural History Society

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- Maps, may vary regionally.

Maps - Shapefiles of village, roads, district overlaid on polygons of DNP sourced from the Office of DyCF, WL, Jaisalmer; polygons derived after discussions with Pokhran Field Firing Range (PFFR) and Border Security Force (BSF) to prepare the maps using ArcMap 10.6.1 software by Sujit Narwade, A. Mohan, Prasad Bolde

Concept and design - Sujit Narwade

Sketches - Saisha Singh

Photo credits

- **Cover** - Top: Dead Great Indian Bustard, after colliding with the high-tension powerlines near Deg Rai Mata temple by Sumer Singh Bhati.

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Final Report

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Contents

ACKNOWLEDGEMENT	10
ABBREVIATIONS	11
GLOSSARY/TERMS USED FREQUENTLY	11
EXECUTIVE SUMMARY	13
LANDSCAPE DETAILS	18
1.1 Site description.....	18
1.2 Habitat /Vegetation	19
1.3 Water sources	20
1.4 Threats to the habitat and birds.....	20
1.5 Great Indian Bustard (GIB)	21
BACKGROUND	22
GOAL	23
LITERATURE REVIEW	24
Avifauna of the Thar Desert.....	24
Account on migratory birds of the Thar Desert.....	24
OBJECTIVES.....	25
METHODS USED	26
Survey design for Landscape Survey	26
Team organization during the survey	26
Vehicle Survey.....	27
Point Count.....	27
Sign Survey	27
Mortality survey	27
Secondary information.....	27
Land Use Land Cover Analysis.....	28
GIS and mapping.....	28
Sensitivity mapping	29
RESULTS.....	30
Survey efforts in brief.....	30
Major habitats and threats (Fig 4 and 5).....	32
Distribution of GIB and MacQueen’s Bustard	35

Distribution of vultures and other raptors	37
Distribution of other key desert fauna in the survey area.....	38
Sensitivity mapping	39
Description of zones under sensitivity mapping.....	40
Site I - DNP AND SURROUNDINGS.....	45
1.1 Introduction.....	45
1.1.1 Land ownership	45
1.1.2 Other stakeholders	45
1.1.3 Management practices	45
1.1.4 Management issues	46
1.1.5 Potential non-protected areas for wildlife outside DNP	47
A) Salkha and Poonam Nagar (Habur)	47
B) Kanoi, Damodara, Khabha	47
C) Alaji ka Oran	47
1.2 Objective.....	48
1.3 Methods.....	48
1.4 Results	48
1.4.1 Birds of DNP and surrounding	48
3. Recommendations	51
SITE II - DEG RAI MATA ORAN.....	54
1.1 Introduction.....	54
2.1.1 Orans of Rajasthan.....	54
2.1.2 Deg Rai Mata Oran.....	55
2.2 Objective.....	56
2.3 Methods.....	56
2.4 Results	57
2.4.1 Communities residing in the Deg Rai Mata Oran	57
2.4.2 Livelihood of the people.....	57
2.4.3 Satellite enclosure of DNP near Deg Rai Mata Oran.....	57
2.4.4 Oran encompassing the villages.....	57
2.4.5 Waterbody inside the Oran.....	57

2.4.6 Oran, upcoming power grid and associated powerlines.....	58
2.4.7 Birds of Deg Rai Mata Oran	59
2.4.8 Mammals and Reptiles of Deg Rai Mata Oran.....	59
2.4.9 Bird mortality	59
2.5 Recommendations	64
SITE III - POKHRAN FIELD FIRING RANGE	68
3.1 Introduction.....	69
3.1.1 History of contribution by Indian Army in Ornithology	69
3.1.2 Role of Indian Army in the conservation of wildlife.....	69
3.1.3 Bishnoi Community	69
3.2 Objectives.....	69
3.3. Study area	70
3.4 Methods used	70
3.5 Results	71
3.5.1 GIB in PFFR and surrounding areas	71
3.5.2 Avifauna of the PFFR.....	75
3.5.3 Habitat restoration work being carried out by the BNHS in Khetolai area	76
3.5.4 Mammals and reptiles in PFFR.....	77
3.5.5 Wildlife-vehicle collisions (WVC) monitoring	77
3.6 Recommendations	81
SITE IV - WESTERN PART OF THAR DESERT, JAISALMER.....	84
4.1 Introduction.....	85
4.2 Objective.....	85
4.3 Study area	85
4.4 Methods.....	85
4.5 Results	87
4.5.1 Human settlement	87
4.5.2. Powerlines	87
4.5.3 Overgrazing.....	87
4.5.4 Poaching.....	87
4.5.5 Free-ranging dogs.....	87

4.6 Status of bustards	87
4.7 A haven for raptors	88
4.8 Recommendations	93
SITE V – KHICHAN: Abode of Kurjans.....	95
5.1 Introduction.....	95
5.1.1 Demoiselle Crane.....	95
5.1.2 Historical Aspect.....	96
5.1.3 Present congregation sites of Demoiselle Crane in the study area	96
A) Chugga Ghar.....	96
B) Naadi and Talab.....	96
5.2 Objectives	97
5.3 Methods.....	97
5.4 Results	97
5.4.1 Mortality of Demoiselle Crane.....	97
5.4.2 Locals in conservation.....	100
5.5 Recommendations	102
DISCUSSION.....	103
SITE-WISE RECOMMENDATIONS.....	104
REFERENCES.....	106
ANNEXURES.....	113
Annexure I) Team involved	113
Annexure II – Key bird species of the Thar Desert.....	113
Great Indian Bustard <i>Ardeotis nigriceps</i>	113
MacQueen's Bustard or Asian Houbara <i>Chlamydotis macqueenii</i>	114
Annexures III) Datasheets used in data collection	115
Point Count (200m radius) (10 minutes)	115
Sign Survey	116
Occupancy survey	116
Wildlife Mortality survey	116
Waterbody survey (50 metres periphery for sign survey).....	117
Annexure IV) Common plants seen in the study area	118

1. Leafless Milk Hedge <i>Euphorbia caducifolia</i>	118
1. Toothbrush Tree <i>Salvadora persica</i>	118
2. Vilaytati Babul <i>Prosopis juliflora</i>	118
3. Khejri <i>Prosopis cineraria</i>	118
4. Ber <i>Ziziphus mauritiana</i>	119
5. Giant Milkweed <i>Calotropis procera</i>	119
6. Kair <i>Capparis decidua</i>	119
7. Tarameera <i>Eruca sativa</i>	119
8. Khimp <i>Leptadenia pyrotechnica</i>	120
9. Senna <i>Cassia angustifolia</i>	120
11. Phog <i>Calligonum polygonoides</i>	120
12. Sania <i>Crotalaria burhia</i>	120
13. Sewan <i>Lasiurus scindicus</i>	120
14. Dhamasa <i>Fagonia indica</i>	121
15. Gathia <i>Dactyloctenium scindicum</i>	121
Annexure V) Birds documented in Thar Desert (literature review)	122
Annexure VI) Birds seen in the survey areas (BNHS 2020-2021)	133
Annexure VII) Birds seen in and around DNP.....	139
Annexure VIII) Birds seen in PFFR and surroundings	143
Annexure IX) Birds seen at Deg Rai Mata Oran during survey	146
Annexure X) Birds seen in the western part of the survey area	149
Annexure XI) Mammalian fauna observed in PFFR	152
Annexure XII) - List of mammals seen in Deg Rai Mata Oran	152

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ABBREVIATIONS

AMSL – Above Mean Sea Level, **BNHS** – Bombay Natural History Society, **BSF** – Border Security Force, **CAF** – Central Asian Flyway, **CBD** – Convention on Biological Diversity, **CITES** – Convention on International Trade of Endangered Species, **CMS** – Convention on Migratory Species of Wild Animals, **COP** – Conference of the Parties, **ETF** – Eco Task Force, **GIB** – Great Indian Bustard, **GPS** – Global Positioning System, **IUCN** – International Union for Conservation of Nature, **IGNP** – Indira Gandhi Nahar Project, **MoEFCC** – Ministry of Environment, Forest and Climate Change, **NAP** – National Action Plan, **NH** – National Highway, **WVC** – Wildlife-vehicle collisions, **PFFR** – Pokhran Field Firing Range, **PTT** – Platform Transmitting Terminal; **SDGs** – Sustainable Development Goals, **UNFCCC** – United Nations Framework Convention on Climate Change, **WII** – Wildlife Institute of India, **WPA** – Wildlife (Protection) Act, 1972

IUCN categories: **CR** – Critically Endangered, **EN** – Endangered, **VU** – Vulnerable, **NT** – Near Threatened, **LC** – Least Concern,

GLOSSARY/TERMS USED FREQUENTLY

- **CAMPA** – Compensatory Afforestation Fund Management and Planning Authority (CAMPA) is meant to promote afforestation and regeneration activities as a way of compensating for forest land diverted to non-forest uses.
- **Central Asian Flyway (CAF)** -- Covers a large continental area of Eurasia between the Arctic and Indian Oceans and the associated island chains. The Flyway comprises important migration routes of several bird species.
- **Chugga Ghar** – Meaning “Bird Feeding Home; it is a fenced area along with granary, created by the locals of Khichan Village, Phalodi Tehsil, Jodhpur. The Chugga Ghar draws inspiration from late Shri Ratanlal Maloo, a representative of the Jain community in Khichan who started feeding grains to birds, especially the Demoiselle Crane.
- **Community Reserve** – land owned by a community and managed by a committee represented mainly by local village representatives.
- **Conservation Reserve** – land owned by the Forest Department usually found around the Protected Areas (PAs) like National Parks and Wildlife Sanctuaries. A committee represented by the Forest Department and local village representatives manage it.
- **Dhani** – It is a type of hamlet in which the settlement/s are fragmented into several units separated from each other.
- **Dukhan/Deccan** - *Deccan* or *Dukhan*, as called in Persian or Urdu, is a large high raised/tailed area south of the Gangetic Plains tapering into the Indian Ocean like a wedge, surrounded by the Eastern and the Western Ghats and joining the Bay of Bengal and the Arabian Sea ultimately.
- **Gauchar** - Also known as *Gauchar Bhumi*, it is, as recorded in settlement records, a pasture land used as grazing land for the cattle of a village/villages.

- **Guzzler** - It is an artificial water harvesting structure, specially designed to collect and store rainwater for the consumption of wild animals and livestock in the dry seasons. It consists of two parts - a collection lid that collects the water and a storage tank situated below the collection lid for storage.
- **Khadeen** - Low line water-logged area with good vegetation
- **Khichan/Kheechan** - Village from Phalodi tehsil, Jodhpur district that sees large congregations of Demoiselle Crane.
- **Naadi** - A man-made bund created to preserve any natural drainage of seasonal streams in the low-lying areas, often occurring close to settlements, which may or may not be a perennial source of water. It is an important source of water for humans and their livestock.
- **Oran** - These are the sacred grooves, worshipped and conserved by the local or indigenous people. The ownership of the land mainly remains with the trusts devoted to some local god/goddess.
- **Pokhran/Pokaran** - Runn is a tract of sand-flat or salt-bog, which is often covered by land floods. Term means land of five runns.
- **Talab** - A natural waterbody with a large catchment area that may or may not be a perennial source of water.
- **Tamrapatra** - An inscription written down on copper plates in the medieval period, which has some historical/ancient information about the people, region, structure found at particular place
- **Tanka** - It is a traditional man-made structure for rainwater harvesting common to the Thar Desert; it provides water security to people in the dry seasons. The stored water in Tanka is generally used for drinking purpose.

EXECUTIVE SUMMARY

Grasslands are among the most neglected ecosystems, often treated as wasteland or pasture. India's Protected Area network covers only a minuscule expanse of our grasslands (<1% are officially protected). However, they provide a wide range of ecosystem services and support numerous threatened species, including the bustard species. Bustards are considered as flagship species of grasslands owing to their habitat association and charismatic nature. The larger species like Great Indian Bustard (GIB) are considered 'extinction prone' due to their slow life-history traits. Several issues plague the GIB in the last remaining grasslands of the Thar Desert landscape, especially the non-protected areas. These include vanishing grasslands; habitat destruction and deterioration; over-grazing; infrastructural developments such as the construction of roads, electric poles, and new renewable energy projects like wind turbines and solar panels; mining; industrialization; threats from high tension powerlines; and poaching.

Since the 1970s, BNHS has been involved in chalking out conservation strategies for the grassland birds. One such was a pioneering decade-long study on the GIB, initiated in the 1980s. Because of a patchy approach focusing only on the meagre protected areas in the region, lack of a wider, landscape-based outlook for the conservation of the vast mosaic of grasslands, scrub forests, farmlands, villages, rivers, small and big cities, and the upcoming industrial areas, the GIB has become locally extinct in many areas and now remains confined to the Thar Desert. Apart from GIB, a large congregation of raptors including vultures and others like cranes are seen at various sites on the Thar Desert. There is especially an increase in the congregation of the birds during early winter arrival and late winter departure period. Therefore, on priority, BNHS selected the Thar Desert, Jaisalmer as a landbird site under the project "Implementing the Central Asian Flyway (CAF) National Action Plan with special focus on preparing a site-specific activity plan and developing a bird sensitivity map."

Since GIB is found mainly in two pockets, continuous field data was collected from the Desert National Park (DNP) and its surrounding areas by project volunteer Mr Musa Khan, a naturalist from the village Neemba and the Pokhran area by the local BNHS staff Mr Pankaj Bishnoi. Landscape-level surveys were carried out from September to November 2020 and March to April 2021. A team of six surveyors conducted the surveys in two vehicles. A total area of ~ 36,100 sq. km divided into 116 grids of 15X15 sq. km was covered. At each 2-km interval of vehicle occupancy, a point count was performed for 10 minutes and a total of 3,306-point counts (33,060 minutes or 551 hrs) were completed. A distance of about 29,000 km was covered by vehicle surveys and GPS tracks were saved for the mapping. Instead of quantitating in this report, the distribution data has been provided in the form of maps.

Based on continuous field observations, we estimate that there are around 15–20 GIB individuals in DNP, 20–25 individuals in Pokhran Field Firing Range (PFFR), 10–15 individuals scattered across the boundary of India and Pakistan, 16 birds in

captivity under the conservation breeding programme being run by Wildlife Institute of India (WII) and Rajasthan Forest Department. We are afraid to say that not more than 75 individuals of GIB are left in Rajasthan. The GIB's activity and movement was found mainly limited to the north DNP portion. There is no recent sighting of DNP recorded from the down south portion in the recent past.

A total of 130 species of avifauna were observed during the survey in and around DNP including 26 species of raptors. Of them, the Critically Endangered included White-rumped Vulture *Gyps bengalensis*, Sociable Lapwing *Vanellus gregarious*, Red-headed Vulture *Sarcogyps calvus*, and Indian Vulture *Gyps indicus*. Endangered raptors included Steppe Eagle *Aquila nipalensis*, Egyptian Vulture *Neophron percnopterus*, and Saker Falcon *Falco cherrug* and Vulnerable included species such as Greater Spotted Eagle *Clanga clanga*, Eastern Imperial Eagle *Aquila heliaca*, Indian Spotted Eagle *Clanga hastata* and Tawny Eagle *Aquila rapax* were seen. DNP and its surrounding areas are also home to other Vulnerable species like Yellow-eyed Pigeon *Columba eversmanni* and White-browed Bushchat *Saxicola macrorhynchus*. Since DNP is a Protected Area, there is no immediate threat to the birds and habitat but the rationalisation of the boundaries needs to be tackled carefully by creating more enclosures for management through public consultations. Salkha, Kanoi, Damodara, Khabha and Alaji ka Oran are the sites outside DNP being used by the GIB intensively. Long-term monitoring and a better understanding of the ecology of the birds inside and on the fringes of DNP is essential.

Devikot area is becoming a hub for upcoming new renewable energy projects, power substation grid, and high-tension powerlines. BNHS team has been visiting the Rasla-Sanwata near Devikot occasionally since 2019. On September 16, 2020, Mr Sumer Singh Bhati from Sanwata village reported the death of a GIB because of collision with the newly installed high-tension powerlines near Deg Rai Mata Oran (sacred grove). The site is located in the Devikot area, Fategarh tehsil of Jaisalmer district almost 50 km away to the east of Jaisalmer city. In 2004, approximately 5,817 hectares of land was registered under the name of Deg Rai Mata Temple Trust. Apart from GIB, eight species of raptors including the Endangered Egyptian Vultures, Vulnerable Tawny Eagle, and Near Threatened Cinereous Vulture were also found dead due to electrocution or a collision with the high-tension powerlines erected in 2020. To design a strategy for the conservation of birds in the area, it is crucial to carry out a cumulative impact assessment study, reroute the high-tension powerlines away from the sacred grove, conduct long-term monitoring of birds and study the impact of land-use changes on them.

PFFR is one of the eight Field Firing Ranges of the Indian Army situated in the state of Rajasthan. This is one of the biggest field firing ranges of the Indian Army, surrounded by villages such as Khetolai, Loharki, Chacha, Odhaniya, Chandhani, Askandra, Ajasar, and Didhoo. Regular military exercise in this landscape and 24x7 surveillance makes it one of the strictly monitored areas, which also makes it a safe

haven for the flora and fauna of the desert ecosystem. Almost throughout the year, the GIB spends time inside PFFR, except in winter when a few birds visit the surrounding farmlands. Their sightings are conveyed to the BNHS team by the army personnel and the locals. With the permission of the Indian Army, the team conducted surveys in November 2020 and March 2021. Apart from GIB, 91 bird species including the Critically Endangered Sociable Lapwing *Vanellus gregarious*; Endangered Egyptian Vulture *Neophron percnopterus* and Steppe Eagle *Aquila nipalensis*; Vulnerable Common Pochard *Aythya ferina*, Eastern Imperial Eagle *Aquila heliaca*, MacQueen's Bustard *Chlamydotis macqueenii*, Tawny Eagle *Aquila rapax* and Yellow-eyed Pigeon *Columba eversmanni* were seen here. PFFR and the adjoining areas are found to be not only the most promising sites but also the last refuge for the wild population of GIB and therefore need to be spared from any kind of heavy infrastructures like solar, wind projects and high-tension powerlines.

Today, a major area in the far western Thar Desert is under the control of the Border Security Force (BSF) where movement of civilians is restricted. With the permission of the North and South Sectors of BSF, BNHS conducted surveys in these areas from March 25 to April 10, 2021. Tributaries of Indira Gandhi Nahar Project (IGNP) ran across the east-south side of the study area. The Bharatmala project connects border places by wider road highways, separating the untouched western part of the Thar Desert from the rest of the study area. The landscape was marked by dunes, grasslands, shrubland, rainfed cropland, canal/borewell supported cropland. Surveys confirmed the presence of GIB (footprints) in only two locations (one near Longewala and one near Sadaner-Bahla). A total of 27 species of raptors including Critically Endangered Red-headed Vulture *Sarcogyps calvus*, White-rumped Vulture *Gyps bengalensis*, Endangered Egyptian Vulture *Neophron percnopterus*, Steppe Eagle *Aquila nipalensis*, Vulnerable Tawny Eagle *Aquila rapax*, Indian Spotted Eagle *Clanga hastata*; Near Threatened Cinerous Vulture *Aegyptius monachus*, Himalayan Griffon *Gyps himalayensis*, Laggar Falcon *Falco jugger* and Pallid Harrier *Circus macrourus* were reported from the entire border area. Sensitization of the BSF personnel to curb illegal hunting and seasonal surveys are essential to design conservation strategies in this area.

Sevaram Mali, a small shop owner who resides near the Chugga Ghar (bird feeding site where people provide grains) in Khichan village, Phalodi tehsil, Jodhpur district, has now become a full-time guardian of the Demoiselle Cranes wintering there in thousands. He started taking care of the injured birds, mostly those that were chased by dogs or injured due to collision with the powerlines. Sevaram started documenting the injured birds he rescued and got them treated with the help of a local veterinarian. A total of 234 dead birds were reported between 2010 and 2021 in Khichan and surrounding areas. Most of the dead individuals were found at Vijaysagar Talab and Ratdi Naadi, the two most important roosting sites of the Demoiselle Cranes. Chugga Ghar is their major foraging site. The cause of these mortalities was identified as food poisoning, collision with powerlines, attack by free-ranging dogs, and injuries from Chinese Manja (kite flying threads). On several occasions, it was observed that the birds were hunted down by the free-

ranging dogs. To resolve this issue, the villagers of Khichan, with the help of the local administration, covered the entire water bodies with chain-linked fencing. Along with this, the local people pressurised and ensured that the 33kv powerline passing from Vijaysagar Talab was laid underground. Efforts by Sevaram and the villagers of Khichan, through a legal battle, ended up in the cables around the Chugga Ghar being laid underground. Additionally, a conservation reserve has been proposed near Teejaniyo ki Naadi to carry out effective and participatory conservation planning for protecting the Demoiselle Cranes in *Kurja* village, Khichan.

Individual development projects alone may have minor impacts on the environment, but collectively a large number of projects can pose a significant impact. The cumulative impact analysis should consider incremental impacts of various development activities combined with the impacts of other land-use changes. It should be ensured that key areas of conservation importance and sensitivity are not considered for development projects, especially ranges with threatened birds including Critically Endangered, Endangered and Vulnerable species. We hope this report will help take a top-down approach where the landscape, habitat and the local people sharing their space with these species will be considered for any form of conservation planning.

IMPLEMENTING THE CENTRAL ASIAN FLYWAY NATIONAL ACTION PLAN

WITH A SPECIAL FOCUS ON PREPARING A SITE-SPECIFIC ACTIVITY PLAN AND DEVELOPING A BIRD SENSITIVITY MAP



JULY 2021



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LANDSCAPE DETAILS

- **Site Name:** Thar Desert of Rajasthan, India (See the map in Fig 1)
- **Site Type:** Land bird site for semi-arid grassland species
- **District:** Jaisalmer, Barmer, Bikaner, and Jodhpur
- **State:** Rajasthan, India
- **Biogeographic Zone:** The area falls in Desert Biogeographic Zone.
- **Forest Type:** Scrub Forest (Champion and Seth 1968)
- **Protection Status:** Only Desert National Park (Jaisalmer and Barmer) and Gajner Wildlife Sanctuary (Bikaner) falls under Protected Areas
- **Altitude:** The general elevation in the sandy plain area is 100 m amsl to 150 m amsl and in the Central, South and Southeast direction, it is 250m amsl to 300m amsl (as published by the Ground Water Department in their Hydrogeological Atlas of Rajasthan -Jaisalmer District, 2013)
- **Total Area:** The Thar or Indian Desert is one of the smallest deserts in the world, but most thickly populated. It is also known for its great civilization in Ghaggar and the Indus River basin. The total forest area is 2.73 million ha, which constitutes 8% of the geographic area of the state (Forest Survey of India (2019)) and covers 2,08,751 sq. km in Rajasthan alone (Rahmani 1997a).
- **Rainfall:** The monsoon winds bring very scanty rains. Rainfall in the Thar desert varies from less than 150 mm in the extreme west to 400 mm in the east towards Aravalli. Nearly 85 % of the rains are received during the monsoon season i.e., from June to September.
- **Temperature:** The year can be divided in to three seasons: Winter (October to March), Summer (April to June), and Monsoon (July to September). June is the hottest month and January is the coldest. The temperature varies from 2^oC in winter to 48^oC in summer.
- **Wetland Type:** Canal, tanks and reservoirs are the primary wetlands. Development of large water bodies due to water seepage from the Indira Gandhi Nahar Project, IGNP attracts many water birds and other species that were not found earlier in the Thar region (Rahmani 1997b).
- **Habitat Available:** The major part of the Thar is occupied either by dry open grassland or by grassland scattered with trees and thorny bushes (Gupta 1975). Most of the other vegetation consists of perennial short, thorny shrubs and herbs that are resistant to drought while sand dunes form 58% of the desert (Shankarnarayanan 1988).

1.1 Site description

Rajasthan can be divided into four major physiographic regions, (a) the western desert with barren hills, level, rocky plains and sandy plains. (b) the Aravalli hills: running south-west to north-east starting from Gujarat and ending in Delhi, (c) the eastern plains with rich alluvial soil and (d) the south-eastern plateau.

The Thar Desert is located at the crossing where Palaeartic, Oriental and Saharan elements of biodiversity are found (Baqri and Kankane 2002). The desert spreads to Punjab in Firozpur, Sangrur and Bhatinda districts in the north and Mahendragarh

and Hisar districts of Haryana in the northeast. On the eastern side lies the Aravalli Mountain ranges starting from north Gujarat and extending up to Delhi. Thar-Parkar, Cholistan and Thal deserts of Pakistan are on the western side of the Thar desert. In the south, it extends into Gujarat mainly in Kachchh, Mehsana and Banaskantha districts, and to some extent in the Saurashtra region. The Thar Desert extends into Pakistan but 62% of it is present in the 11 districts of western Rajasthan.

IBA Code (if available)

The sites that would be covered are listed below, four of which are recognized as **Important Bird and Biodiversity Areas** in the Thar region by the Bombay Natural History Society, Mumbai in the worldwide programme of Birdlife International (Rahmani et al. 2016).

IBA Site Code	Site Name	District
IN-RJ-03	Desert National Park	Jaisalmer, Barmer
IN-RJ-04	Bap-Diyatra	Bikaner
IN-RJ-08	Khichan	Jodhpur
IN-RJ-28	Jorbeer	Bikaner
-	Pokhran	Jaisalmer
-	Mohangarh	Jaisalmer
-	Indo-Pak Border areas	Jaisalmer

1.2 Habitat/Vegetation

The major portion of the Thar is occupied either by dry open grassland or by grassland interspersed with trees and thorny bushes (Gupta 1975). The bulk of the vegetation consists of stunted, thorny or prickly shrubs and perennial herbs capable of resisting drought (Bhandari 1990, Shetty 1994). The main grass type of the Thar is *Dichanthium-Lasiurus-Cenchrus* (Dabadghao and Shankarnarayan 1973). Nearly 58% of the Thar is covered with sand dunes and interdunal valleys.



Habitat variation in different sites © Sujit Narwade

Many shifting dunes that have stabilized are covered with *Capparis decidua*, *Calotropis procera*, *Calligonum polygonoides*, *Acacia Senegal*, *Prosopis cineraria*, *Aerva javanica*, *Aristida adscensionis* and other psammophytic species (Shetty 1994). The major grasses and sedges are *Eleusine compressa*, *Eragrostic ciliaris*, and *Dactyloctenium aegyptium*. The most famous saline depressions are Taal Chapper,

Didwana, Pachpadra, Lunkaransar and Kuchaman. The important species of plantations found here are *Acacia* spp., *Dalbergia sissoo* and *Azadirachta indica*.

1.3 Water sources

The major water divide in the state of Rajasthan is the Aravalli Range. The area to the east is well-drained by several integrated drainage systems, whereas that in the west has only one, the Luni drainage system, which is rainfed. Canal, tanks and reservoirs are the primary aquatic habitats. The creation of a large water bodies due to water seepage from the IGNP attracts many water birds and other species that were not found earlier in the Thar region (Rahmani 1997b). Reservoirs such as those at Jawai Bandh and Hemawas harbour many species of waterfowls because of sufficient food availability (Sharma and Mehra 2009)

The Desert National Park, for instance, has no perennial waterbody. Water accumulates during monsoon in several low-lying areas, which are then used for household and cultivation purposes. Due to water scarcity, the locals harvest the rain water in artificial structures locally known as *Tanka*, *Naadi* and *Talab* that are present in most villages. In some parts of the Desert National Park, authorities have constructed artificial water sources called *Guzzlers* to ensure water supply to wildlife (Rahmani 1997b).



Provision of water through IGNP canal has led to drastic changes in the vegetation as well as wildlife in the Thar Desert © Sujit Narwade

1.4 Threats to the habitat and birds

Some of the threats to the habitat and birds of the Thar region:

1. **Habitat destruction and deterioration:** The Thar region being the most densely populated desert in the world – the human population density is 84 per sq. km compared to 3–9 per sq. km in other deserts (Baqri and Kankane 2001) – has a serious biotic pressure on its ecosystem and natural resources. There have been substantial changes in the habitats following alterations in the traditional land-use pattern (Sharma and Mehra 2009), conversion into agricultural fields.
2. **Over-grazing:** Easy availability of drinking water has tremendously increased the livestock. Earlier grazers used to lead a nomadic life, leaving the desert during summer when water was limited; but they are now present throughout the year, leading to severe pressure on the land.

3. **Infrastructural Developments:** Another major reason for habitat fragmentation is infrastructural development such as construction of roads, electric poles and renewable energy projects like wind turbines and solar panels, mining and industrialization. DNP for example has many windmills outside the limits of the park boundary causing obstructions in the flight routes of many bird species.
4. **Poaching:** Poaching is one of the major problems in the area, especially in the non-protected zones.



Because of agricultural expansion and overgrazing, the grasslands of the Thar Desert are seeing a fast decline
© Sujit Narwade

1.5 Great Indian Bustard (GIB)

Great Indian Bustard *Ardeotis nigriceps* is an agro-grassland/grassland obligatory bird, endemic to the Indian Subcontinent, belonging to the family Otididae. It is a Critically Endangered species as per the IUCN Red Data List. It is locally known as Godawan in the Thar desert. The species is sexually dimorphic with the male possessing a distinct gular pouch that plays a vital role during mating display. GIB is an omnivorous bird. The current viable population is less than 100-150 individuals (Dutta *et al.* 2017).

The species mainly survives in the Thar desert of Rajasthan. There are less than 150 birds in the Thar Desert, Rajasthan (WII 2020); ~ 6-7 birds in Gujarat (per. comm. Devesh Gadhvi; ~ 2-3 in Maharashtra (per. comm. Bhagwat Mhaske from Nannaj, Solapur and B.T. Lalsare from Warora, Chandrapur); ~ 10 birds in Karnataka (per. comm. Samad Kottur from Hospet); and ~ 3-4 Andhra Pradesh (per. comm. Dr Ranjit Manakadan, BNHS). However, if the present trend continues, the GIB, which is already locally extinct from 90% of its former range, may become extinct from the

wild. In Rajasthan, viable populations of GIB are found only in two pockets, the Desert National Park and Pokhran area.

The Wildlife Institute of India (WII) and the Bombay Natural History Society (BNHS), in collaboration with other conservation partners (WWF, TCF and Aranyak), developed a “Guidelines for State Action Plans for Resident Bustards’ Recovery Programme” document (Dutta et al. 2013), which was published by the Ministry of Environment, Forest and Climate Change (MoEFCC) to lead a scientific bustard conservation management. This National Recovery Plan advocated a multi-pronged landscape-level approach to save the GIB involving: a) stringent protection and informed management of breeding enclosures, b) mitigation of threats and compatible livelihoods in the adjoining non-breeding habitats, and c) establishment of the captive population as an insurance against extinction.

As a Party to the Convention on Migratory Species, India successfully proposed the listing of the GIB on Appendix I of the Convention and initiated a Concerted Action with neighbouring Pakistan to advance conservation measures for the species.

BACKGROUND

India is an important wintering site for several landbirds and raptor species, which migrate from Europe, Africa, and Central Asia. At least 440 species of migratory birds from three flyways (CAF, East Asian Australasian Flyway, and Asian East African Flyway) are reported to visit the Indian subcontinent. To address their needs and to identify coordinated actions to conserve those species, the MoEFCC launched a five-year National Action Plan for the conservation of migratory species (2018 to 2023). The National Action Plan (hereinafter NAP) for the conservation of migratory birds and their habitats states the national priority and specific actions required to ensure healthy populations of migratory species in India and within their range across the flyway.

The NAP aims at enabling national- and state-level policy makers responsible for the conservation and management of a habitat, its stakeholders and the society to take coordinated actions for securing and enhancing the migratory bird population. To achieve this goal, the National Action Plan is structured under six interrelated components: 1. Species conservation, 2. Habitat conservation and sustainable management, 3. Capacity development, 4. Communication and outreach, 5. Research and knowledgebase development 6. International cooperation. In addition, it calls for the establishment of a network of internationally important sites to promote the conservation of migratory birds in the CAF. The action plan also urges to take up more effective planning for the long-term conservation of migratory birds in the country and for the region.

Various resolutions have been passed in the CMS. CMS Resolution 7.5 on Wind Turbines and Migratory Species, Bern Convention Recommendation No. 110 on

minimizing the adverse effects of overground electricity transmission facilities (powerlines) on birds and the Budapest Declaration on bird protection and powerlines adopted in 2011 focus on urging the parties to implement various guidelines to avoid an adverse impact due to the development of energy sector. Renewable energy and migratory species resolution were adopted by the Conference of the Parties (COP) at its 12th Meeting in Manila during October 2017; it endorses the document “Renewable Energy Technologies and Migratory Species: Guidelines for Sustainable Deployment”. It is noteworthy to mention here that India has been one of the party members in CMS since 1983. The CMS COP 2020 was organized in India in February 2020, with the GIB as its mascot. BNHS was one of the important NGOs that played a crucial role in the conference proceedings. GIB was one of the ten new species that were added to the CMS Appendices. It was added under Appendix 1, the category comprising migratory species that are in danger of extinction throughout all or a significant portion of their range.

Hence, it is necessary to develop a strategic bird sensitivity map that will play a crucial role in selecting safer locations for the installation of new wind turbines/solar panels and managing the existing projects. This sensitivity map will provide a strategic view of the habitat and the bird species that are sensitive to infrastructure development and considered for conservation while planning wind/solar farms.

This proposed study aims to prepare suitable site-specific actions to be taken by the state governments to successfully implement the NAP, which will help in conserving the migratory birds and their habitats in the country. Moreover, site-based management actions will be helpful to adhere to India’s commitment to International agreements / conventions like Ramsar Convention; Convention on Biological Diversity (CBD); Convention on the Conservation of Migratory Species of Wild Animals (CMS); and sister agreements under the CMS, particularly CAF; Convention on International Trade of Endangered Species (CITES); United Nations Framework Convention on Climate Change (UNFCCC); and Sustainable Development Goals (SDGs). The biodiversity values of the wetlands provide additional strength for protecting the wetlands.

GOAL

Though the study had set six targeted activities under the CAF project in the Thar Desert, due to the outbreak of the Covid-19 pandemic, it was decided to focus on understanding the status and distribution of the GIB, which is highly sensitive to land-use changes, and other threatened birds for preparing a sensitivity map and site-wise action plans.

LITERATURE REVIEW

Avifauna of the Thar Desert

Nearly 250 bird species were reported from the Thar region of Rajasthan in the late 1990s (Rahmani 1997a, b). Later after a 3-years study, a total of 272 bird species were recorded in the Thar region of which 223 species were residents and 49 were migratory species (Sivaperuman *et al.* 2009).

The most important threatened bird species found in the desert region is one of the rarest bustards of the world, the Great Indian Bustard *Ardeotis nigriceps*. It is one of the Critically Endangered birds enlisted in the Red Data Book of IUCN. Studies on the bustards in the 1980s estimated that more than half of the GIB in India are present in Rajasthan, mainly in the Thar Desert (Rahmani and Manakadan 1990). Of the eleven arid and semi-arid districts of Rajasthan (Chouhan 1988), the bustard was found in six districts, namely Bikaner, Jodhpur, Jaisalmer, Barmer, Pali and Jalore (Rahmani 1997a). The GIB is still widely but thinly distributed in many parts of DNP. Important bustard areas are Sudasari, Suers, Myajlar and Khuri. In the 1980s, during summer, up to 100 bustards were seen in and around Sudasari but the number is now much less. Nevertheless, Sudasari is still the best area in DNP to spot these birds.

Stoliczka's Bushchat *Saxicola macrorhyncha* is another threatened bird of the arid and semi-arid areas (Rahmani 1994, 1997c, d). It was quite common in some areas (e.g., Diyatra) and absent in seemingly suitable habitats (Rahmani 1994, 1997b). It is frequently seen in and around Sam and Sudasari enclosures, but it is likely to be more widely distributed. The White-rumped Vulture *Gyps bengalensis* and the Indian Vulture *Gyps indicus* were once common in the desert (Rahmani 1997c) but have declined drastically. The Black-bellied Sandgrouse *Pterocles orientalis*, Houbara or Macqueen's Bustard *Chlamydotis macqueenii*, Demoiselle Crane *Grus virgo* and many other are among the important migratory bird species found in the desert.

Account on migratory birds of the Thar Desert

The Thar region is visited by a wide range of migratory bird species each year from the Himalayas and Central Asian countries. The wetlands across the region provide a suitable habitat for many winter visitors. Moreover, water pools created due to seepage from the IGNP canal and also the saline wetlands like Deedwana attract many species of migratory waterfowls and waders, including the Lesser Sand Plover *Charadrius mongolus*, Eurasian Curlew *Numenius arguata*, Curlew Sandpiper *Calidris ferruginea*, Whiskered Tern *Chlidonias hybridus*, Black-headed Gull *Larus ridibundus* and Pallas's Gull *Larus ichthyaetus* (Sivaperuman *et al.* 2009).

The semi-arid habitat of the Thar region is ideal for ground-dwelling birds such as the MacQueen's Bustard *Chlamydotis macqueenii*, Black-bellied Sandgrouse *Pterocles orientalis*; large flying birds such as Common Crane *Grus grus* and Demoiselle Crane *Grus virgo*; passerines like Sind Sparrow *Passer pyrrhonotus*, Spanish Sparrow *Passer hispaniolensis*, European Chiffchaff *Phylloscopus collybita*, Lesser Whitethroat *Sylvia curruca* along with several migratory vulture species like the Himalayan Griffon

Gyps himalayensis and Cinereous Vulture *Aegypius monachus* (Chhangani 2009). The Thar habitat is crucial not only for the resident bird population but also for the migrants.

OBJECTIVES

1. To understand the distribution of the resident and migratory bird species.
2. To create a sensitivity map for the Thar Desert using the distribution data of threatened species such as Great Indian Bustard, vultures and other desert fauna.
3. To provide recommendations for immediate conservation actions to be taken at selected sites - DNP, Deg Rai Mata Oran, Pokhran, western part of the Thar Desert and Khichan.

METHODS USED

Survey design for Landscape Survey

Based on the past and present sighting records of the Great Indian Bustard, surveys were planned in Jaisalmer and parts of Barmer, Bikaner and Jodhpur districts of Rajasthan (see map in figure 1). Species and habitat data were collected using a systematic grid-based vehicle survey. Around 36,000 sq. km of the survey area was divided into grids of 225 sq. km (15 km × 15 km). Grids were planned to cover habitats excluding human populated areas (See Fig. 2 on page 28 under results section). Each grid was surveyed along the approachable dirt roads of 25 ± 5 km length (continuous or broken tracks based on accessibility). Surveys were conducted in the early morning (0600–1100) and late afternoon (1600–1900) when birds/animals are most active. If the weather condition was good, day-long surveys were conducted. The speed of the vehicle was maintained between 15–20 km/hr during the survey (Dutta et al. 2014).

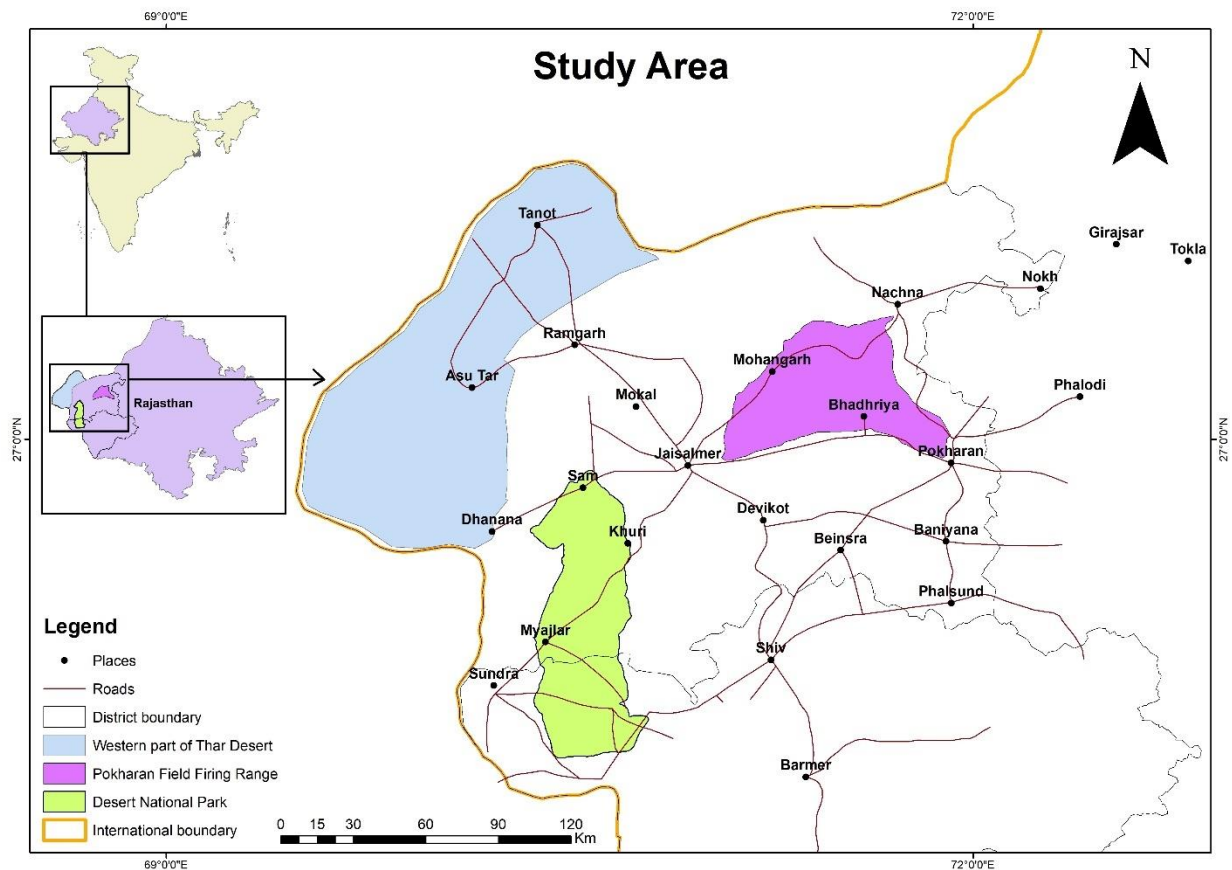


Figure 1 Map showing study area and important sites covered

Team organization during the survey

Two survey teams were deployed for 30 days. Each team covered 25 to 30 km distance from the selected grid (15×15=225 sq. km.) every day. Each team consisted

of one experienced driver from the landscape, two surveyors with field experience in wildlife surveys in the Thar landscape and a volunteer. A workshop and practice field surveys were held to train the team members in using the standardized data collection protocol before undertaking the systematic grid-based survey.

Vehicle Survey

Sighting records of GIB and associated species (Chinkara, Indian Desert Fox, Indian Fox, Nilgai, Spiny-tailed Lizard, Monitor Lizard, Desert Monitor Lizard) were collected along with the GPS coordinates to prepare distribution maps.

Point Count

At each 2 km interval of vehicle transect, point count was performed for 10 minutes. Corresponding to the sightings of the bustard and associated species, the dominant land-cover type (barren/agriculture/grassland/dunes), terrain type (flat/sloping/undulating), and the vegetation cover of three to five dominant plant species within 100 m radius of the point were also included for consideration. The vegetation composition was recorded as percentage of ground covered by trees, herbs, shrubs, grasses and their height (Bibby et al. 2000). Anthropogenic threats such as humans, dogs, powerlines, solar energy, wind energy, and grazing livestock were also recorded at each interval point.

Sign Survey

At each point count, one surveyor conducted a 10-minute random sign survey for indirect signs of the Great Indian Bustard and associated species. For GIB, footprints, feathers and excreta were considered as indirect signs (Rahmani 1989).

Mortality survey

Mortality data can give vital information of the fauna of Thar Desert. During the survey, mortality data was noted down with GPS coordinates and probable causes such as roadkill and collision with infrastructures like powerlines.

Secondary information

Secondary information was collected from published literature, local people and area experts. Great Indian Bustard location data was collated from publicly available databases, published scientific reports from 1980 to 1990 (Rahmani 1989; Sangha and Kulshreshtha 1993; Rahmani 1997), 2004 to 2005 (Dookia 2010), 2016 to 2017 (Dutta et al., 2017). Only GPS-location data was used. Publicly available databases included eBird and the Global Biodiversity Information Facility (GBIF) that collates information from the collections of natural history museums as well as citizen science databases. Only citizen science data points that passed quality checks were included in the dataset. We filtered data to exclude historic and inexact "hotspot" observations, as well as observations in which the travelling distance was greater than 2 km. The dataset included observations from 1983 to 2018, with the mean observation in 2008. The primary data was collected through landscape-level

surveys conducted by the BNHS 2019 –2020 and intensive monitoring of the sites where GIBs are currently present.

The records of sites where the GIBs were found dead after colliding against powerlines indicate that the collisions happened while they were in flight. We collated these records of GIB collisions against powerlines from published reports and media coverage. There were seven collisions reported in the last five years. It is relevant to note that these mortalities were primarily observed in “flyways” connecting leks and enclosures, as this provides some confidence about flight paths.

Land Use Land Cover Analysis

Satellite Data: The Landsat 8 OLI (Operational Land Imager) satellite imagery was acquired in October 2020 with less than 1% cloud cover. The satellite images accessed from USGS earth explorer with path and row (in bracket) 148(40,41,42), 149(40,41,42,43), 150 (40,41,42,43) and 151(41) were used for land use and land cover analysis. Band 2 (Blue), Band 3 (Green), Band 4 (Red) and Band 5 (Near Infrared) with 30-metre resolution was used for False Colour Composition (Hereafter FCC) of satellite imagery.

The bands were layer-stacked in the Earth Resources Data Analysis System (ERDAS) Imagine 2011 software to get FCC. Then the unsupervised classification was carried out with the threshold of 0.95 for 45 classes and later reclassified using recode tool to 9 classes with the help of ground truth points through field surveys. While processing images, because of similarity in reflectance seen in satellite imageries the solar power plants with water cannot be separated. Similarly, human settlement area with the desert classes could not get classified separately. Therefore, the possibility would be explored to digitize manually later on using SOI (Survey of India) toposheets as these datasets are based on actual ground-based surveys. The vegetation class, fallow land and desert classes were reclassified with the help of ground truth points as well as NDVI (Normalized Differential Vegetation Index = (NIR-Red)/(NIR+Red)) to ensure accuracy, as the bare ground has negative NDVI values while vegetation has positive.

GIS and mapping

Coordinates of GIB distribution data were collated from systematic surveys conducted by the BNHS from September to November 2020, opportunistic surveys from 2018 to 2020, secondary information received from the local people, preferably grazers and farmers in February 2014. Additional layers of GIB distribution locations were collated chronologically from various publications. Different legends have been given for sighting records from the respective period such as the 1980 to 1990 (Rahmani 1989; Sangha and Kulshreshtha 1993; Manoj Kulshreshtha per. comm.; and Rahmani 1997), 2004 to 2005 (Dookia 2010), and 2016 to 2017 (Dutta *et al.* 2017).

Sensitivity mapping

Sensitivity mapping is used to identify areas of 'concern' or 'major concern' (Bright et al. 2006). Production of sensitivity maps in many different countries gathered pace following a statement made by European Commission that "wildlife sensitivity maps will also help to avoid potential conflicts with the provisions of Article 5 of the Birds Directive and Articles 12 and 13 of the Habitats Directive as regards the need to protect species of EU importance throughout their entire natural range within the EU" (European Commission 2010). Sensitivity map produced in this report would be a tool for sensible energy investment.

For sensitivity mapping, a species is selected based on its conservation status, vulnerability to collision with powerlines and habitat preference. For sensitivity mapping, high scores were given to the grids with the presence of GIB, raptor congregation, comparatively minimum threats, and the suitability of a potential habitat. Polygons were drawn around these areas. Highly sensitive areas include sites where the GIB was reported during the last decade and considered as potential areas/corridors. Areas where vultures and other globally threatened bird species were reported/seen but are thinly distributed were categorized under medium sensitive areas. These areas also had comparatively high disturbance due to rapidly changing landscape and emerging infrastructures.

RESULTS

Survey efforts in brief

- Duration: September to November 2020 and April 2021
- Number of surveyors: A team of six surveyors conducted surveys in two vehicles
- Area covered: 116 grids of 15X15 sq. km = 26,100 sq. km (see figure 2 for details)
- Point counts: At each 2-km interval of vehicle occupancy, point count were performed for 10 minutes and total 3,306-point counts were taken in and around the area.
- Hours of field observations: ten minutes at 3306 points counts = 33,060 minutes or 551 hrs
- Distance covered by vehicle surveys: 25 km per grid, 116 grids and 2900 km

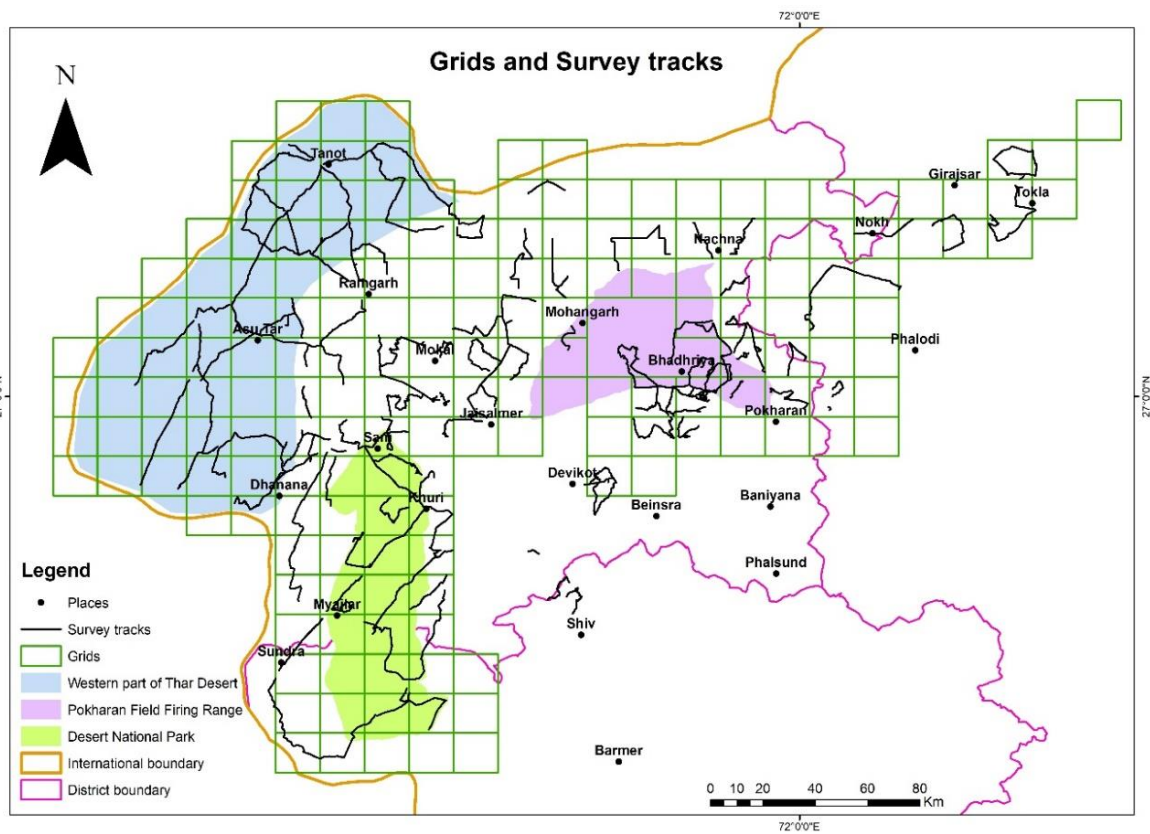


Figure 2 Survey areas where BNHS conducted the field surveys from August to November 2020 (GPS tracks saved by the team during the surveys to prepare the map)

Table 1 List of highly sensitive sites where the development of energy sectors should be avoided

SN	Site	Places surveyed
1.	Pokhran-Devikot	Khetolai, Dholiya, Odhania, Chandani, Chacha, Loharki, Ajasar, Askandra, Ramdevra, Rasla, Sanwata, Bhikhsar, Sanawada, Nedan, Keroliya, PFFR
2.	Jaisalmer-Mohangarh	Habur, Salkha, Kuchdi, Netsi, Mokala, Parewar, Nachna,
3.	Desert National Park (DNP)	Sundara, Myajlar, Phulia, Dav, Sudasari, Neemba, Bida, Jamda, Barna, Sipla and Ganga
4.	Bikaner, Jodhpur	Baap, Diyatara, Jorbeer, Khichan, Nokha, Nokh
5.	Border areas	Tanot, Kishangarh, Shahgarh, Ghotaroo, Asutar, Muhar, Bhuvana Ramgarh, Dhanana, Suthar Mandi, 192RD, Bahla, 190RD, Longewala, Sadewala

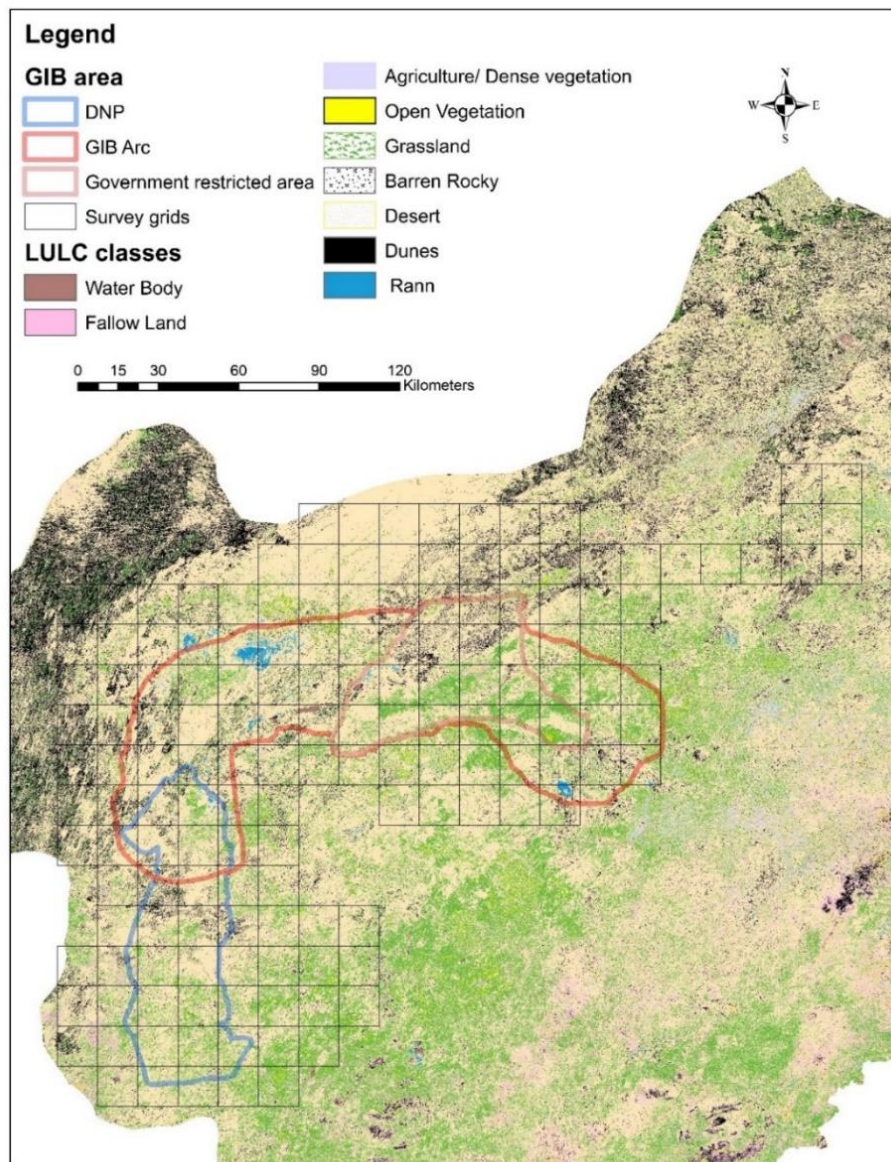


Figure 3 Land Use Land Cover map of Thar Desert

Major habitats and threats (Fig 4 and 5)

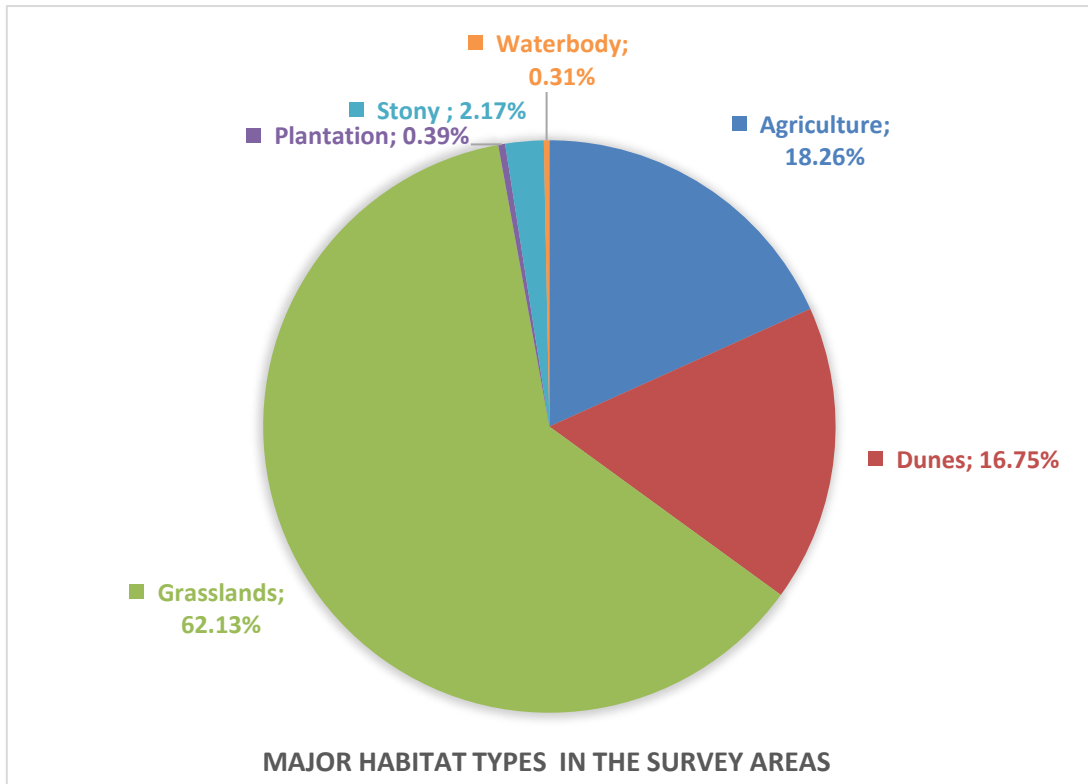


Figure 4 Habitat types of the landscape

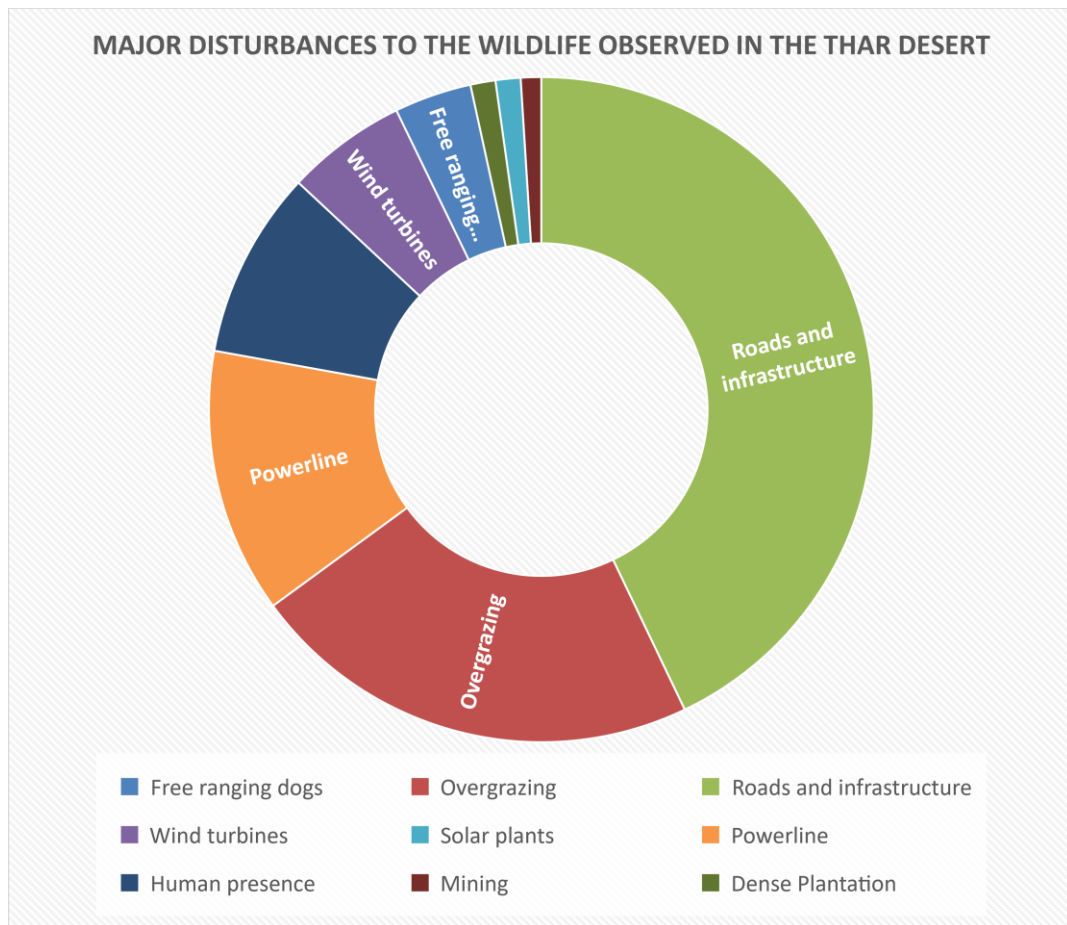


Figure 5 Major disturbances to the wildlife observed in the landscape

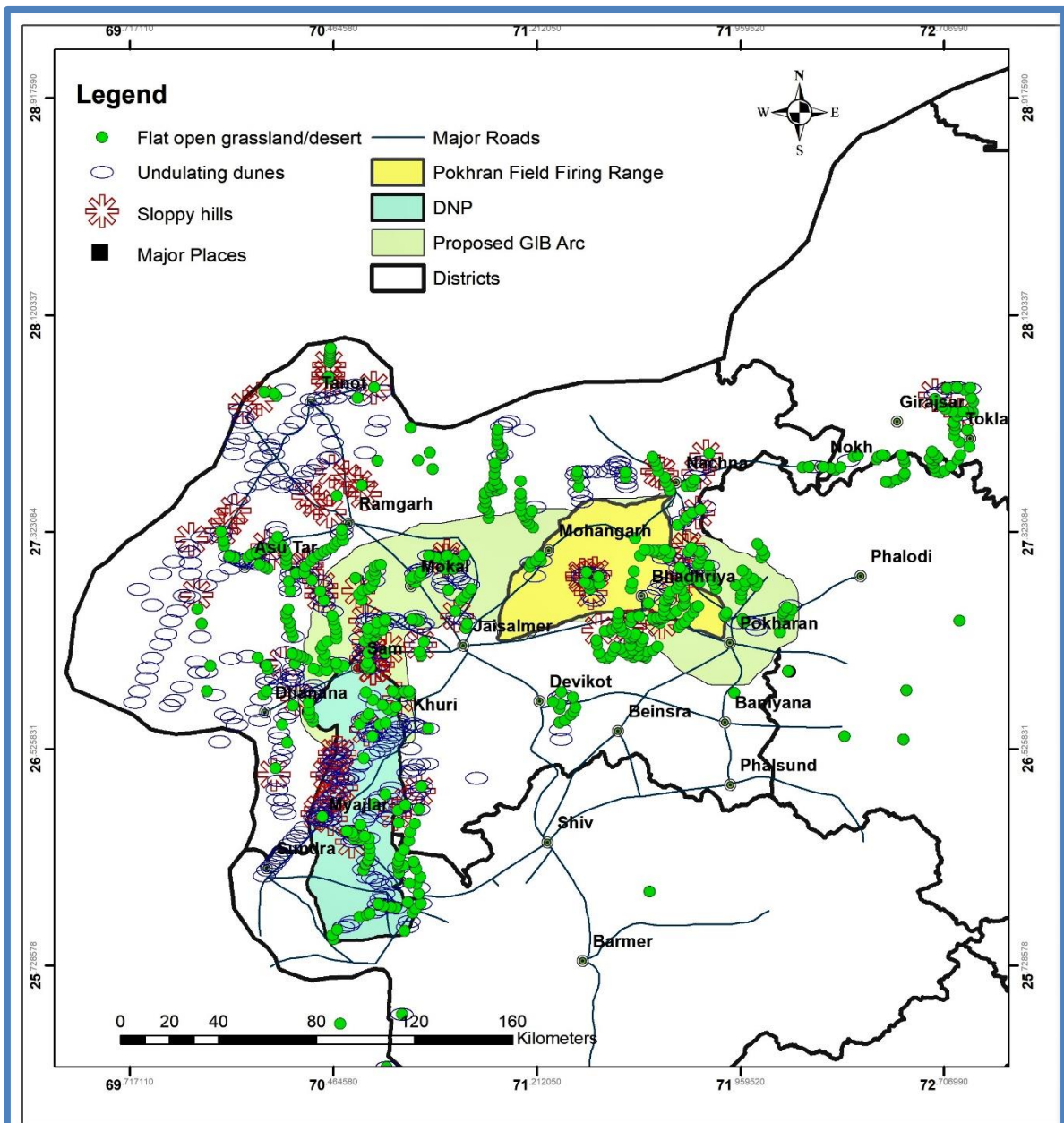


Figure 6 Major terrain types found in the study area (Locations of dominant vegetation recorded by the team during the surveys to prepare the vegetation map)

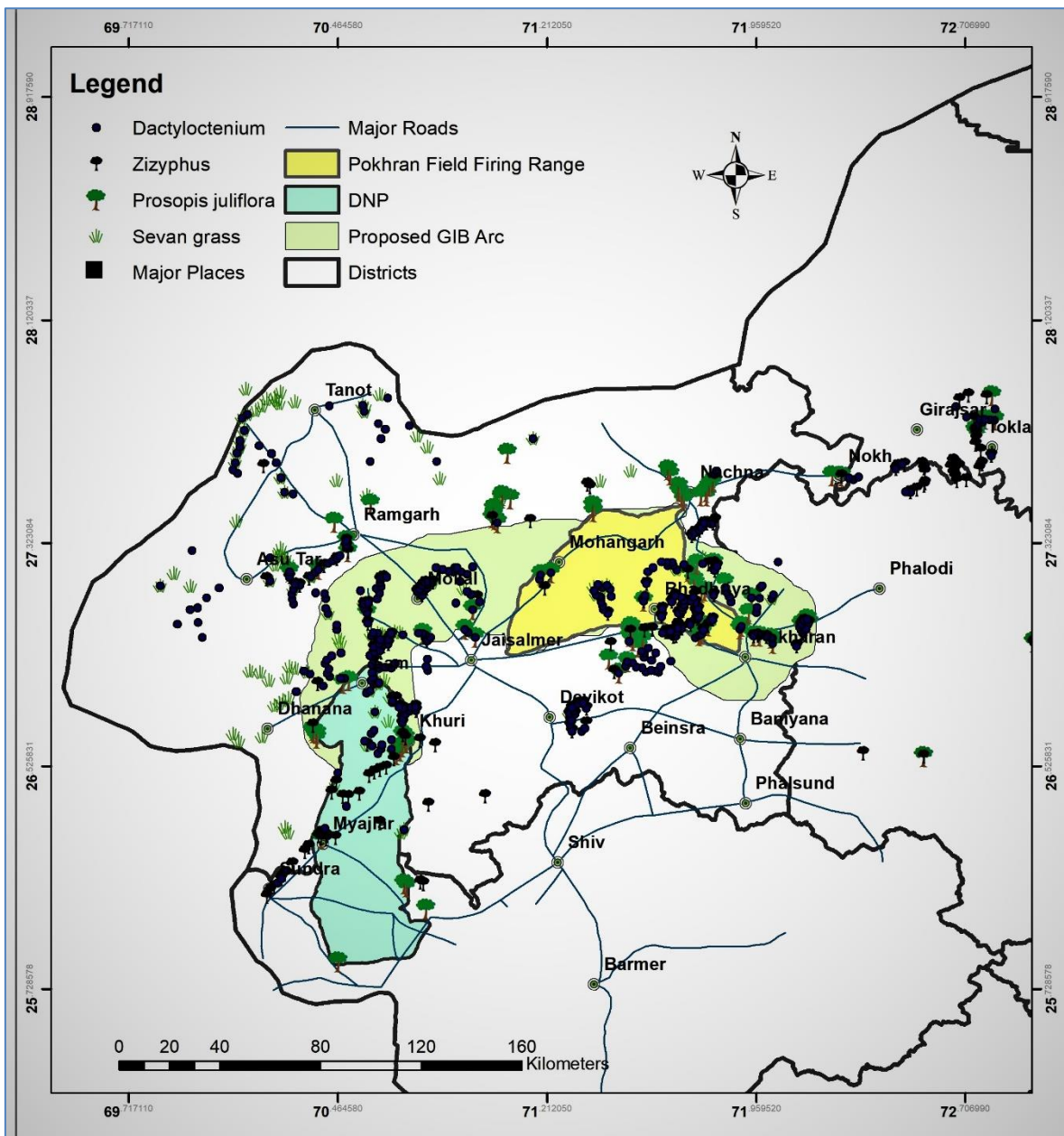


Figure 7 Map of major indicator grass and tree species. Area with a mixture of *Dactyloctenium* grass and *Zizyphus* tree was found more suitable for the GIB (locations of suitable grass/bush species recorded by the team during the surveys to prepare suitable habitat map)

Distribution of GIB and MacQueen's Bustard

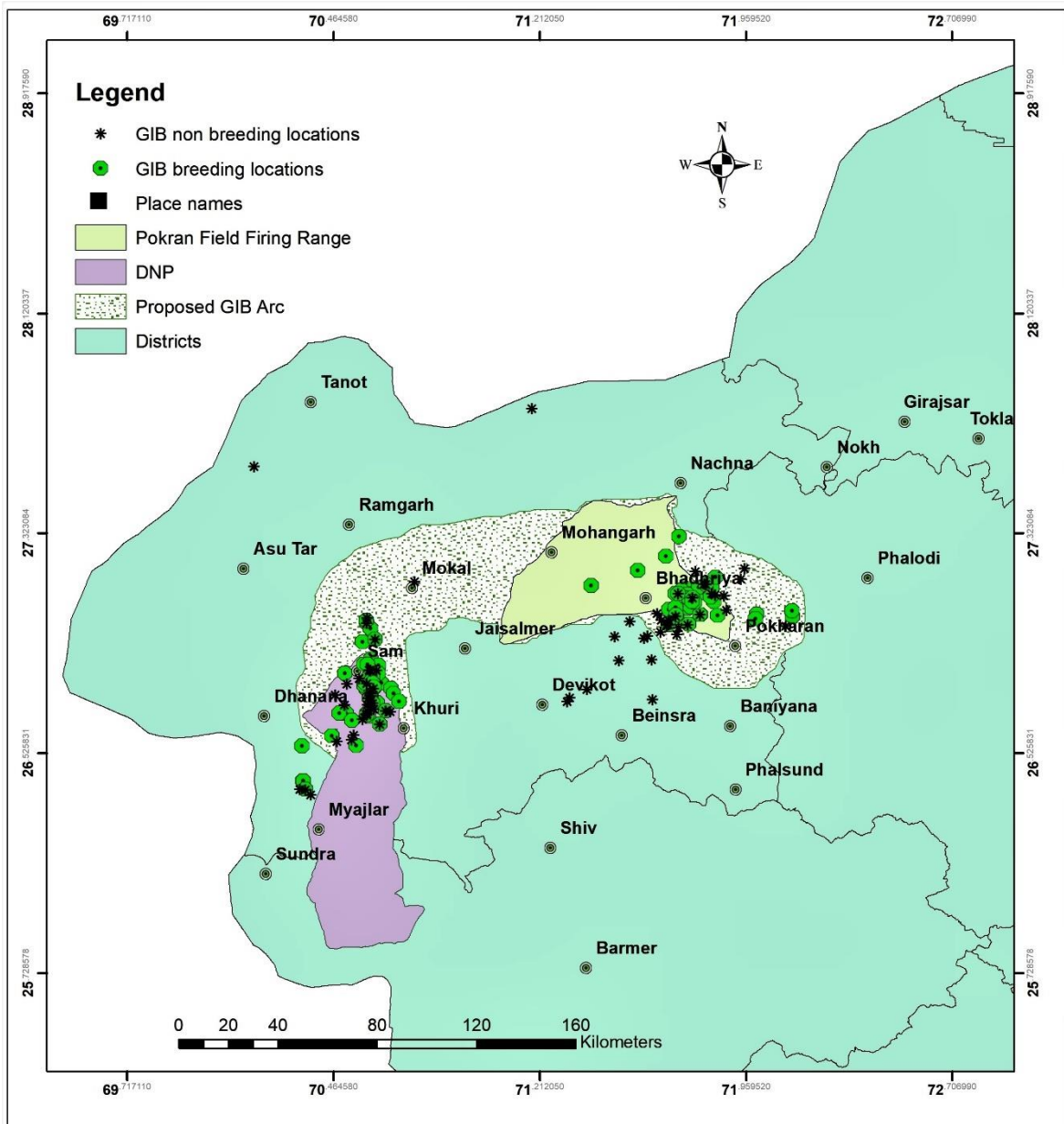


Figure 8 Distribution of GIB, sightings during breeding and non-breeding seasons (locations of GIB sightings recorded by the team during the surveys to prepare distribution map)

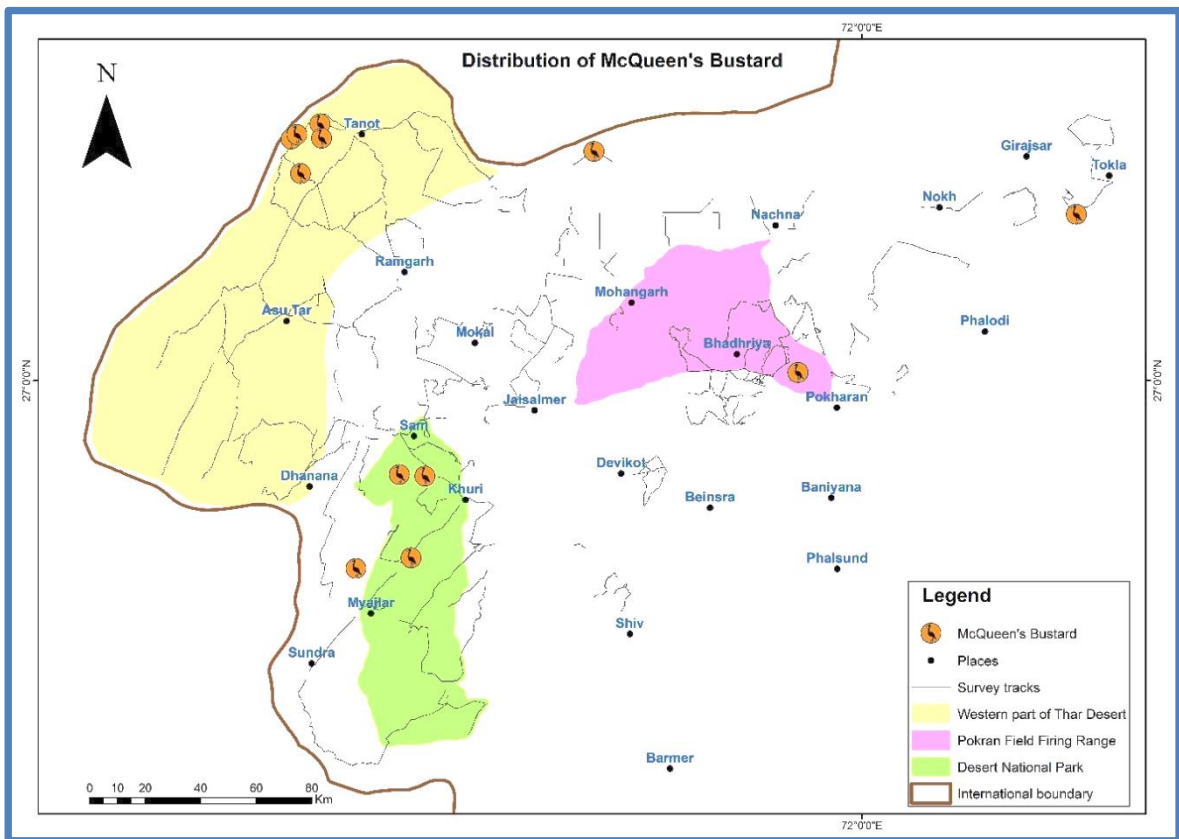


Figure 9 MacQueen's Bustard sightings during the survey period (locations of the MacQueen's Bustard sighted by the team during the surveys to prepare the distribution map)



MacQueen's Bustard is a wintering bird and is in peril owing to hunting © Musa Khan

Distribution of vultures and other raptors

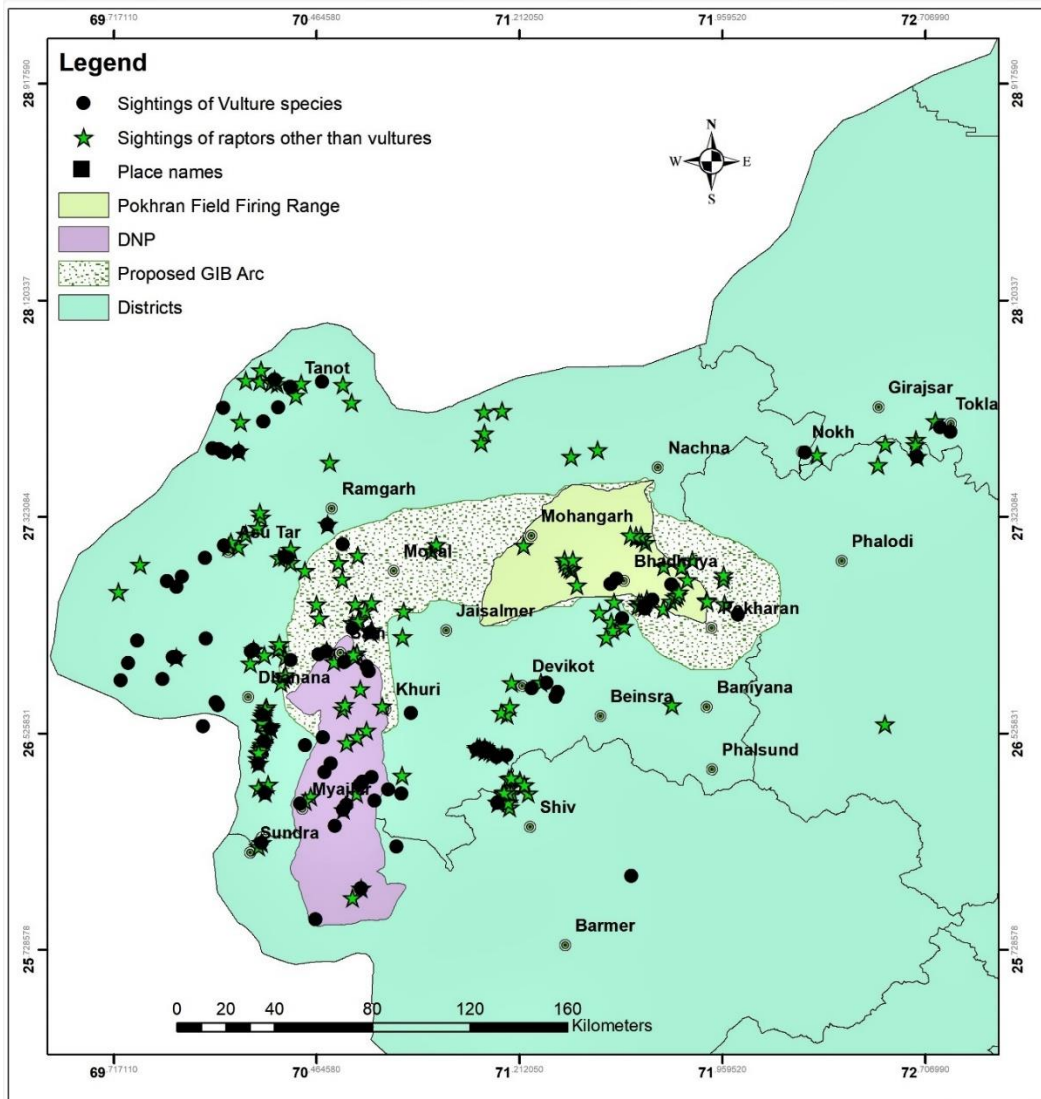


Figure 10 Vultures and other raptors sighting locations (ocations of vultures and other raptors sighted by the team during the surveys were used to prepare the distribution map)



(Left) Endangered Egyptian Vulture is the most abundant raptor in the landscape; (Right) Near Threatened Cinereous Vulture seen commonly but in low numbers © Mohan A

Distribution of other key desert fauna in the survey area

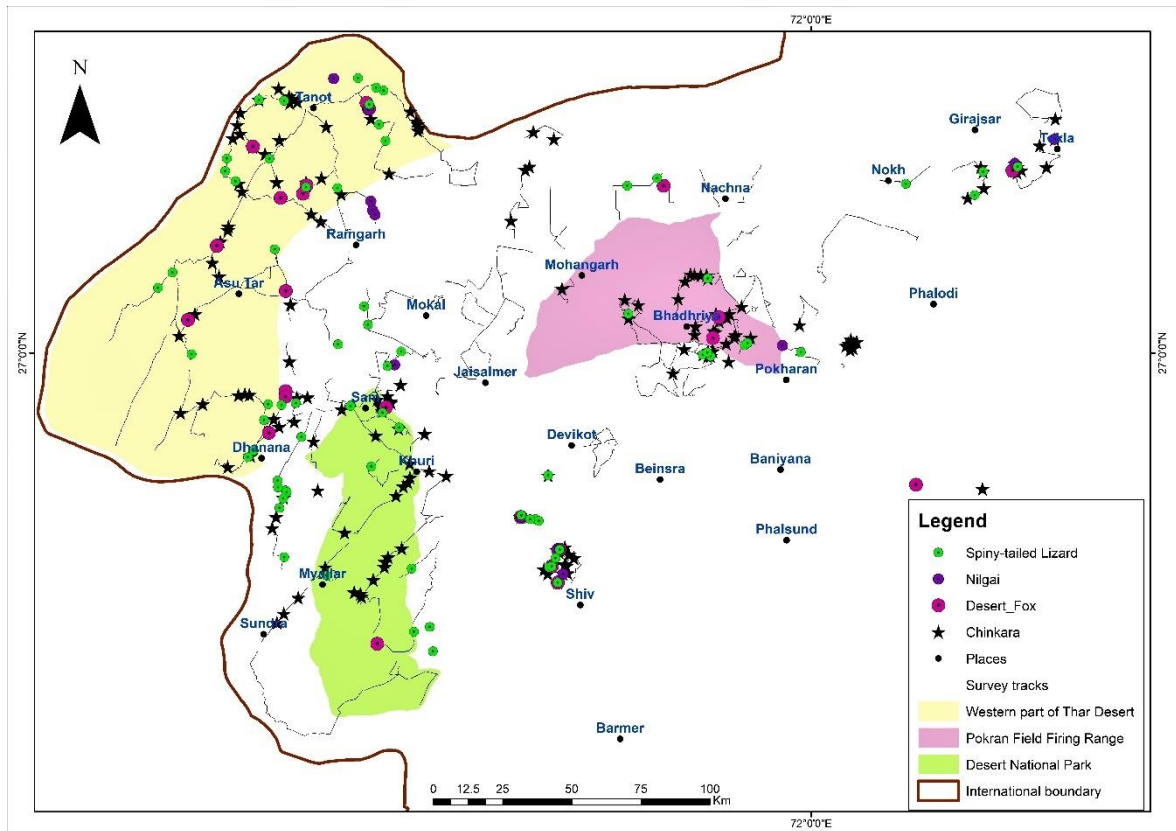


Figure 11 Distribution of key desert fauna across the landscape (locations of key desert fauna sighted by the team during the surveys were used to prepare the distribution map)



Spiny-tailed Lizard is the food of many carnivores as well as large birds © Ashley Chiu

Sensitivity mapping

The Thar Desert landscape is a distinct and diverse ecosystem in Rajasthan, India, which serves as a stronghold for several species of globally threatened wildlife. The Thar Desert has also been identified as a key location in India for wind and solar energy resources and is a region of active energy investment (Deshmukh *et al.*, 2019). The development of sustainable energy infrastructure in Rajasthan presents both benefits and risks to the region's wildlife. The following sites were found highly sensitive in terms of the conservation of GIB and other migratory birds.

1. **Desert National Park** – Since it is a Protected Area and its management plan is available, it does face an immediate threat from new renewable energy infrastructure.
2. **Deg Rai Mata Oran** – This was an excellent habitat until the last couple of years. It has now become a death trap for birds because of high-tension powerlines and new renewable energy projects that have mushroomed in great numbers.
3. **Pokhran Field Firing Range (PFFR) and surrounding villages** – This is the last refuge for a few remaining bustards found in the non-protected areas of Thar Desert. Most of the time, the GIB spends time inside PFFR and visits the cornfields in the adjoining villages during the winter season.
4. **Western part of the Thar Desert under the control of BSF**– A mixed habitat of sandy dunes and grasslands, fewer disturbances, pure dunes with scanty vegetation, no monitoring and control on wildlife hunting.
5. **Khichan** – One of the major congregation sites of Demoiselle Cranes. More than 20,000 cranes visit the site every winter.
6. **GIB Arc** – possible corridor being used by GIB



Rapidly increasing new renewable energy projects and associated infrastructure like high tension powerline, overgrazing, and land use change are the prominent threats to the birds © Sujit Narwade

Description of zones under sensitivity mapping

Variables like the presence of GIB, threatened species of vultures (vulnerability to collision with powerlines), availability of potential habitat, level of disturbance due to rapidly changing landscape and emerging infrastructures were considered to develop sensitivity maps (Fig 12) and describe the zones in table followed by the map.

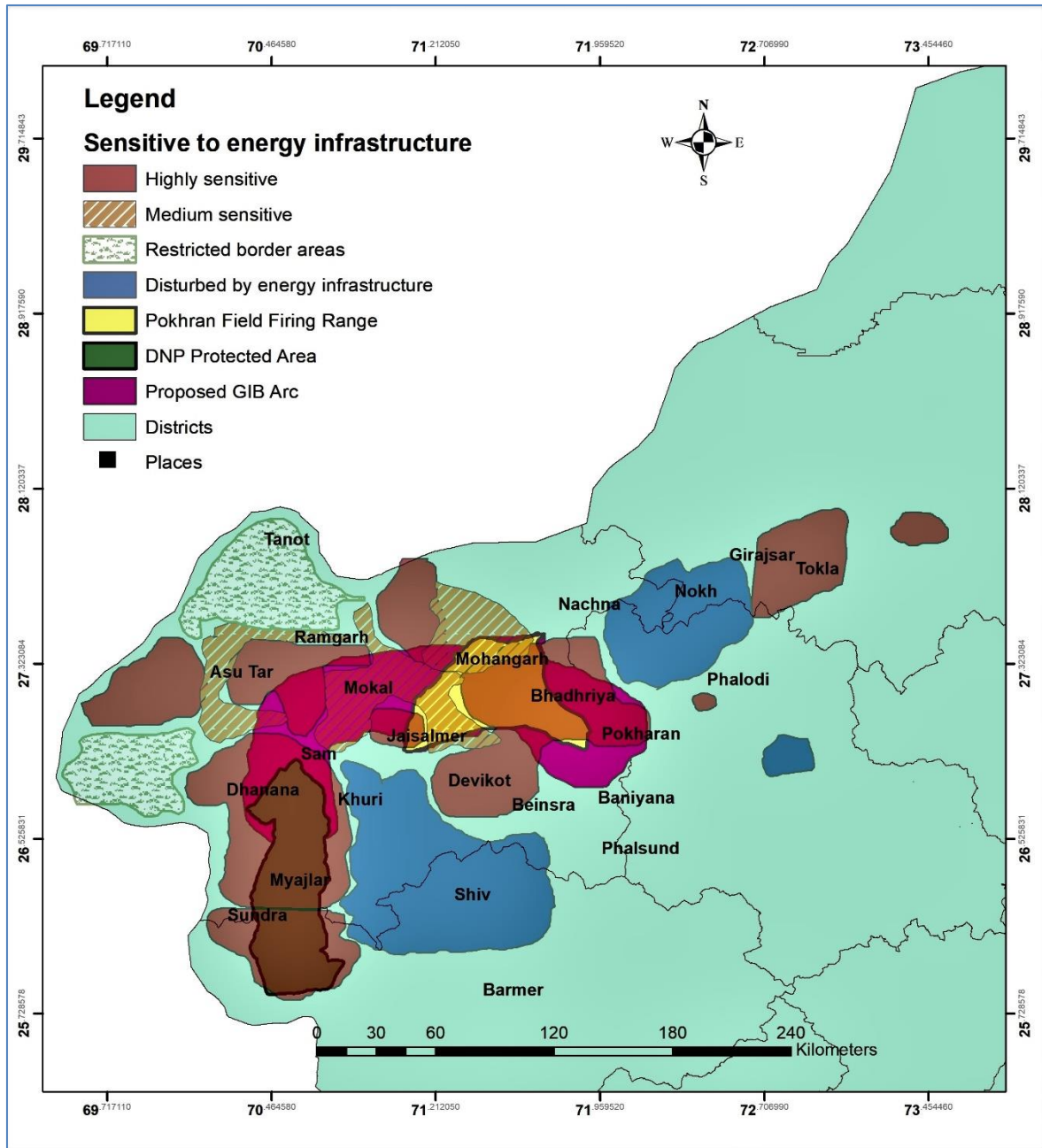


Figure 12 Map showing sensitive areas for new renewable energy projects (polygons were drawn around places where GIB and the threatened species of vultures (vulnerable to collisions with powerlines) were seen, besides considering the availability of potential habitats, level of disturbance due to the rapidly changing landscape and emerging infrastructures, to develop sensitivity maps)

Table 1 - Description of sensitive zones

Zones	Description	Sensitivity to Ground Development	Sensitivity to Aboveground Cabling	Energy Infrastructure Development Summary
1- Green (DNP)	Government land - protected areas, restricted area	Not permitted	Not permitted	No development of energy infrastructure.
2. Yellow (PFFR)	Area owned by Indian Army	Not permitted	Not permitted	No development of energy infrastructure.
3. Pink (GIB Arc)	Mixed land ownership	Medium	Restrictive	Development allowed on the condition that diverters or underground cables be used in areas where GIB is seen
4 - Chocolatey Red	Very high sensitivity: Core GIB use area and optimal habitat	High	High	No development of energy infrastructure.
5 - Brown lined	Medium sensitivity: Expected current flight corridors. Ground habitat is not optimal	Low	High	Aboveground cabling, including powerlines, should be avoided. They should, only be considered under exceptional circumstances but not without considering the impact on the biodiversity, particularly GIB. Powerlines should be buried, or power should be carried on existing infrastructure that has been retrofitted with diverters and other mitigation measures. An upper limit on the number of wind and solar facilities permissible

Zones	Description	Sensitivity to Ground Development	Sensitivity to Aboveground Cabling	Energy Infrastructure Development Summary
				within this Zone should be established. Comprehensive Environmental and Social Impact Assessment (ESIA) including three season bird surveys should be conducted prior to all developments. Projects should only proceed under a Net Gain offset approach. Post Construction Fatality Monitoring is essential.
6 - Restricted border areas pasture green	GIB could be using the border areas of India and Pakistan. A less disturbed area but with high probability of illegal hunting	High	High	No development of energy infrastructure. This area constitutes an important and relatively undisturbed area of habitat. Seasonal bird/biodiversity surveys are needed to confirm its importance. Monitoring to curb the hunting, sensitization among BSF staff
7 - Light Blue (Disturbed by energy infrastructure)	Extent of possible movement. GIB may fly through this area at lower frequency. Other collision-prone species may also fly through this area.	Low	Low	Comprehensive ESIA including three-season bird surveys should be conducted prior to all developments. Aboveground cabling, including powerlines, should be considered carefully and diverters and other mitigation measures should be used. Post-construction Fatality Monitoring is recommended.



A GIB male at sunset © Sujit Narwade



1.1 Introduction

1.1.1 Land ownership

In the Desert National Park, the land is mostly revenue or private land (not forest). At the time of declaration, there were 88 villages located inside the notified boundary (Management plan of DNP). The villagers have been cultivating their own land as well as some revenue lands within the sanctuary. Private agricultural land holdings lie scattered across the park. Since the boundaries of private lands are not demarcated, it is difficult to check the villagers from illegally cultivating the adjoining revenue lands.

The DNP Wildlife Sanctuary was under the control of Director, Desert Afforestation & Pasture Development, Jodhpur from 1980 to 1986. The main emphasis at that time was on the development of pasture lands under Desert Development Programme. The area came under the administrative control of Wildlife Wing of the Forest Department in 1986. The planned development had started since 1986 under the Five-Year Working Plan Project. For administrative convenience, the total area of the sanctuary was divided into four ranges: Jaisalmer, Myajlar, Barmer and a few enclosures under the satellite range Pokhran. The head of the management of the DNP is Deputy Conservator of Forests (Wildlife), Jaisalmer, who reports to Chief Conservator of Forests, Wildlife, Jodhpur.

Apart from a proposed Conservation Reserve (Jorbeer) and a WLS (Gajner), the rest are non-PAs with private land holding, *oran* or sacred groves, and panchayat and revenue areas.

1.1.2 Other stakeholders

The Desert National Park is spread over 3,162 sq. km. in which 1400 sq. km. falls in Barmer and 1762 sq. km. in Jaisalmer district. According to 2011 census records, the total human population residing inside the Park is around 38,696 and the cattle population is about 332,750. In addition to these 88 villages, there are about 64 villages located in 10 km area of Park boundary (Anoop *et al.* 2017).

Besides the villages, many of the government departments such as Agriculture, Horticulture, Animal Husbandry, Public Works Department and Energy Department are the ones that especially need to work, keeping in mind sustainable and environmentally friendly approaches. With the increasing demand for green energy, there is also a need to consider the detrimental impact of solar and wind energy projects in such a sensitive ecosystem.

1.1.3 Management practices

Enclosures were created in the Desert National Park for biodiversity conservation and to safeguard the land suitable for the Critically Endangered Great Indian

Bustard to breed. Overgrazing was controlled initially through barbed wire fencing and stone posts; later, a wire mesh was added as an extra layer of protection barring the cattle from breaking into the enclosures (See Fig. 13).

Nesting grounds are more sensitive from the breeding standpoint and hence Predator Proof Fencing (PPF) is done around the periphery of such habitats (Anoop *et al.* 2017). Since water bodies are scarce, it is also important to provide a water source for the fauna, especially in summer when most smaller tanks dry up. This water is provided to the animals and birds by a dispenser system called 'Water guzzler' (Anoop *et al.* 2017).

Due to the lack of proper demarcation of private lands, it becomes difficult to locate any illegal cultivation inside the Park. However, the patrolling intensifies during the monsoon season to keep the so-called encroachment in check. Since the geographical area of Jaisalmer is very large, further control on poaching can be achieved through a coordinated approach by the police, Indian army and BSF.

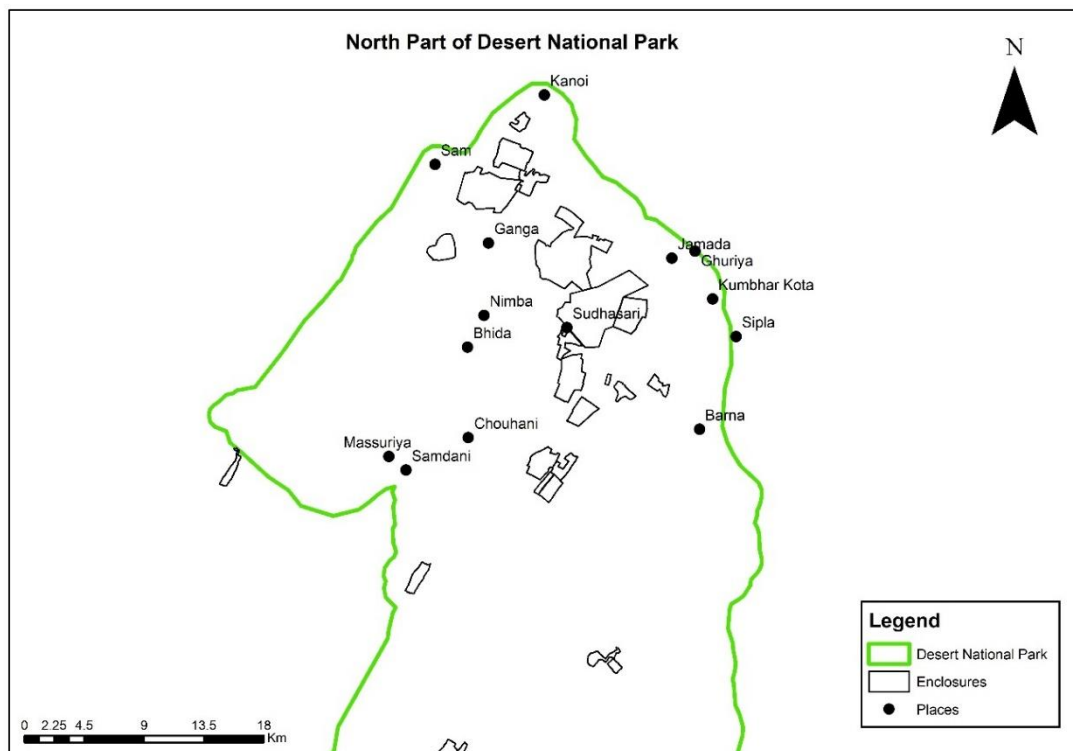


Figure 13 Northern Part of DNP with grassland enclosures, one of the crucial sites for GIB (Shapefiles of DNP and its enclosures sourced from the Office of DyCF, WL, Jaisalmer were used to show the northern part of DNP where GIB is still found)

1.1.4 Management issues

The management issues faced in the Park can be broadly classified as below.

1. Resentment and lack of participation by local people due to genuine basic requirements being denied as a result of creating a sanctuary or a Protected Area.
2. The shortcomings and lack of resources for the management of the sanctuaries.

Regulations due to the Wildlife (Protection) Act, 1972 and various judgments of the Supreme Court has slowed down the pace of developmental activities in the villages. This has resulted in bitterness against the PA and its flagship species in the minds of the people. However, the Supreme Court of India vide its judgment dated 5.10.15, clearly placed out the procedure for undertaking various developmental activities in the PAs. There are other reasons for the lack of participation by villagers:

- a. Seasonal tourism and dependency on agriculture or animal husbandry.
- b. Change in land use, especially with the advent of water irrigation system from IGNP canal; land use has greatly been impacted as cultivation pattern has changed from local vegetation to cash crops.
- c. The wildlife-rich areas are Revenue lands and have yet not been transferred to the name of the Forest Department.
- d. Increase in land value due to an increase in the land demand for energy projects.

1.1.5 Potential non-protected areas for wildlife outside DNP

A) Salkha and Poonam Nagar (Habur)

The Salkha area was one of the major GIB areas until 2013, when around 23 males together were sighted (Bhardwaj and Rahmani 2020). However, the habitat is under tremendous pressure from various anthropogenic pressures, especially new renewable energy projects and expansion of intensive agriculture. A majority of the area where it had good grass cover has now gradually disappeared and some are being converted into agriculture lands (Dookia 2010). GIB usually moves between the Sudasari and Salkha areas, and while moving across, the birds must overcome numerous obstacles like transmission lines and wind turbines. Along with power projects, expansion of roads, electricity pylons, wind turbines other infrastructures have degraded the existing habitat. Added to this is highly intensive form of agriculture, using advance methods, excessive usage of pesticides and plantations, making the habitat unsuitable for the GIB.

B) Kanoi, Damodara, Khabha

Khadeen is a waterlogged area in monsoon but cropping takes place in winter. The *gauchar* land is managed by the local people voluntarily. Wind mills were erected in 2011-12 but expansion stopped towards westward/Sam area because of the opposition by local people dependent on tourism. There are some historical perennial waterbodies created by Paliwal community, which are used by the birds.

C) Alaji ka Oran

The sacred grove is adjacent to Salkha area near Habur and Kuchdi and is as important as Salkha. The total area of Oran is 13,600 bigha (~2267 Ha). On record, 2250 bigha (~375Ha) has already been declared as Oran. The remaining 10,700 bigha (~1783 Ha) is yet to be declared and the case is still pending in the Jodhpur High Court. The local people have been fighting for it to be declared as an Oran. The prevailing threats in the Oran are tree cutting and encroaching for agriculture.

Species like Chinkara, Nilgai, Indian Hare, Indian Peafowl are commonly seen in this Oran along with McQueen's Bustard.

1.2 Objective

To find out the status and distribution of GIB and raptors in and around DNP

1.3 Methods

Core areas of DNP were visited occasionally by Musa Khan, a nature guide and resident of Neemba Village from 2019 to April 2021. The location of the GIB and raptors sighted in recent past was collected through Musa Khan. Landscape-level surveys were conducted across DNP in the third week of November 2020. A grid-based (15 km × 15 km) survey was conducted along the approachable dirt roads of 25 ± 5 km length (continuous or broken tracks based on accessibility). Surveys were conducted in the early morning (0600-1100) and late afternoon (1600-1900) when birds/animals are most active. The speed of the vehicle was maintained between 15-20 km/hr during the survey.

1.4 Results

The activity and movement of GIB was found mainly limited to north DNP portion. There is no recent sighting of DNP recorded from down south in recent past. The western part of DNP, across the Bharatmala road project, was identified as a safe haven for raptors. As many as 34 individuals of EN Steppe Eagle *Aquila nipalensis* were recorded from this area.

1.4.1 Birds of DNP and surrounding

A total of 130 species of avifauna were observed during the survey in and around DNP. Among them, the following IUCN Red Listed (threatened species) were found in the area.

1. **Critically Endangered:** Great Indian Bustard *Ardeotis nigriceps*, White-rumped Vulture *Gyps bengalensis*, Sociable Lapwing *Vanellus gregarious*, Red-headed Vulture *Sarcogyps calvus*, Indian Vulture *Gyps indicus*.
2. **Endangered:** Steppe Eagle *Aquila nipalensis*, Egyptian Vulture *Neophron percnopterus*, Saker Falcon *Falco cherrug*.
3. **Vulnerable:** Greater Spotted Eagle *Clanga clanga*, Eastern Imperial Eagle *Aquila heliaca*, Indian Spotted Eagle *Clanga hastata*, Tawny Eagle *Aquila rapax*, Yellow-eyed Pigeon *Columba eversmanni*, White-browed Bushchat *Saxicola macrorhynchus*
4. **Near Threatened:** Painted Stork *Mycteria leucocephala*, Himalayan Griffon *Gyps himalayensis*, Cinereous Vulture *Aegypius monachus*, Pallid Harrier *Circus macrourus*, Laggar Falcon *Falco jugger*, Red-headed Falcon *Falco chicquera*.

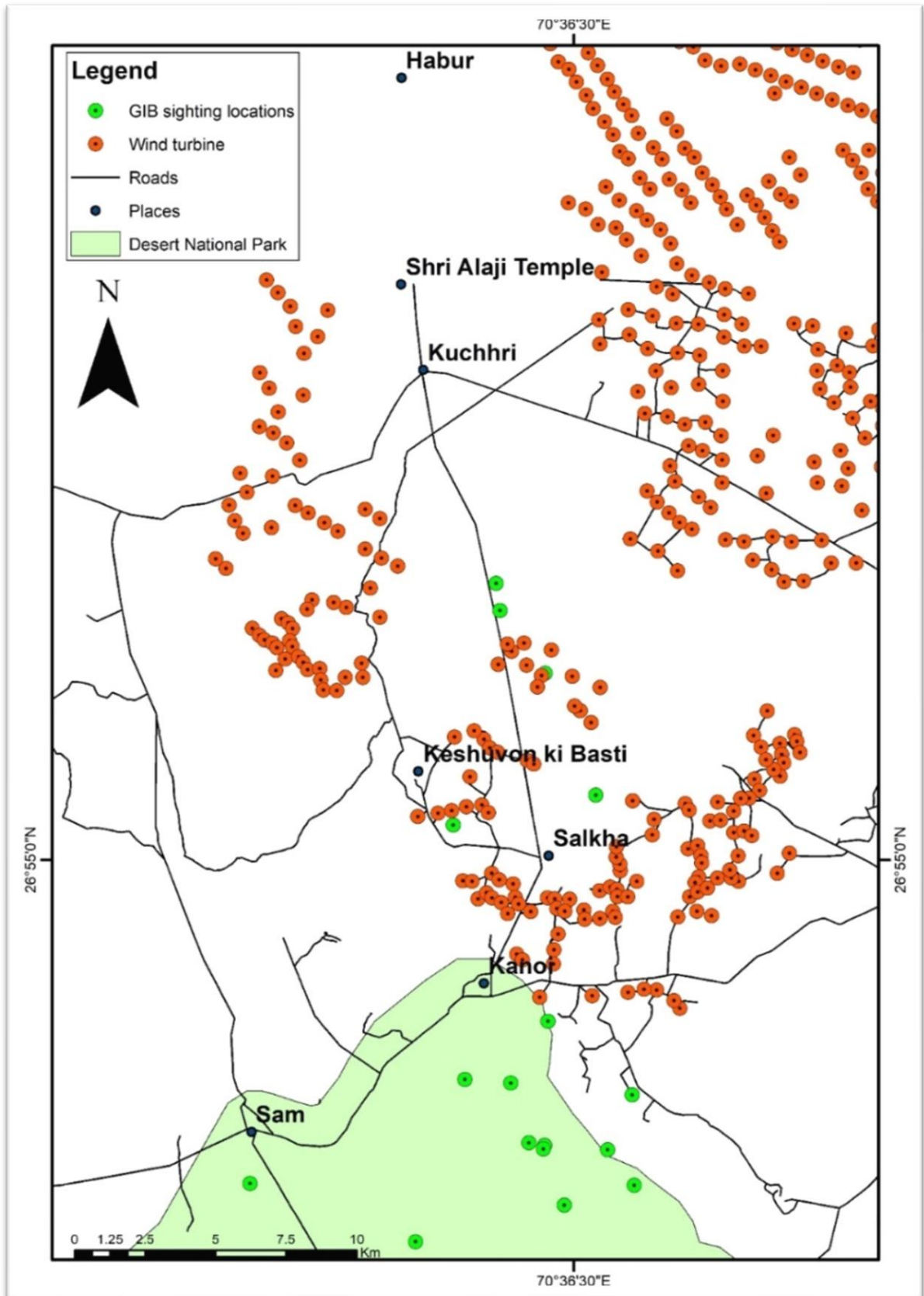


Figure 14 Salkha and its surrounding areas together form a potential habitat for GIB but the entire region is full of wind turbines and high-tension powerlines (locations of the wind turbines, powerlines were used to prepare the map)

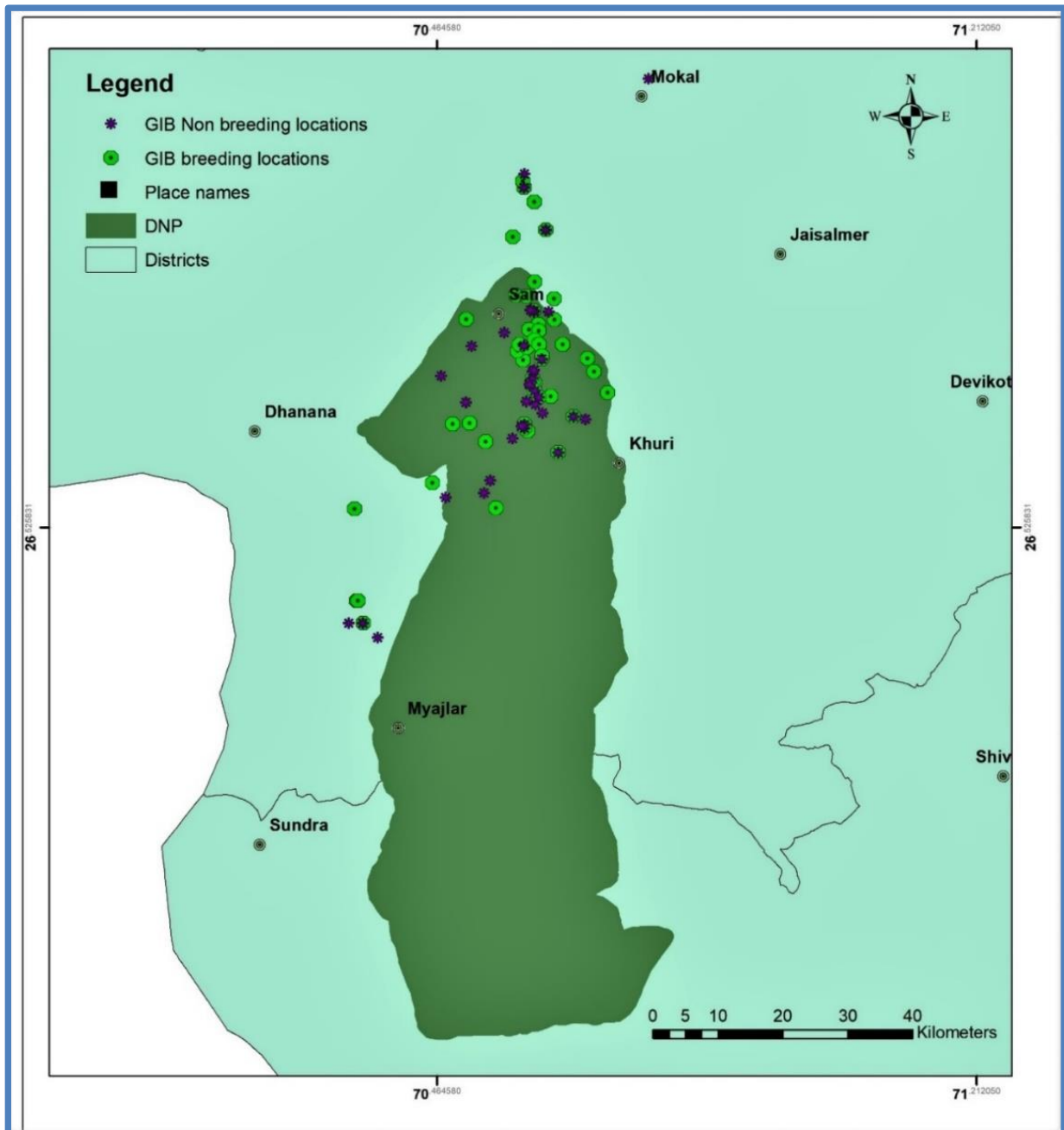


Figure 15 GIB distribution in and around DNP (Shapefiles of village overlaid on polygons of DNP sourced from the office of DyCF, WL, Jaisalmer, locations of the GIB used to prepare a distribution map)

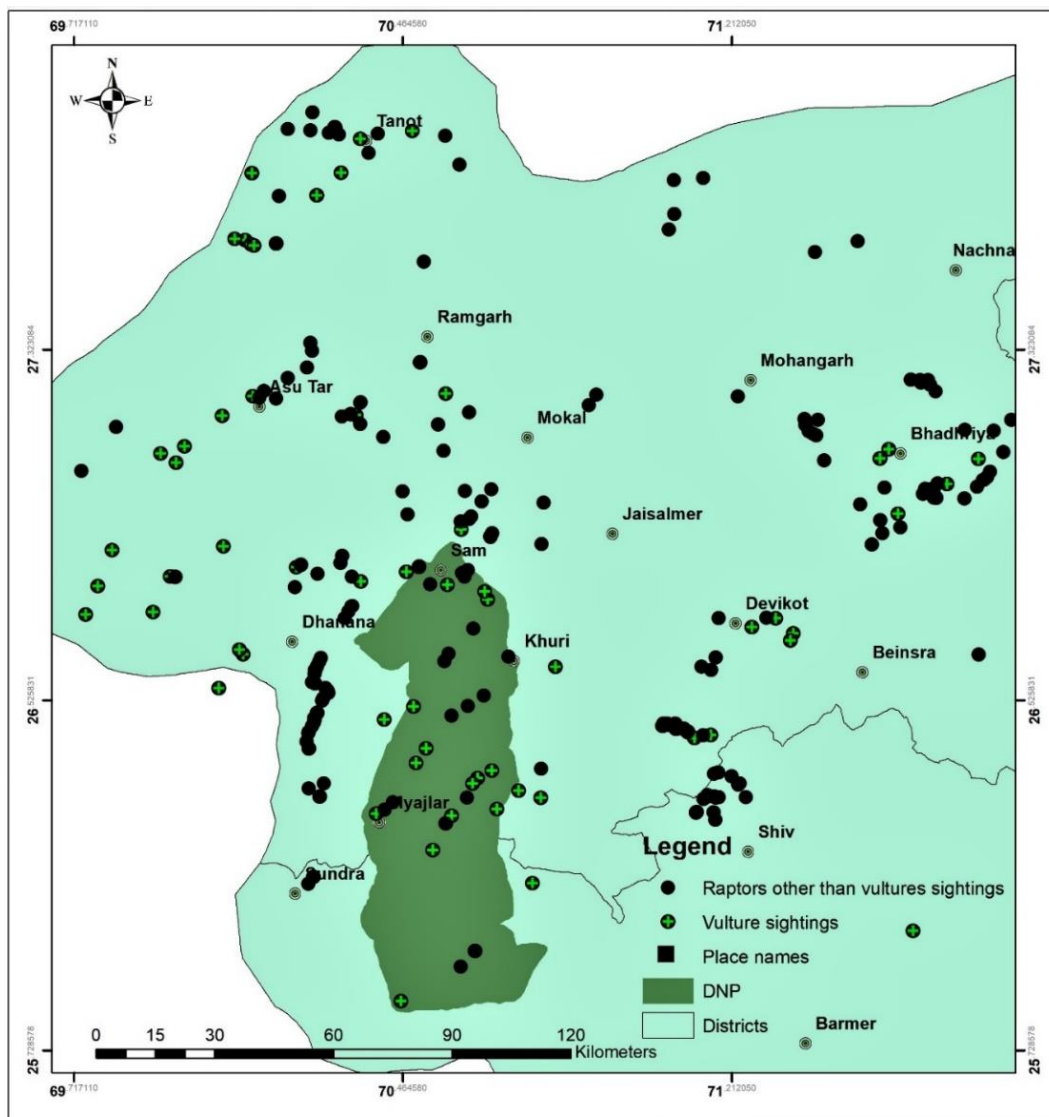


Figure 16 Distribution of vultures and other raptors in and around DNP (locations of the vultures and other raptors were used to prepare the distribution map)

3. Recommendations

1. Capacity building of the community and frontline staff of the forest department for effective conservation actions
2. Conservation-oriented research and knowledgebase development
3. Effective communication and outreach at landscape as well as site level
4. Boundary demarcation, notification, and inclusion within land-use records
5. Encourage research institutes, civil society, and community-based organizations to act as 'knowledge hubs', custodians or stewards of birds and their habitats
6. Conservation initiatives through local community participation
7. Plans for periodic assessment and monitoring of the sites to understand the response of the birds to the rapidly changing landscape



GIB female (right) and juvenile (left) in front of a wind turbine near Khabha village © Musa Khan



Apart from grassland birds, the Thar Desert also receives rare wintering wetland birds like Osprey © Musa Khan



Birds like Hoopoe Lark are seen in a few places like DNP and its surroundings, and need to be studied © Musa Khan



Can we spare Deg Rai Mata Oran from becoming a death trap for birds?



1.1 Introduction

2.1.1 Orans of Rajasthan

Orans or Sacred groves are natural forest patches worshipped and conserved by the local or indigenous people. It is a widespread phenomenon in old world cultures. The historical account of Oran dates back to the ancient Greek and Indian cultures. They have better vegetation in comparison to unprotected surrounding areas. Since the ancient times, ethics like protecting trees and the prohibition of hunting in such areas by the locals have played a crucial role in conservation (Gadgil and Vartek 1994, Robbins 1998).

The Oran falls under the “Culturable Waste Land” category (Mukhopadhyay 2008). In Rajasthan, the Oran constitutes around 9% of the desert area whereas a single Oran can possess an area of a few metres to several hundred hectares (Mukhopadhyay 2008). Some of the important Oran of Jaisalmer are Bhadariya Rai Mata Oran and Deg Rai Mata Oran; Kundla Oran falls in the Barmer district. Historical accounts are full of tales of the divine retribution for destroying an Oran such as blinding and paralysis (Gadgil and Vartek 1994). The Oran acts as a grazing land for the livestock and ideal habitat for various indigenous floral and faunal species. The local people have faith in the local deity, abide by the natural laws, and therefore the Oran is free from encroachment and over-exploitation (Dagla *et al.* 2007).

Orans are unique examples of gene pool conservation of plant species. However, traditional biodiversity conservation methods have not appealed to many people and therefore, there is an urgent need to systematically survey, demarcate and conduct research in Orans (Singh and Bahl 2006). Jodha (1985) makes a case for the protection of Orans from encroachment and land diversion.

2.1.2 Deg Rai Mata Oran

Deg Rai Mata Oran is located in Fategarh tehsil, Jaisalmer district, surrounding Deg Rai Mata temple. It is almost 50 km away to the east of Jaisalmer city. History has it that the fifteenth-century ruler of the Bhati dynasty, Rawal Bersi Singh went to Pushkar as a pilgrim around 600 years ago and during his return journey he stopped by Deg Rai Mata temple and later donated around 22,000-hectare land in the name of the temple. Rawal Bersi Singh also provided a ‘*Tamrapatra*’ (inscription on a copper plate) as proof of the donation. The popular belief is that people around the Oran protected this land since that time and this community effort made it a refuge for the wildlife.

After independence, the Oran was not recognized in the land settlement process. But in 2004, approximately 5,817 hectares of land was registered in the name of Deg Rai Mata Temple Trust. The rest of the historical Oran land is still not recognised. In June 2020, villagers submitted a memorandum to the District Collector to register the remaining land in the name of Deg Rai Mata Temple Trust.

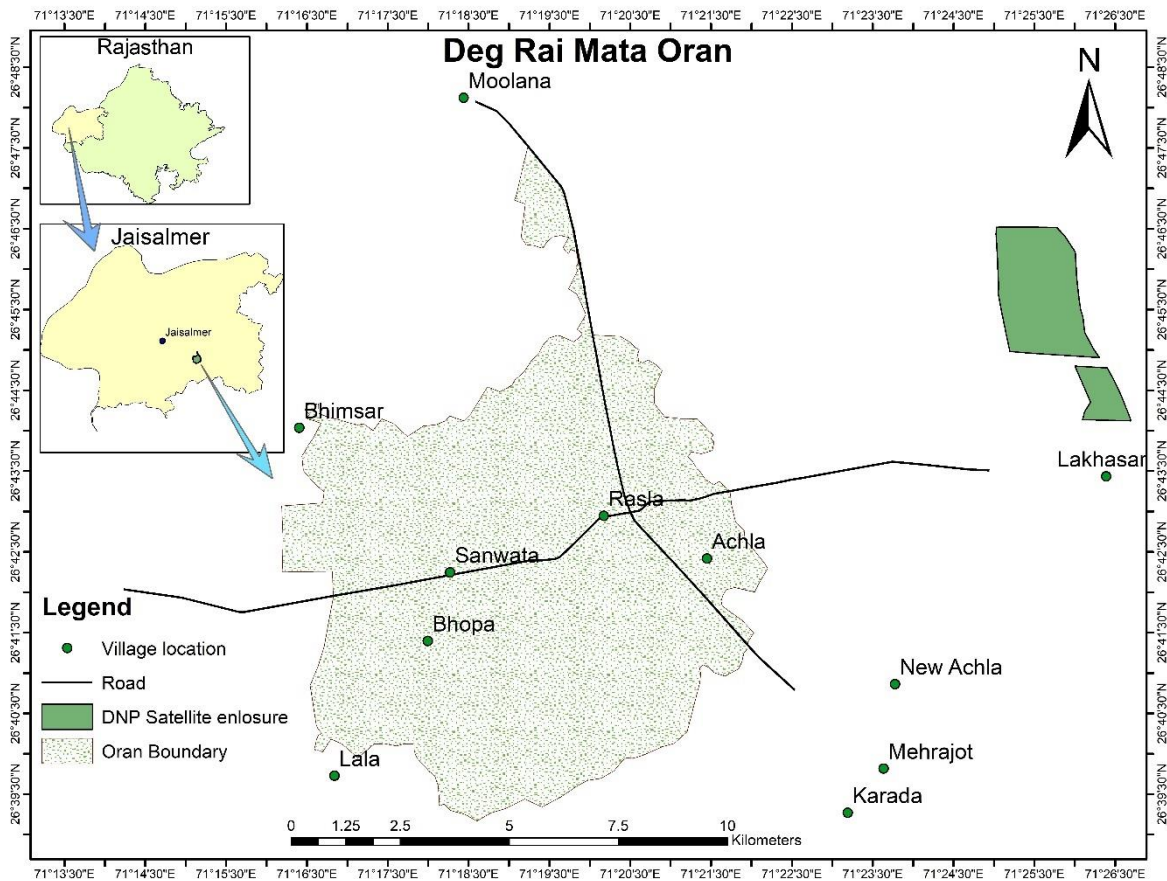


Figure 17 The location of Deg Rai Mata Oran in Jaisalmer district and villages in and around the Oran (polygon generated by moving on the boundaries of Deg Rai Mata Oran was used to prepare the map)

2.2 Objective

To understand the impact of the energy sector on birds in Deg Rai Mata Oran as a case study.

2.3 Methods

Deg Rai Mata Oran area was visited monthly between September 2020 and March 2021 and a grid-based vehicle survey was conducted in the last week of January 2021. The grids (15 km × 15 km) were surveyed along the approachable dirt roads of 25 ± 5 km length (continuous or broken tracks based on accessibility). Surveys were conducted early morning (0600-1100) and late afternoon (1600-1900) when birds/animals are most active. The speed of the vehicle was maintained between 15-20 km/hr during the survey.

Powerline mortality data was collected by using a network of shepherds known to one of the authors Sumer Singh Bhati. After getting secondary information over phone, the spot was visited immediately and photographs of the dead or injured birds were recorded for identification and GPS co-ordinates were recorded for preparing the distribution data.

The GPS locations of the species sighted, electric pylons, and mortality of birds recorded during the surveys were saved and maps were generated through ArcMap

10.6.1 software. Secondary information on wildlife, landscape and people were collected during conversation with community leaders, shepherds and shopkeepers of the area.

2.4 Results

2.4.1 Communities residing in the Deg Rai Mata Oran

People belonging to the Rajput, Muslim, Raika, Meghwal, Jogi and Gowari communities reside in the above-mentioned villages.

2.4.2 Livelihood of the people

Most of the villagers here make their livelihood by herding camels, cows, goats and sheep. A few of them depend on rainfed agriculture in the monsoon. According to the local estimation, the villagers in and around Oran have about 5,000 camels, 3,000 cows, 25,000 sheep and 15,000 goats, which are completely dependent on the Oran for grazing.

2.4.3 Satellite enclosure of DNP near Deg Rai Mata Oran

One of the six satellite enclosures outside the Desert National Park (DNP) boundary was established near Deg Rai Mata Oran. It is named Rasla satellite conservation area. There are two separate enclosures, one 500 hectares and another 110 hectares. One male and one female Great Indian Bustard was observed inside the enclosure in 2016 (Durgaram, Forest Guard, per. comm). Asad Rahmani (pers. comm. 2020) has seen GIB many times during his surveys from 1980s to 2000s. A very healthy population of Chinkara is present in and around Rasla satellite conservation area. In winter, Macqueen's Bustard *Chlamydotis macqueenii* is found. Another IUCN Red List species, White-browed Bushchat *Saxicola macrorhynchus* was also found here.

2.4.4 Oran encompassing the villages

The following four villages are present in and around Deg Rai Mata Oran.

Table 1 Demographic information of the villages from Deg Rai Mata Oran area

Sr. No.	Name of the Village	Geographical area (hectare)	Total population (2011 census)	Male	Female	Houses
1	Sanwata	6269.25	702	364	338	111
2	Rasla	6235.68	1,047	542	505	182
3	Achla	1215.31	462	250	212	65
4	Bhopa	2171.67	259	137	122	39

2.4.5 Waterbody inside the Oran

There are about eighteen perennial and temporary waterbodies present in this Oran along with a few waterlogging areas during monsoon. Among them, ten are present in Sanwata village, four in Rasla village, two in Achla and two in Bhopa village.

2.4.6 Oran, upcoming power grid and associated powerlines

The Power Grid Corporation of India Ltd (PGCIL) is constructing a grid in this Oran comprising 75-hectare area. In the last one year, total ten powerlines spread along 115 km length across the Oran were installed all together. Until December 23, 2020, a total of 339 pylons (see fig 19) were constructed inside the Oran to hold these powerlines.

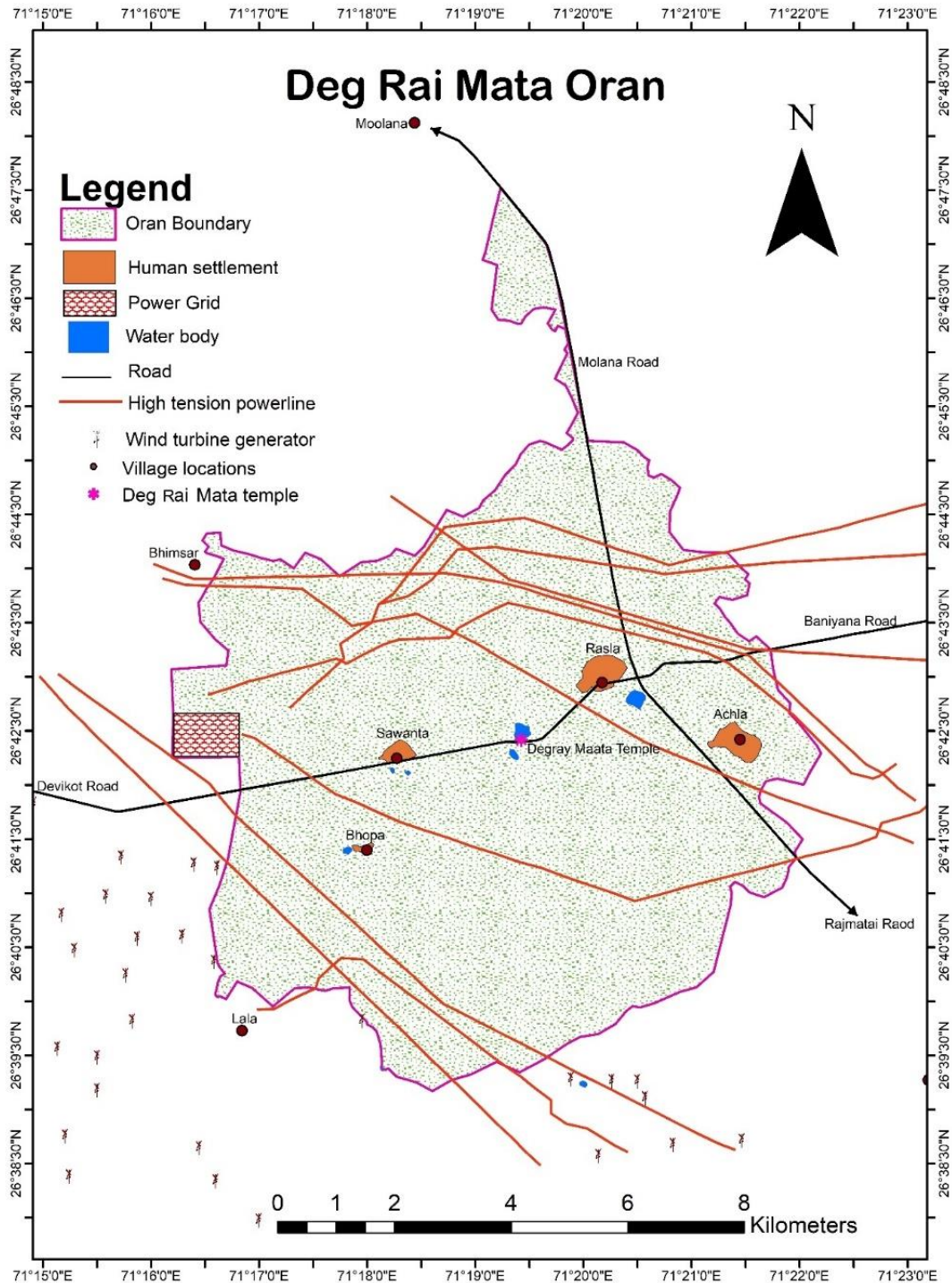


Figure 18 Map showing huge pressure on Deg Rai Mata Oran from the upcoming development and energy related, heavy infrastructure (Shapefiles of villages, overlaid on polygon prepared by moving on the boundaries of Deg Rai Mata Oran, using saved tracks of powerlines crossing the areas, location of upcoming powergrid and wind turbines to prepare location map)

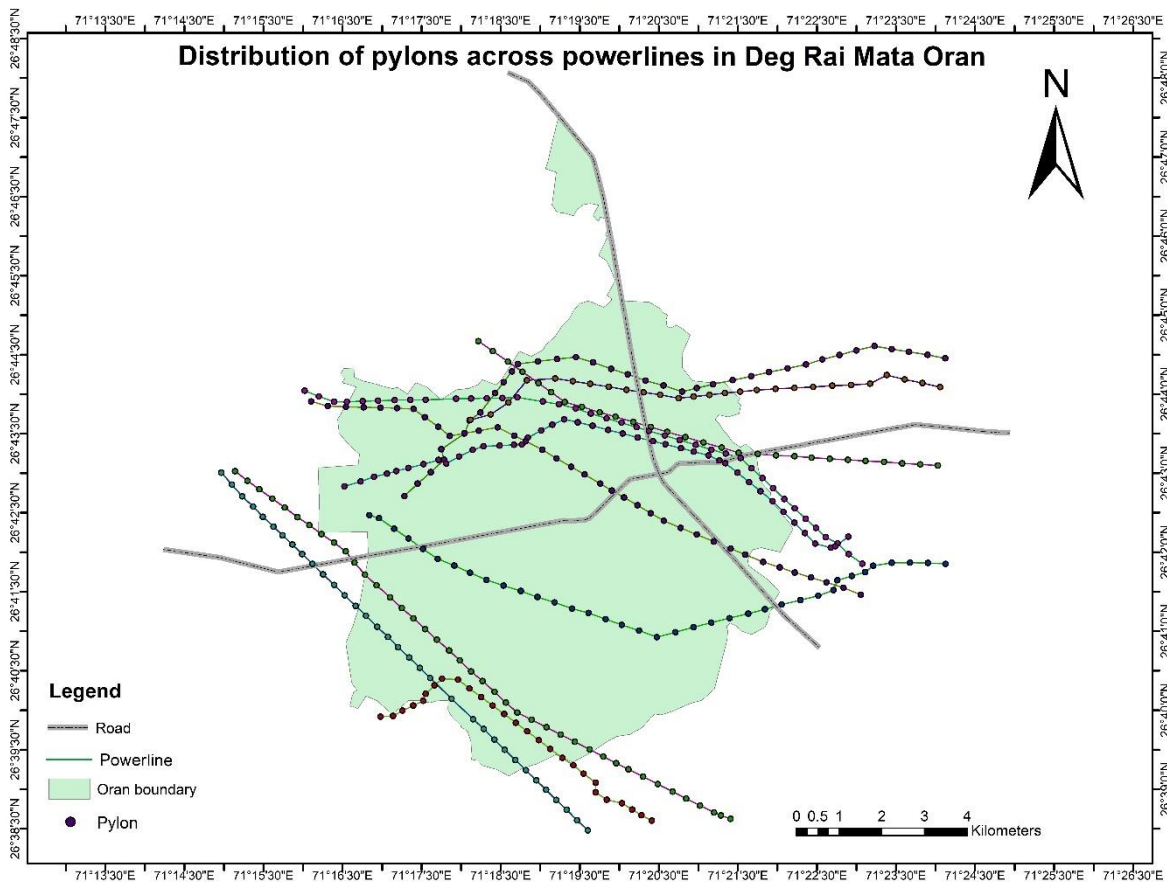


Figure 19 A surge in pylons and powerlines has created a mesh that is becoming a death trap for the birds (Shapefiles of polygon prepared by moving on the boundaries of Deg Rai Mata Oran to location map)

2.4.7 Birds of Deg Rai Mata Oran

A total of 66 species of avifauna were observed during the survey around Deg Rai Mata Oran. Among them, the following IUCN Red Listed (Threatened and Near Threatened) were found in the area.

1. **Critically Endangered:** Great Indian Bustard *Ardeotis nigriceps* and Indian Vulture *Gyps indicus*
2. **Endangered:** Egyptian Vulture *Neophron percnopterus*
3. **Vulnerable:** Common Pochard *Aythya ferina*, Macqueen's Bustard *Chlamydotis macqueenii*, and Tawny Eagle *Aquila rapax*
4. **Near Threatened:** Black-headed Ibis *Threskiornis melanocephalus*, Cinerous Vulture *Aegypius monachus*, Dalmatian Pelican *Pelecanus crispus*, Laggar Falcon *Falco jugger*, and Pallid Harrier *Circus macrourus*

2.4.8 Mammals and Reptiles of Deg Rai Mata Oran

Mammalian species such as Indian Desert Fox *Vulpes vulpes pusilla*, Chinkara *Gazella bennettii*, and Nilgai *Boselaphus tragocamelus* were observed during the study. Active burrows of Desert Jird *Meriones hurrianae*, Indian Long-eared Hedgehog *Hemiechinus collaris* as well as Spiny-tailed Lizard *Saara hardwickii* were observed.

2.4.9 Bird mortality

Eight species of birds were found dead due to electrocution or collision with high tension powerline. 'Critically Endangered' Great Indian Bustard was killed as a

result of electrocution on September 16, 2020. Apart from that, two 'Endangered' Egyptian Vultures were spotted dead on February 05, 2021. Six 'Vulnerable' Tawny Eagle became the victim of this death trap on January 22 and 23, February 7, February 24 and February 25. One 'Near Threatened' Cinereous Vulture became a victim of the powerline (February 22, 2021). In a few instances, the dead birds were found a few hundred metres away from the powerline as they had managed to fly to an extent even after being injured in the collision.



Birds are not safe while flying in the Deg Rai Mata Oran landscape © Ashley Chiu



'Critically Endangered' Great Indian Bustard *Ardeotis nigriceps* was killed due to powerline collision inside Deg Rai Mata Oran in September 2021 © Sumer Singh Bhati

List of birds killed due to electrocution/ collision with powerline

Sr. no.	Name of Bird	Scientific Name	IUCN category	Number of Individuals	Date of Mortality
1	Great Indian Bustard	<i>Ardeotis nigriceps</i>	CR	1	16-09-2020
2	Rock Eagle Owl	<i>Bubo bengalensis</i>	LC	1	17-12-2021
3	Common Crane	<i>Grus grus</i>	LC	1	09-01-2021
4	Tawny Eagle	<i>Aquila rapax</i>	VU	1	22-01-2021
5	Tawny Eagle	<i>Aquila rapax</i>	VU	1	23-01-2021
6	Griffon Vulture	<i>Gyps fulvous</i>	LC	1	25-01-2021
7	Long-legged Buzzard	<i>Buteo rufinus</i>	LC	1	02-02-2021
8	Egyptian Vulture	<i>Neophron percnopterus</i>	EN	2	05-02-2021
9	Tawny Eagle	<i>Aquila rapax</i>	VU	1	07-02-2021
10	Griffon Vulture	<i>Gyps fulvous</i>	LC	3	10-02-2021
11	Cinereous Vulture	<i>Aegypius monachus</i>	NT	1	19-02-2021
12	Demoiselle Crane	<i>Grus virgo</i>	LC	1	Undated
13	Tawny Eagle	<i>Aquila rapax</i>	VU	1	24-02-2021
14	Tawny Eagle	<i>Aquila rapax</i>	VU	2	25-02-2021
15.	Griffon Vulture	<i>Gyps fulvous</i>	LC	1	27-02-2021



'Endangered' Egyptian Vulture *Neophron percnopterus* became a victim of electrocution (beak burnt due to electrocution) in February 2021 © Unmesh Mitra



'Near Threatened' Cinereous Vulture *Aegypius monachus* succumbed to its injuries after colliding with a powerline inside Deg Rai Mata Oran © Sumer Singh Bhati



'Vulnerable' Tawny Eagle *Aquila rapax* was killed after colliding with a powerline collision inside Deg Rai Mata Oran © Sumer Singh Bhati

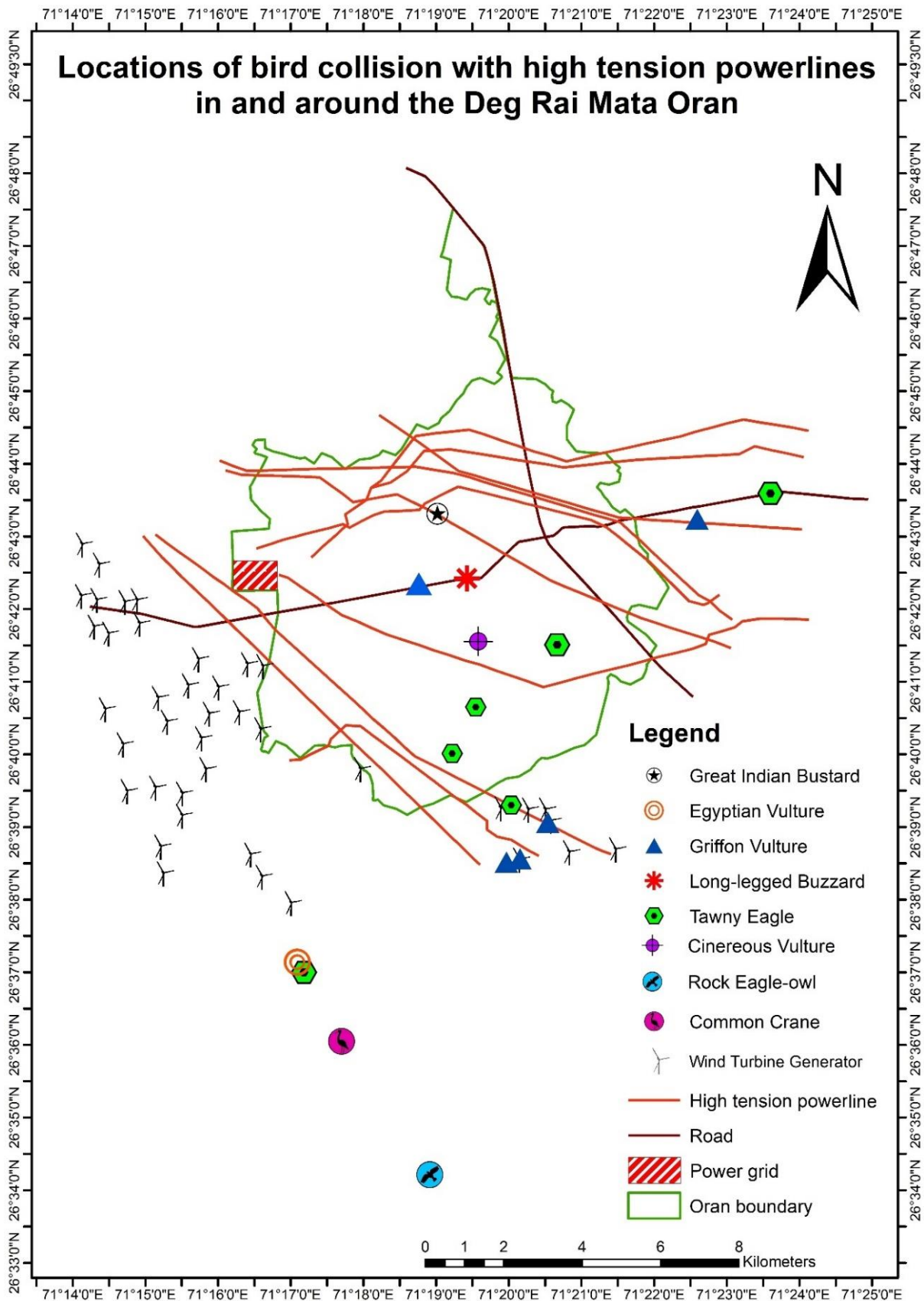


Figure 20 Location of bird mortality due to collision with high tension powerlines (Shapefiles of polygon generated by moving on the boundaries of Deg Rai Mata Oran, locations where particular species got killed due to collision/electrocution at the newly installed powerlines)

2.5 Recommendations

Legal as well as illegal diversion of Orans and Gauchars for non-grazing purposes is increasing exponentially. Need of the hour:

1. A strict ban on any further destruction of the Oran through privatization and infrastructure development.
2. All existing powerlines could be laid underground and new powerlines should be rerouted from outside the Oran.
3. Through consultations with the local people, the process of declaring Deg Rai Mata Oran as a Community Reserve, which will be managed by a Community Reserve Management Committee, should commence immediately.



Left: Camels grazing in Oran; right: Herders taking rest under a Khejri tree © Unmesh Mitra



New high voltage powerlines are coming up despite stay order by National Green Tribunal © Sujit Narwade



Egyptian Vultures roosting on pylons in Deg Rai Mata Oran © Unmesh Mitra



Demoiselle Crane roosting near the waterbody behind Deg Rai Mata Temple © Ashley Chiu



Egyptian Vultures were killed by electrocution in Deg Rai Mata Oran © Unmesh Mitra



SITE III - POKHRAN FIELD FIRING RANGE

**A refuge for the last remaining <75 individuals
(population of Thar Desert) of the Critically
Endangered Great Indian Bustard**



Bird view from one of the dunes in PFFR © Sujit Narwade



In non-breeding season males and females form flocks © Sujit Narwade and Dharmendra Puniya

3.1 Introduction

3.1.1 History of contribution by Indian Army in Ornithology

The history of Indian Army's contribution to ornithology is very old. In 1713, Edward Buckley, an East India Company surgeon in Madras, made descriptions and drawings of 22 birds; in 1831, Captain W.H. Sykes of the Bombay Army gave a detailed account of the birds in 'Dukhun' (now Deccan); Lieut. S. R. Tickell, an officer of the 1st Native Infantry, collected birds in Bengal and Bihar; Captain James Franklin of the 1st Bengal Cavalry collected birds for the Society (Proc. Zool. Soc., London 1881) and so on (Kinnear 1952, Ali 1979).

3.1.2 Role of Indian Army in the conservation of wildlife

The Indian Army has conducted several workshops to sensitize the army personnel as well as locals in several parts of India. There are many examples. The Northern Command of the Indian the State Forest Department of Jammu and Kashmir has appointed army officers as honorary wildlife wardens. The Central Command has conducted workshops in various places like Lucknow, Keoladeo Ghana and Shivpuri Nature Reserve. Tree planting has been taken up on a major scale in hilly areas and near the Sariska.

The Eastern Command of the Indian Army has carried out a massive reforestation programme in Siliguri and on the mountain slopes of Sikkim to prevent soil erosion and landslides. One of its activities has included a nature camp for children in the Lachen/Lachung Valleys of northern Sikkim. It has instructed the local artillery units to suspend firing on the ranges in the Torsa River area when the annual elephant migration takes place to ensure a safe passage for these wild herds. The Southern Command has undertaken plantation work in Pulgaon, Maharashtra.

The Indian Army is one of the few armies in the world that has implemented the concept of ecological units of the Territorial Army since the 1980s. These units, called Ecological Task Forces (ETF), are officered/lead by a mix of regular and Territorial Army officers and based on manpower comprising young ex-servicemen [Gautam 2009]. ETF units demonstrated the importance of water and fodder management in small villages in the Thar Desert. In the Desert National Park, a couple of enclosures are being protected by ETF units.

3.1.3 Bishnoi Community

This community is not a caste but a sect mainly dominant in the Thar Desert of Rajasthan. They follow a set of 29 principles/commandments imparted by Guru Jambheshwar (1451-1536) and are involved in protecting animals and nature. Owing to the presence of the Bishnoi community in the surrounding areas of Pokhran Field Firing Range (PFFR), wildlife can be seen freely roaming here.

3.2 Objectives

1. To find out the status and distribution of GIB in and around PFFR.
2. Monitor the wildlife-vehicle collisions (WVC) in a small stretch of NH11.

3.3. Study area

PFFR is one of the eight Field Firing Ranges of the Indian Army situated in the state of Rajasthan. This is the biggest field firing range of the Indian Army, surrounded by villages such as Khetolai, Loharki, Chacha, Odhaniya, Chandhani, Askandra, Ajasar, and Didhoo. Regular military exercise in this landscape and 24×7 surveillance makes it one of the strictly monitored areas, which also results in it being a safe haven for the flora and fauna of the desert ecosystem.



Firing range is one of the best unaltered spaces of grasslands left in India © Sujit Narwade

3.4 Methods used

The village surrounding the PFFR were monitored regularly to understand the movement and estimated number of GIBs between January 2019 and January 2021. Whereas in the core area of PFFR grid-based (15 km. × 15 km.), a survey was conducted in the third week of November 2020 and first week of January 2021. The grids (15 km × 15 km) were surveyed along the approachable dirt roads of 25 ± 5 km length (continuous or broken tracks based on accessibility). Surveys were conducted in the early morning (0600-1100) and late afternoon (1600-1900) when birds/animals are most active. The speed of the vehicle was maintained between 15-20 km/hr during the survey. A 23-km stretch between Dholiya village and Chacha village was selected for WVC monitoring. This stretch was regularly monitored on every fourth day from August 2020 to April 2021. This activity was carried out preferably between 0600-0900 on a bike. The speed of the bike was kept below 10 km/hr and the location of the roadkill was recorded using a handheld GPS machine.



Mammals like Chinkara roam across the firing range without any fear © Neelkanth Bora

3.5 Results

3.5.1 GIB in PFFR and surrounding areas

The GIB spends time inside PFFR throughout the year except in winter when a few birds visit the surrounding farmlands. The BNHS team has been receiving feedback about GIB sightings from the locals and the army personnel. Fortnight surveys were undertaken by the BNHS staff and volunteers in the village areas. While the entire PFFR was covered in the last week of November 2020 and the first week of January 2021, our count never touched two digits, except in winter (12 birds in November 2020, and 16 birds in January 2021).

Two birds, one at Khetolai and one at Gangaram-ki-dhani (per. comm Radheshyam Bishnoi) died because of collision with powerlines (see fig 21). Although GIB resides in the PFFR area most of the year, in winter, a few individuals move out into the surrounding villages as mentioned in the table 2. These places need to be spared from any kind of heavy infrastructures like solar, wind projects and high-tension powerlines.

Table 2 GIB counted regularly in surrounding areas of PFFR and in core area of PFFR on selected days

Sr. No.	Date	Male	Female	Juvenile	Day count	Comment
1	14-04-2020	2	0	0	2	Regularly visits water leakage points across the pipelines near Loharki to drink water
2	20-04-2020	6	0	0	6	
3	30-04-2020	6	3	0	9	
4	05-05-2020	4	0	0	4	Male Display
5	08-05-2020	5	0	0	5	
6	10-05-2020	7	0	0	7	
7	16-05-2020	3	0	0	3	
8	06-06-2020	5	0	0	5	
9	10-06-2020	2	0	0	2	
10	20-06-2020	0	5	0	5	
11	23-06-2020	4	0	0	4	
12	27-06-2020	3	0	0	3	
13	01-07-2020	2	0	0	2	
14	03-07-2020	4	4	0	9	
15	10-07-2020	1	1	0	2	
16	16-07-2020	3	0	0	3	Male Display
17	20-07-2020	2	0	0	2	
18	08-08-2020	4	0	0	4	
19	14-08-2020	4	0	0	4	
20	20-08-2020	4	0	0	4	
21	05-09-2020	0	7	0	7	
22	09-09-2020	0	4	0	4	
23	21-09-2020	2	2	0	4	
24	12-10-2020	3	0	0	3	
25	19-10-2020	0	1	0	1	
26	22-10-2020	0	4	0	4	
27	29-10-2020	0	1	0	1	
28	04-11-2020	5	0	0	5	Covered entire PFFR
29	23-11-2020	4	3	1	8	
30	23-11-2020	5	6	1	12	Covered entire PFFR
31	08-12-2020	5	0	0	5	Separate groups of males and females
32	30-12-2020	4	0	0	4	
33	29-01-2021	9	7	0	16	Covered PFFR and adjoining villages

Table 3 Places visited by GIB frequently and names of the villages that should be kept away from any infrastructure development fatal to birds and other wildlife

Sr. No.	Village name	Latitude	Longitude
1.	Khetolai	27.01972	71.705425
2.	Khetolai	27.01658	71.708508
3.	Khetolai	27.02432	71.705536
4.	Malka talab	27.10088	71.757982
5.	Silotra talab, Chacha	26.99172	71.751301
6.	Chopardi Naadi	27.02638	71.7939
7.	Loharki	27.12561	71.78747
8.	Soraliyo ki dhani	27.10223	71.834893
9.	Rathora	27.09742	71.846936
10.	Rathora	27.09576	71.878572
11.	Bhaba	27.04391	71.889123
12.	Tekra water body Chhayan	27.19363	71.95431
13.	Odhaniya	26.95554	71.709006
14.	Odhaniya	26.96485	71.648807
15.	Chandani	26.94967	71.602348
16.	Ratan Koshi talab, Keraliya	26.86058	71.499035
17.	Gangaram ki dhani	27.03122	71.636747



GIB drinking water at a water leakage point. The same individual was found drinking water at the same point for almost two months © Dharmendra Kumar



Outside PFFR, many solar plants and associated HT powerlines have suddenly mushroomed in the GIB habitats, even in Chayan village inside the GIB arc identified by the Government of Rajasthan © Sujit Narwade



GIB is so rare now that locating even single individual is difficult. The survey team came across the signs like feathers, faecal matters left by the birds during roosting time © Sujit Narwade

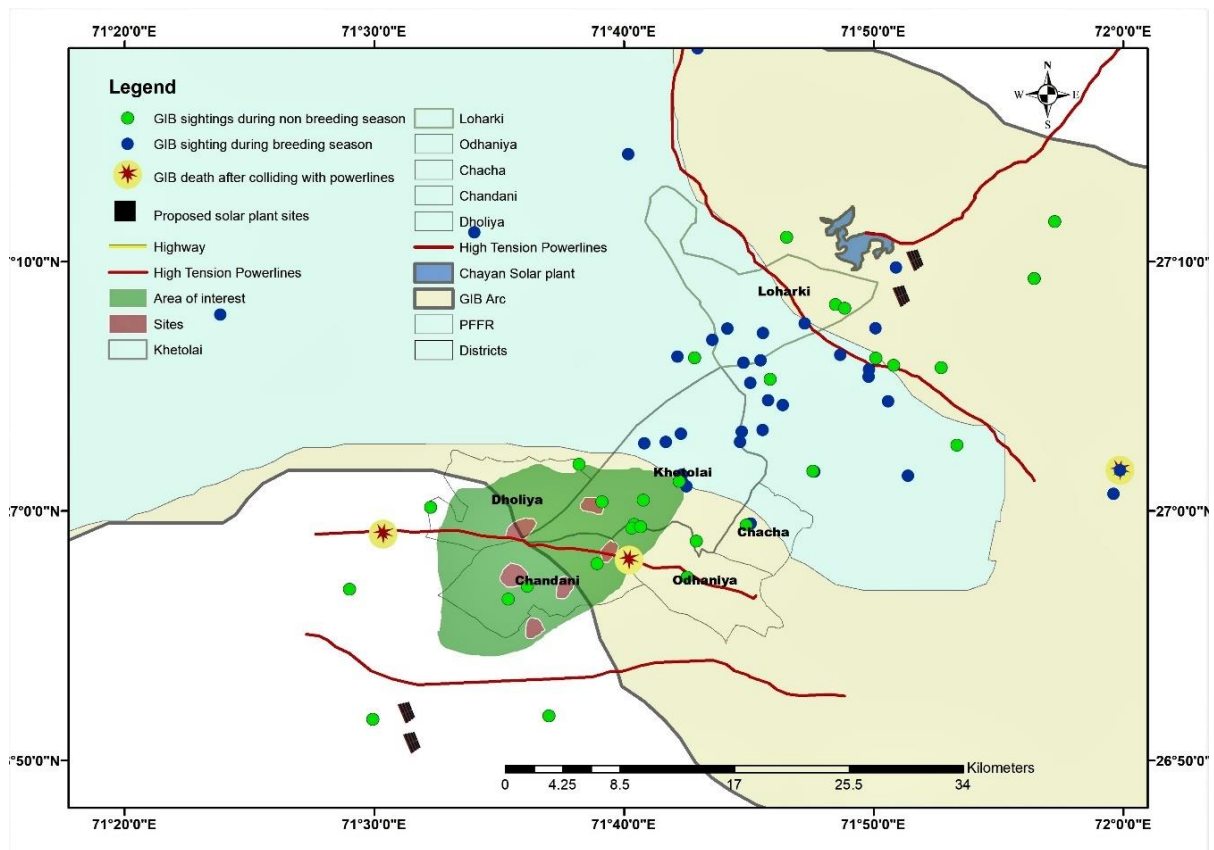


Figure 21 Map showing GIB in PFFR area, the existing infrastructures, villages playing a crucial role in wildlife conservation and the proposed no-infrastructure zone (Shapefiles of villages, polygon of PFFR, GIB arc, locations where GIB was sighted, killed due to collision/electrocution at the newly installed powerlines, locations of energy infrastructure in the landscape used to prepare the map)

Note: HTPL in the map stands for High Tension Powerlines. Arrows indicate the movement of GIB from PFFR to outside and vice versa. No-infrastructure zone here indicates that no developmental activities fatal to birds and wildlife should be allowed in the area.

3.5.2 Avifauna of the PFFR

A total of 91 species of birds were observed during the survey inside and around PFFR. Among them the following species fell under the IUCN Red List category.

1. **Critically Endangered:** Great Indian Bustard *Ardeotis nigriceps* and Sociable Lapwing *Vanellus gregarius*
2. **Endangered:** Egyptian Vulture *Neophron percnopterus* and Steppe Eagle *Aquila nipalensis*
3. **Vulnerable:** Common Pochard *Aythya ferina*, Eastern Imperial Eagle (*Aquila heliaca*, Macqueen's Bustard *Chlamydotis macqueenii*, River Tern (*Sterna aurantia*), Tawny Eagle *Aquila rapax*, and Yellow-eyed Pigeon *Columba eversmanni*
4. **Near Threatened:** Cinerous Vulture *Aegypius monachus*, Laggar Falcon *Falco jugger*, and Pallid Harrier *Circus macrourus*

3.5.3 Habitat restoration work being carried out by the BNHS in Khetolai area

Habitat restoration work being carried out by the BNHS with the help of the local community in Khetolai village and its surroundings that are frequented by the GIB. Through this work, more than 20,000 ha area would become a suitable open habitat for the GIB and wildlife.

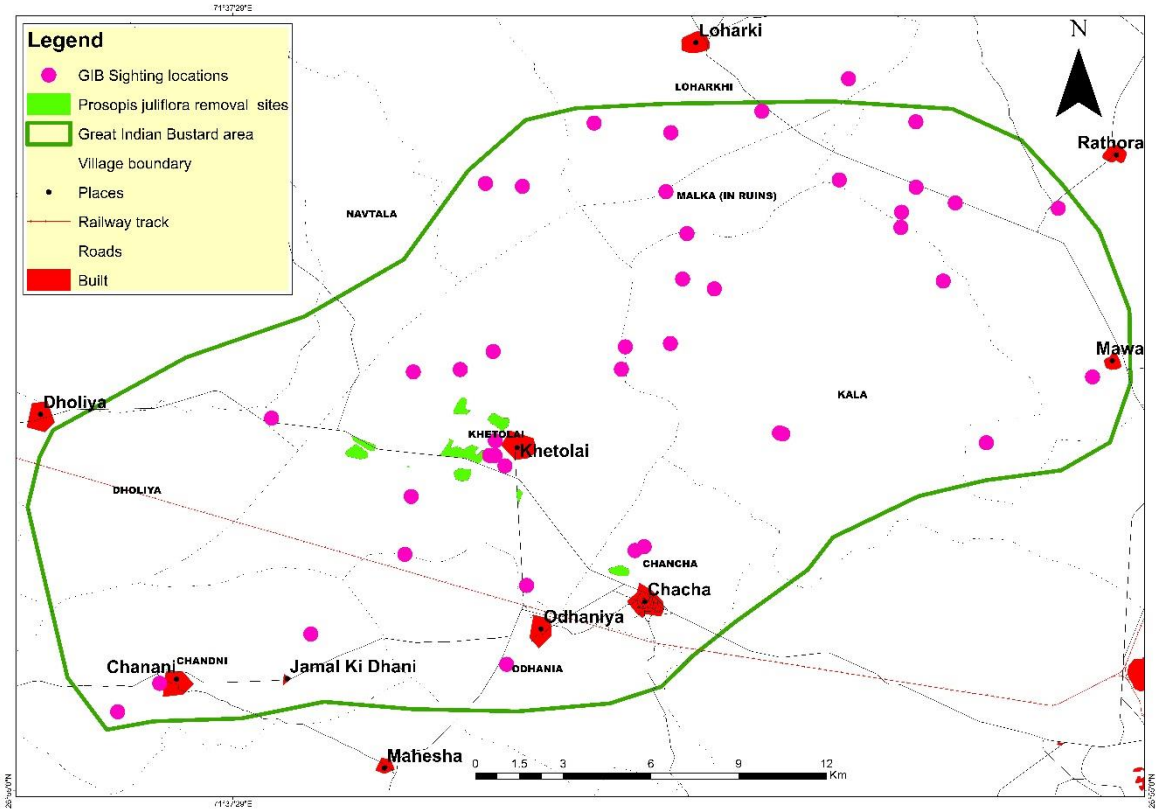


Figure 22 Areas frequented by the GIB where BNHS is carrying out Habitat restoration work with the help of the local communities. Through this work, more than 20,000 ha area would become a suitable open habitat for the GIB and wildlife (Shapefiles of villages, locations where GIB was sighted, areas from where *P. juliflora* was removed were used to prepare the map)



GIB roaming around human settlement without any fear © Sujit Narwade

3.5.4 Mammals and reptiles in PFFR

During the survey, mammalian species such as Desert Fox *Vulpes vulpes pusilla*, Indian Fox *Vulpes benghalensis*, and Chinkara *Gazella bennettii* were observed to be widely spread, but the presence of some new species such as Wild Boar *Sus scrofa* and Indian Grey Mongoose *Herpestes edwardsii*, which were not to be seen three decades ago (Rahmani 1989), were spotted commonly drawing attention to the changes that have come about in the surrounding habitats in recent times. Active burrows of Desert Jird *Meriones hurrianae*, Long-eared Hedgehog *Hemiechinus collaris* as well as Spiny-tailed Lizard *Saara hardwickii* and Brilliant Ground Agama *Trapelus agilis* were observed.



(Left) Spiny-tailed Lizard (Right) Brilliant Ground Agama displaying ©Unmesh Mitra

3.5.5 Wildlife-vehicle collisions (WVC) monitoring

The WVC monitoring study conducted in the area revealed the impact of high-speed vehicles on nocturnal species. Obligatory nocturnal mammals such as Indian Long-eared Hedgehog *Hemiechinus collaris* was not observed during the vehicle or

point count survey but the BNHS team found many road kills during the WVC survey. The presence of another mammalian species Indian Grey Mongoose *Herpestes edwardsi* was also found during this survey. It was found that Indian Monitor Lizard *Varanus bengalensis* was the major victim of road mortality (n=27) followed by Indian Long-eared Hedgehog (n=14) and Rock Dove (7 individuals). Mammalian species like Chinkara (n=7), Desert Fox (n=4), the elusive Desert Cat (n=1), Nilgai (n=3), and Indian Grey Mongoose (n=4) were also becoming victims of vehicle collisions. Other reptiles like Brilliant Ground Agama (n=2), Desert Monitor Lizard (n=2), Spiny-tailed Lizard (n=4), and Red Sand Boa (n=2) were also found killed on the roads.



Wildlife-vehicle collisions or roadkill mortality of Left - Indian Long-eared Hedgehog and Right - Desert Fox on NH 11 is a common sighting near Khetolai village © Unmesh Mitra



Awareness board near Khetolai bus stop ©Unmesh Mitra

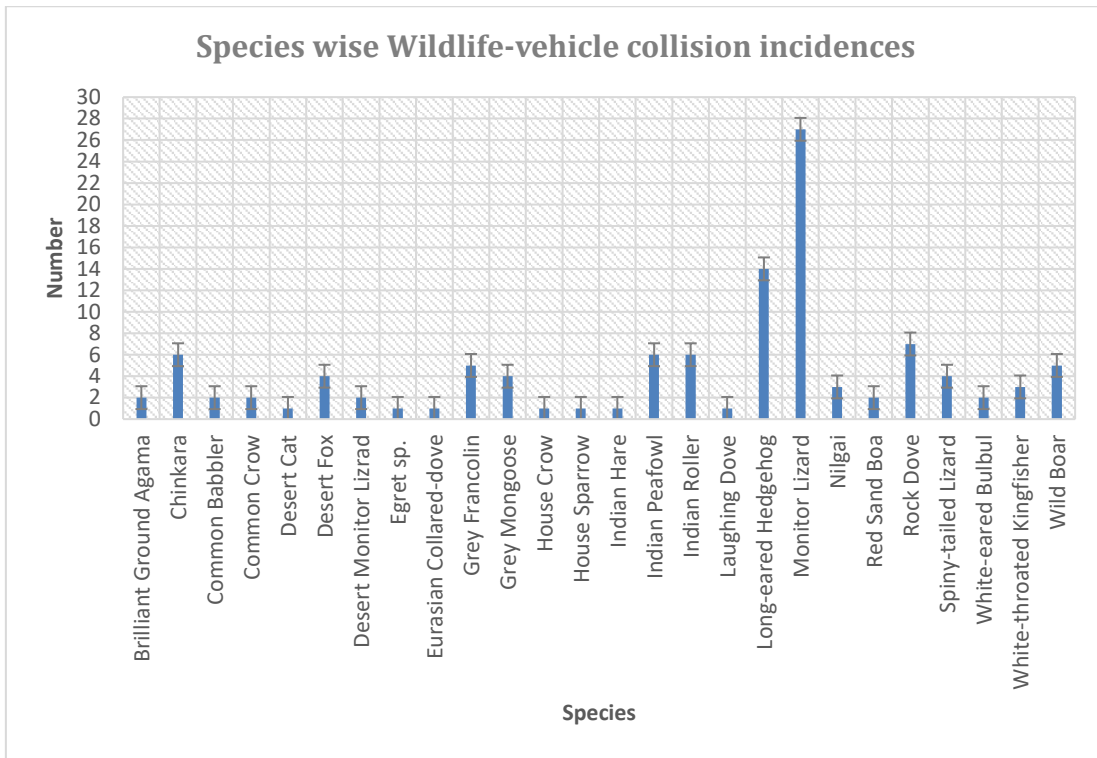


Figure 23 Graph depicting victims of WVC

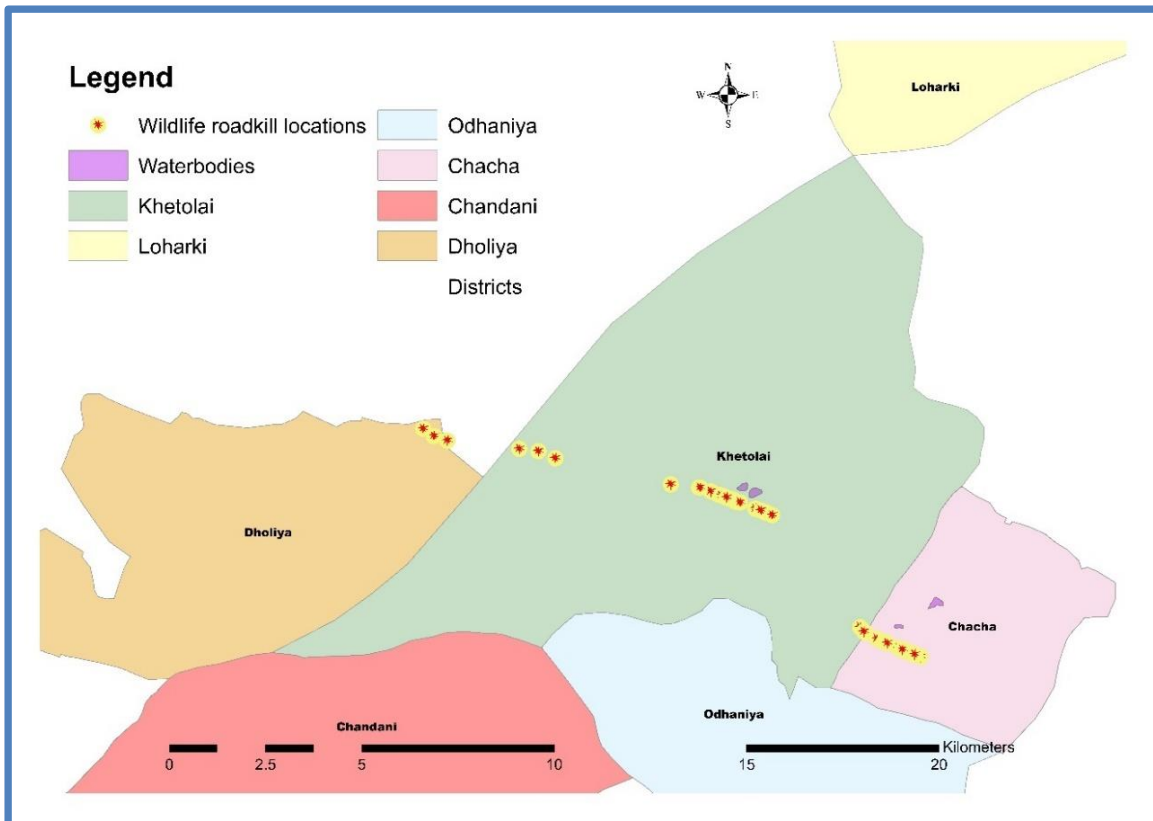


Figure 24 Map showing locations of high wildlife mortality due to road accidents

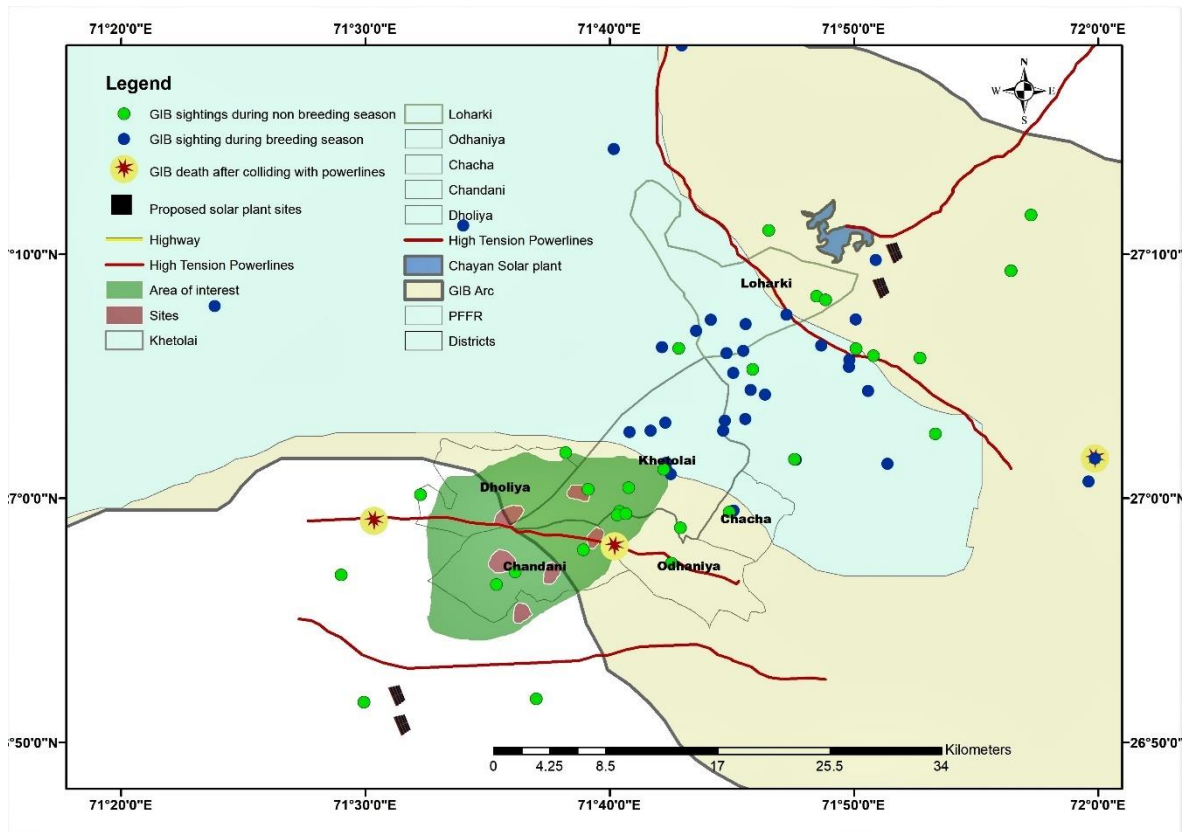


Figure 25 "Area of interest" is the proposed reserve of 5 sq. km as a safe wintering ground for the GIBs (Shapefiles of villages, polygon of PFFR, GIB arc, locations where GIB was sighted, killed due to collision/electrocution at the newly installed powerlines, locations of energy infrastructure in landscape were used to prepare the map)



The PFFR is fortunately surrounded by the Bishnoi community, which is known for its conservation commitments © Sujit Narwade

3.6 Recommendations

1. Strict ban on further infrastructure development planned in GIB areas near PFFR (see no-infrastructure zone suggested in fig 12 and table 1 on page 38-39).
2. All existing powerlines should be laid underground and new lines should be rerouted away from the GIB distribution sites.
3. Government departments such as Agriculture, Horticulture, Animal Husbandry, Public Works Department and Energy Department should utilize the area keeping sustainable and environmentally friendly approaches in mind.
4. The habitat should be restored by removing exotic and invasive plant *Prosopis juliflora* in villages around PFFR.
5. Free ranging dogs and invasive Wild Boars should be controlled
6. Proper fencing should be ensured around PFFR to stop the illegal movement of people and overgrazing.
7. The old wells inside PFFR should be filled up and closed permanently to avoid accident.
8. The proposal to transform Jaisalmer district into a 'solar hub' is threatening the future of GIB. A solar power plant was installed in Chayan in 2019. That was historically a suitable habitat of the GIB. The need of the hour is to safeguard these critical habitats to save the future of the species. These areas should be purchased after consultation with the gram panchayat, community leaders and land owners and transform it into a Reserve, thus providing a safe wintering ground for the GIBs. The local people should be employed to monitor the reserve.
9. It was found that the area near NH 11 is intensively used by various wildlife species to cross the national highway to approach the perennial source of water (*Naadis* in local language) such as Khetolai naadi and Silotra naadi to quench their thirst. It is also the only road for travellers coming from Jaipur, Bikaner and Jodhpur to Jaisalmer. BNHS with the help of Khetolai gram panchayat has installed a sign board near Khetolai bus stop to make people aware of the need to maintain a minimum vehicle speed while driving through the area; there is a need to install more colourful boards with photographs of the wildlife along with attractive slogans to make people aware of the dangers of over speeding, creating wildlife corridors, putting speed breakers



The PFFR is also a haven for raptors and vultures © Sujit Narwade



Wild Boar population is increasing exponentially and needs to be controlled © Sujit Narwade



Shepherds and nomadic grazers refill the old wells though tankers and survive on this water while they reside deep inside PFFR for many days © Sujit Narwade



SITE IV - WESTERN PART OF THAR DESERT, JAISALMER

Clear sky, abundant Sewan grass, but missing key wildlife: exploration of border areas



Sevan grass is abundant in some portions of the western part of the Thar Desert but there are very few signs of the wildlife activity on the ground © Neelkanth Bora



According to Ibrahim Khan (third from left), the western part of Thar Desert was once part of the silk route, acting as a socio-economic as well as cultural hub of Thar Desert © Saddam Hussein

4.1 Introduction

The far western part the Thar Desert meets the Cholistan Desert of Pakistan at the International Boundary (IB). An expanse of 471 km of Jaisalmer district border touches Pakistan. Historically this area was a busy pit stop of *Silk Route*, a 2,000-year-old trading route that connected China to Turkey and Italy via India and Central Asia. This landscape was once vibrant with the presence of rich merchants and rich fragrance of spices and colourful clothes but started declining with the opening up of the sea trade routes and after partition in 1947. Today, a major area in the far western Thar Desert comes under the control of Border Security Force (BSF) where the movement of civilians is restricted. With the permission of the North and South Sectors of BSF, BNHS conducted surveys in these areas from March 25 to April 10, 2021.

4.2 Objective

To explore the area to find out the status of bustards and raptors

4.3 Study area

The study area is situated along the International Boundary under Jaisalmer district. The tributaries of Indira Gandhi Nahar Project (IGNP) run across the eastern side of the study area. A majority of the habit was characterized by dunes, grasslands, shrubland, rainfed cropland, and canal/borewell supported cropland.

4.4 Methods

A grid-based vehicle survey was conducted between March 26 and April 9, 2021. The study area was 8,400 sq. km and divided into 40 grids (15 km × 15 km). The grids were surveyed along the approachable dirt roads of 25 ± 5 km length (continuous or broken tracks based on accessibility). Surveys were conducted in the early morning (0600-1100) and late afternoon (1600-1900) when birds/animals are most active. On days with good weather conditions, daylong surveys were conducted. The speed of the vehicle was maintained between 15 and 20 km/hr during the survey. Secondary information was collected during casual conversations with the local inhabitants of Dhani, community leaders and shepherds.

Surveyors conducted a 10-minute random sign survey for indirect signs at every 5 km. of the vehicle transect. For GIB and MacQueen's Bustard, footprints, feathers, and excreta were considered as signs.

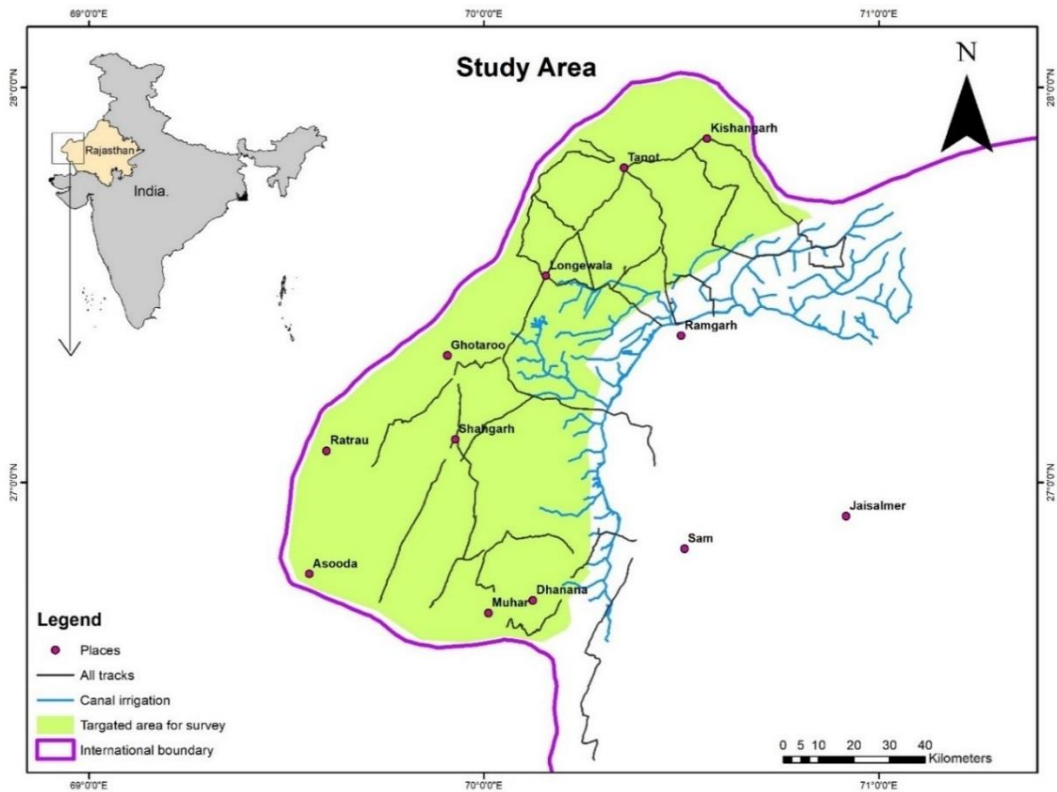


Figure 26 Map of the far western part of Thar Desert, which is technically separated by a network of Indira Gandhi Nahar Project (IGNP). Places and tracks covered by the BNHS team are shown here (Shapefiles of villages, polygon showing area under BSF contro and the, network of IGNP canal were used to prepare the map)



(Left) Landscape dominated by dunes, (Right) Dunes interspersed with grassland dominated by *Lasiurus scindicus* © Unmesh Mitra



(Left) Path indicator of a Dhani in the middle of the desert, (Right) A traditional Dhani in the Thar Desert © Neelkanth Bora

4.5 Results

4.5.1 Human settlement

The onset of partition in 1947 led to the depopulation of the far western Thar Desert, near the international boundary. Very few human settlements were seen in this part of the desert. Traditional *Dhani* with 10-12 mud huts were observed, with roof made up of dried *Leptadenia pyrotechnica*. Other than the local inhabitants, a few governments and non-government enterprises were observed exploring and extracting natural gas in this region.

4.5.2. Powerlines

Low-tension powerlines and a few high-tension lines were observed along the tar road throughout the landscape. No powerline surveys were done due to time constraint. But on one occasion, a Common Raven *Corvus corax* was found hanging on the powerline probably because of electrocution and on another occasion, a Demoiselle Crane *Grus virgo* was found injured (injury on right wing), seemingly due to collision with powerline.

4.5.3 Overgrazing

Cattle, sheep and goats were found in varying numbers in different areas of the landscape. A few grasslands were overgrazed due to huge livestock pressure. Sheep and goats are the major livestock found here, followed by cattle and camels. Free-ranging donkeys were found in moderate groups (5-6 individuals in one group) in the northern fringe of the landscape as compared to the southern portion.

4.5.4 Poaching

Poaching might be a major threat to wildlife in this landscape. Though we had not come across any direct incident, there were indirect evidences on two occasions. On April 04, 2021, we spotted a vehicle at N 27.744754°, E 70.602186°. When we approached the vehicle, it scooted from the spot and vanished within a few minutes. We found footprints of *Gazella bennettii* and Sandgrouses in that area. We could not however confirm if the passengers were there to poach on the animals. On April 9, we heard two rounds of gunshot at N26.87603°, E70.28962° in a gap of 3 minutes.

4.5.5 Free-ranging dogs

Free-ranging dogs were observed on a few occasions during the survey. All of them were close to human settlements.

4.6 Status of bustards

After scanning for the traces of GIB, conducting sign survey, and interacting with the locals, we found footprints of GIB on two locations (see map below). One near Longewala, on a dune on March 30, 2021, three days after heavy rain along with sand storm in the area and another, near Buili-Bahla area. These locations indicate probable movement of birds between India (~5 km Indian territory) and Rahimyar Khan and Bahawalpur districts in Pakistan. Footprints of MacQueen's Bustard *Chlamydotis macqueenii* were seen in a few locations in the Indian side of the border. Since we conducted surveys in late March and early April period, probably most of

the MacQueen's Bustard would have left the western part of the Thar Desert. The locals were well acquainted with the presence of MacQueen's Bustard (*Tilor* in local language) in peak winter season.

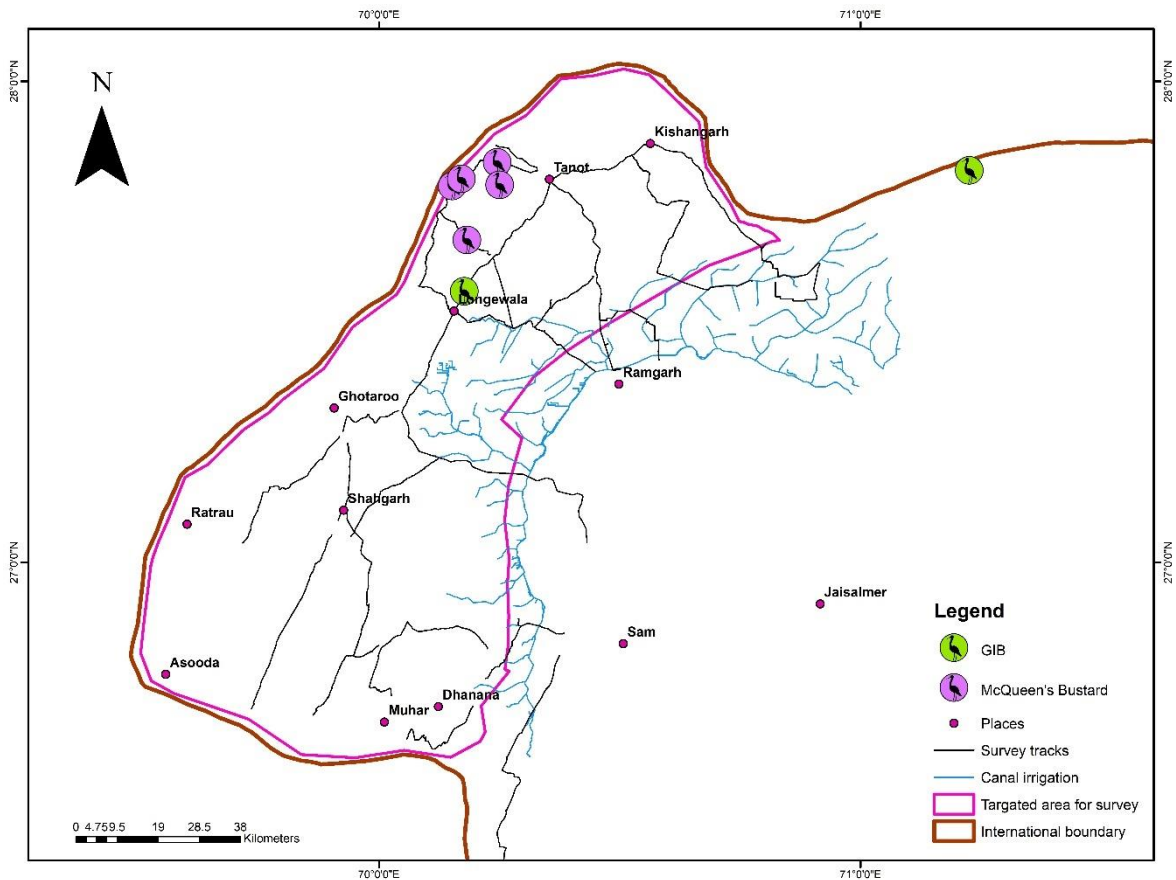


Figure 27 GIB and MacQueen's Bustard seen in BSF area during the survey period

4.7 A haven for raptors

A total of 27 species of raptors were observed, including the following threatened and Near Threatened species:

1. Critically Endangered: Red-headed Vulture *Sarcogyps calvus*, White-rumped Vulture *Gyps bengalensis*
2. Endangered: Egyptian Vulture *Neophron percnopterus*, Steppe Eagle *Aquila nipalensis*
3. Vulnerable: Tawny Eagle *Aquila rapax*, Indian Spotted Eagle *Clanga hastata*
4. Near Threatened: Cinerous Vulture *Aegypius monachus*, Himalayan Griffon *Gyps himalayensis*, Laggar Falcon *Falco jugger* and Pallid Harrier *Circus macrourus*.

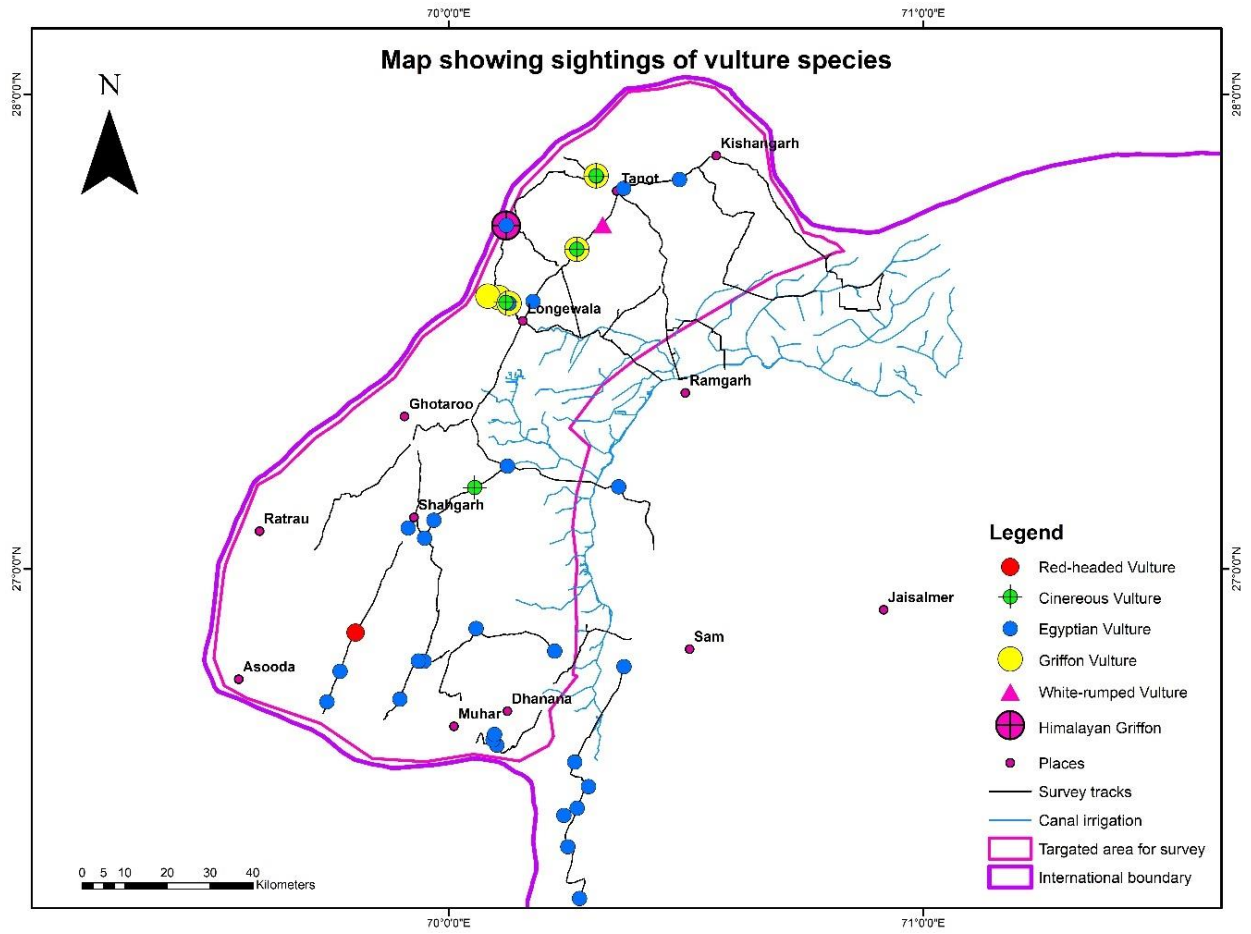


Figure 28 Distribution of vultures in the western part of the Thar Desert



(Left) One Critically Endangered Red-headed Vulture was seen soaring in scorching afternoon, (Right) Six Griffon Vulture perching on a Khejri *Prosopis cineraria* tree. © Neelkanth Bora

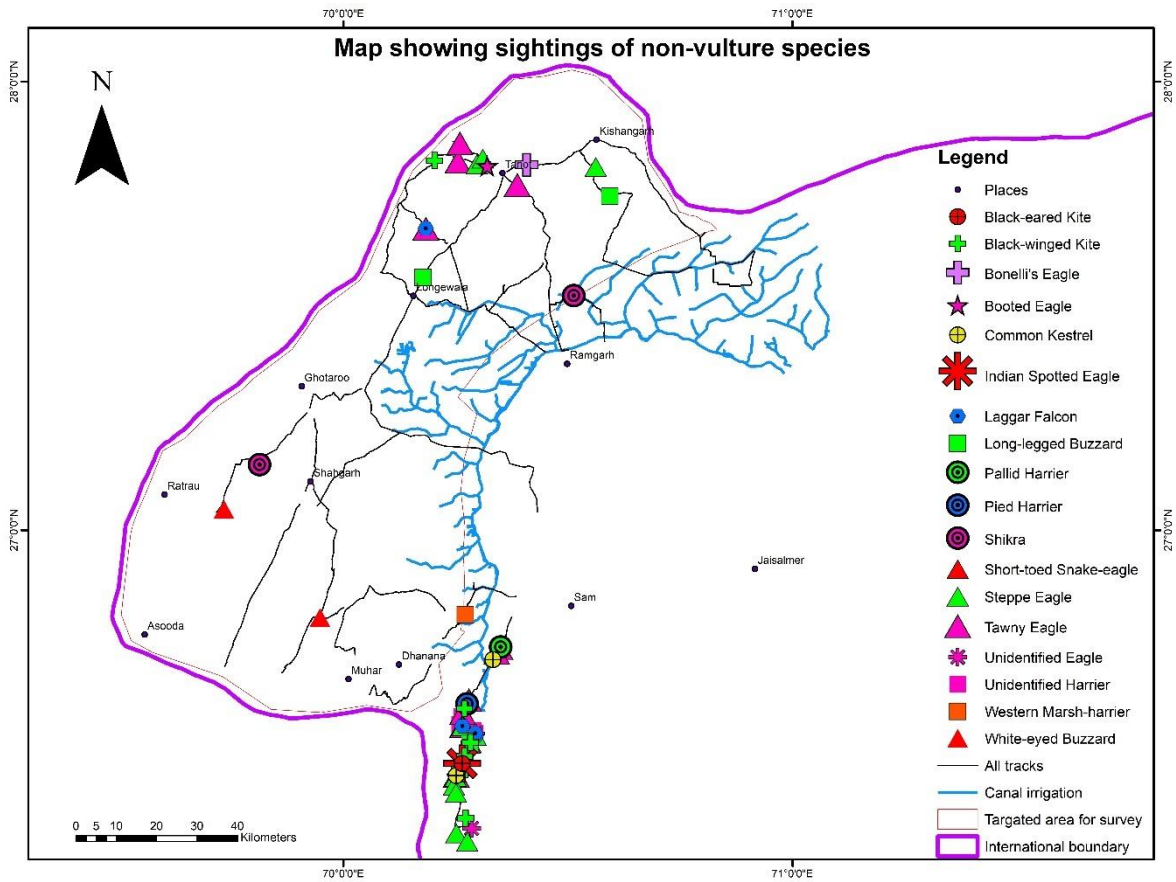


Figure 29 Distribution of raptors (other than vulture) in the western part of the Thar Desert



Left: A Steppe Eagle flying; Right: White-eyed Buzzard perching on a pole. © Neelkanth Bora



Left: Footprints of MacQueen's Bustard; Right: Feathers of MacQueen's Bustard © Sujit Narwade



Left: Footprint of GIB; Right: Feather of GIB © Sujit Narwade



Left: Spiny-tailed Lizard; Right: Desert Jird, found abundantly in the study area, forms the prey of raptors. © Ashley Chiu



Left: One of the few high-tension powerlines in the landscape; Right: An injured Demoiselle Crane *Grus virgo*
© Neelkanth Bora



Free-ranging donkeys and cattle are the main herbivores in the area © A. Mohan



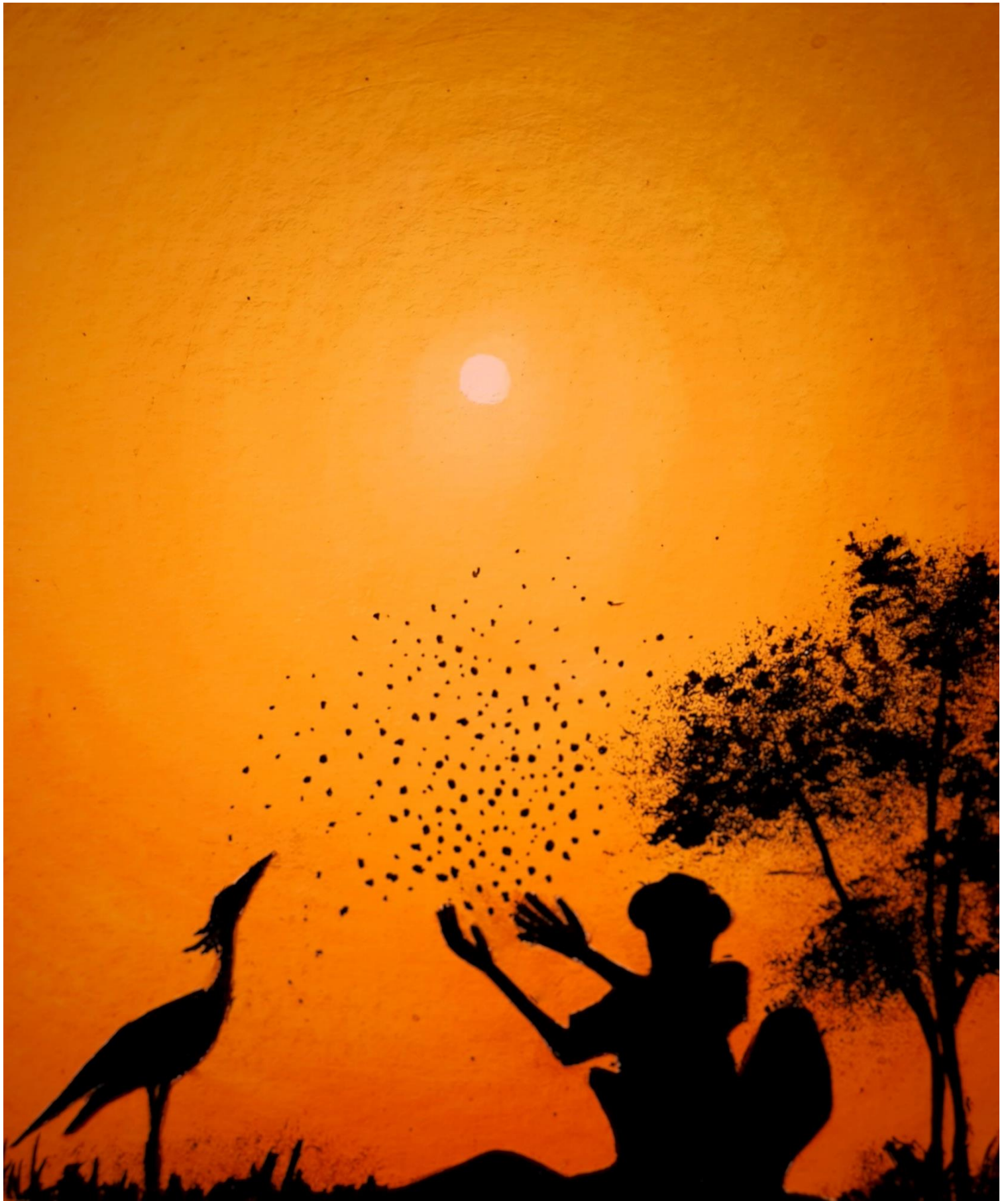
BNHS team interacting with the local villagers to obtain secondary information on the habitat, Bustard and other wildlife. © Unmesh Mitra

4.8 Recommendations

1. An all-season survey should be carried out in this area to get an overall idea of the status and distribution of migratory and threatened species.
2. Sensitization of BSF personnel by organizing a workshop once or twice in a year.
3. Construction of a Nature Interpretation Centre in Longewala somewhere near the Army Museum. This will help to create awareness on wildlife of Thar among the army personnel and tourists.



There is a need to protect such vast open undisturbed habitat patches in the border areas © Sujit Narwade



SITE V – KHICHAN: Abode of Kurjans

5.1 Introduction

The village of Khichan is situated 5 kilometres east of the tehsil headquarters, Phalodi, and 150 kilometres north of the district headquarter, Jodhpur. Khichan gained popularity in the 19th century as most of its inhabitants were traders. Recently, Khichan has been recognized by the Rajasthan Tourism Development Corporation (RTDC) as a tourist hotspot. A seasonal rivulet or Naala passes by the western fringe of the village in which occasional flash floods occur. Previously, the Naalas used to be the roosting site for the Demoiselle Cranes. Currently, these floodplains have been encroached by the exotic invasive plant species *Prosopis juliflora*. Thousands of cranes spend the winter in Khichan and they can be seen right in the middle of the village.

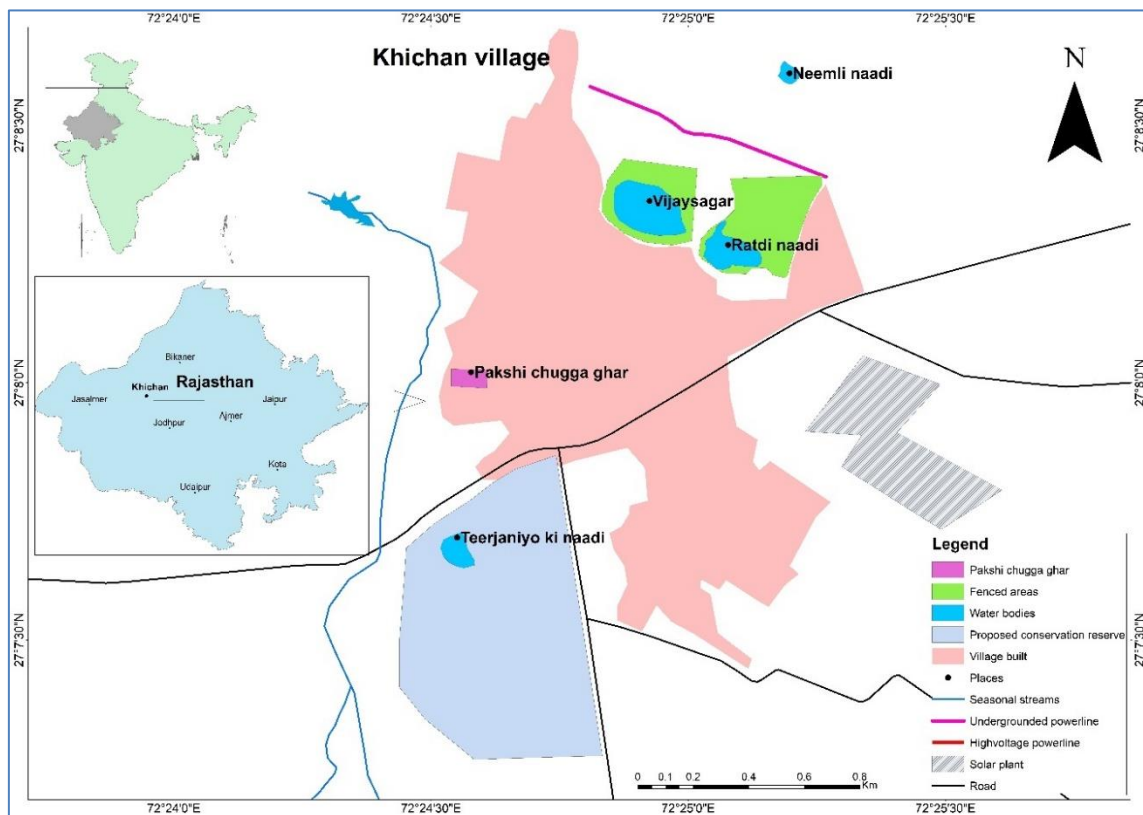


Figure 30 Map of Khichan village and important sites used by the cranes (Shapefiles of villages, polygons of the sites used by Demoiselle Crane were used to prepare the map)

5.1.1 Demoiselle Crane

Demoiselle Crane *Grus virgo* is among the six species of cranes found in India and is known as Kurjan in the northern part of India. These winter migrants start their journey from the breeding grounds of Siberia, China, Mongolia, the Tibetan and Ladakh Plateau and fly over Central Asia and Afghanistan before settling down in the Thar Desert (Gehlot *et al.*, 2021). These birds arrive in the Thar Desert early September and return to their breeding grounds by the last week of March. They follow the Central Asian Flyway (CAF) in their migratory journey.



Cranes fly very low during landing and take-off at foraging and resting sites © Sujit Narwade

5.1.2 Historical Aspect

The history of cranes or Kurjan in Khichan dates back to 40 years ago when a young Ratanlal Maloo (a recipient of Salim Ali Nature Conservation Award in the year 2009 presented by BNHS) returned from Odisha, responding to his uncle's call to look after his ageing mother. Maloo and his wife Sundarbai, being devout Jains, considered it their duty to feed the birds. Maloo observed that the crane population increased from September, peaking in winter and they moved around the area in search of food. Maloo approached the Village Panchayat to allot some land for the Kurjan, raised funds from the high-income families of the village to get the allotted land fenced, which eventually came to be recognized as Chugga Ghar. Fenced with a 6-foot wire mesh, it protects the foraging birds within.

5.1.3 Present congregation sites of Demoiselle Crane in the study area

A) Chugga Ghar

The Chugga Ghar is 7286 sq. metres wide. A granary is located in the vicinity of the Chugga Ghar where grains are stored. On a daily basis, a total of 2500 kilogram of grains are fed to the birds in the winter season. The stock of the grains is mainly provided by the Jain community of the village.

B) Naadi and Talab

In the northern side of the villages are two waterbodies, Vijaysagar Talab and Ratri Naadi, used by the cranes as resting sites and sources of drinking water.



In the morning, the cranes can be seen feeding on the grains at Chugga Ghar © Sujit Narwade

5.2 Objectives

To find out the threats faced by Demoiselle Crane in the study area.

5.3 Methods

Sevaram Mali, a small shop owner who resides near the Chugga Ghar, has been keeping systematic records of the rescued, injured, dead birds since October 6, 2010. We have collected data from him with his permission and analysed them.

5.4 Results

5.4.1 Mortality of Demoiselle Crane

A total of 234 dead individuals were recorded between 2010 to 2021 in Khichan and surrounding areas. Most of the dead individuals were found at Vijaysagar Talab and Ratri Naadi, the two most important roosting areas of Demoiselle Crane. Chugga Ghar has been their major foraging site. The cause of these mortalities was identified as food poisoning, collision with powerlines, attack by feral dogs, and injury from Chinese Manja. In a few cases, the reason for the mortality was natural. The pie chart on page 99 depicts the highest number of bird mortality that has taken place at Vijaysagar Talab, Ratri Naadi followed by Teejaniyo ki Naadi and Chugga Ghar.

Vijaysagar, being the major source of water for the birds to quench their thirst, attracts major congregations, which in turn attracts predators such as stray dogs. The powerlines passing close to the Talab region have also been responsible for obstructing the flight of the birds and causing mortality. The Bar graph on page 99 shows that the highest number of incidences of mortality in birds have been due to collision with the powerlines, followed by attacks by free ranging dogs. Food poisoning incidences were recorded, caused by the contamination of grains by high levels of insecticides containing phosphorous.

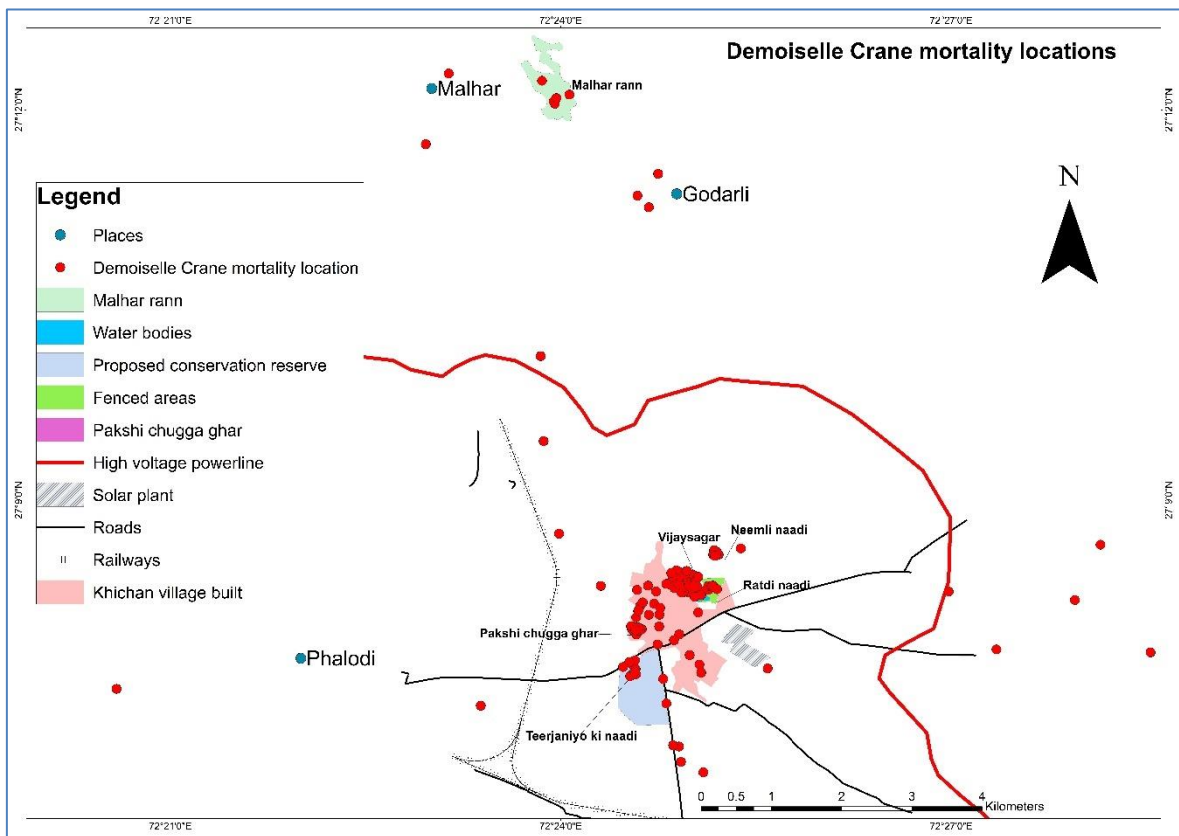


Figure 31 Map showing locations of Demoiselle Crane mortalities (location data collected by Mr. Sevaram Mali used to prepare the map)

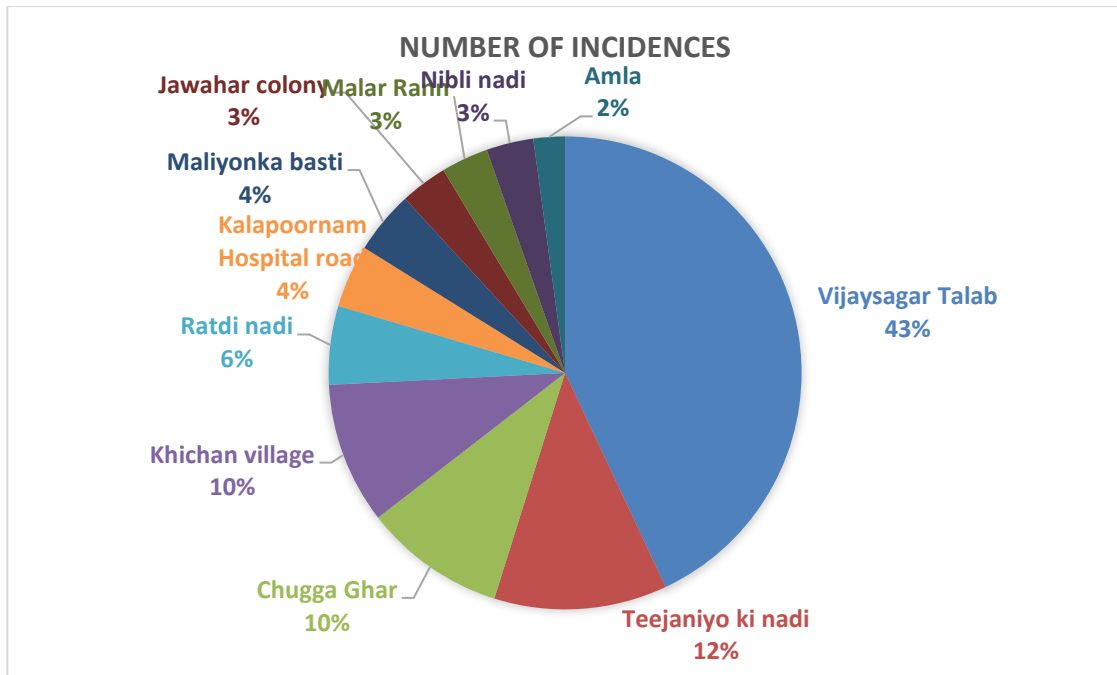


Figure 32 Roosting (Vijaysagar Talab) and foraging site (Chugga Ghar) shows high incidences of injuries in cranes during taking off and landing

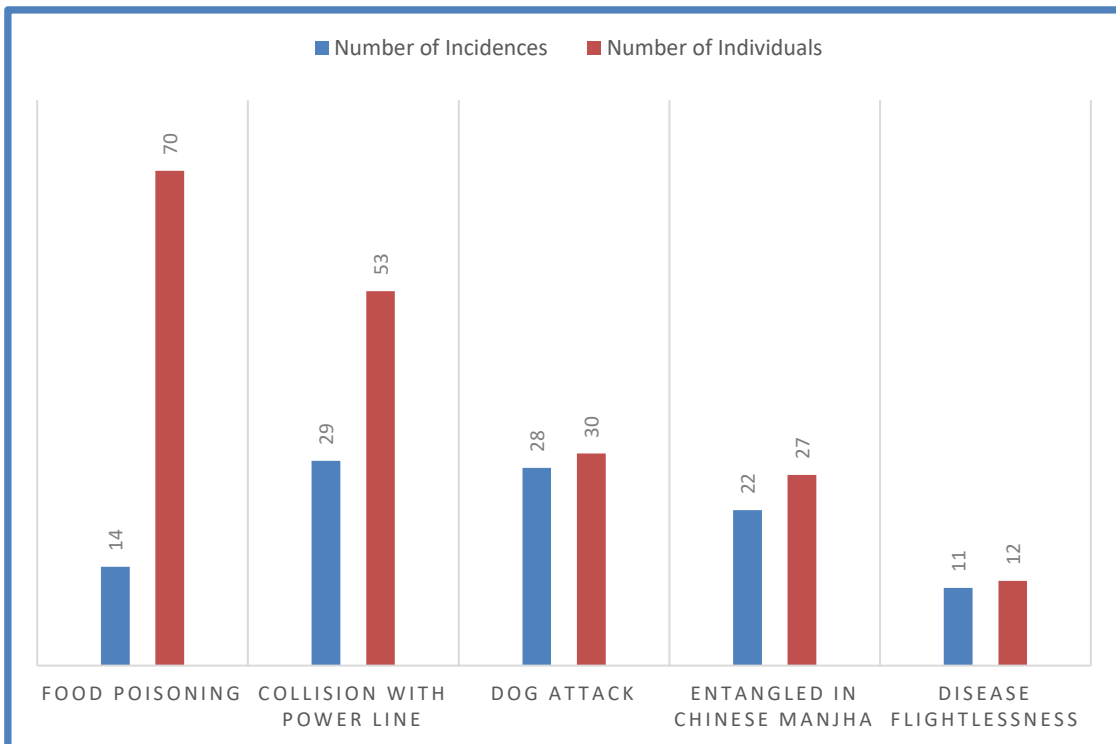


Figure 33 Cranes are being injured or killed due to the major five reasons shown in the figure

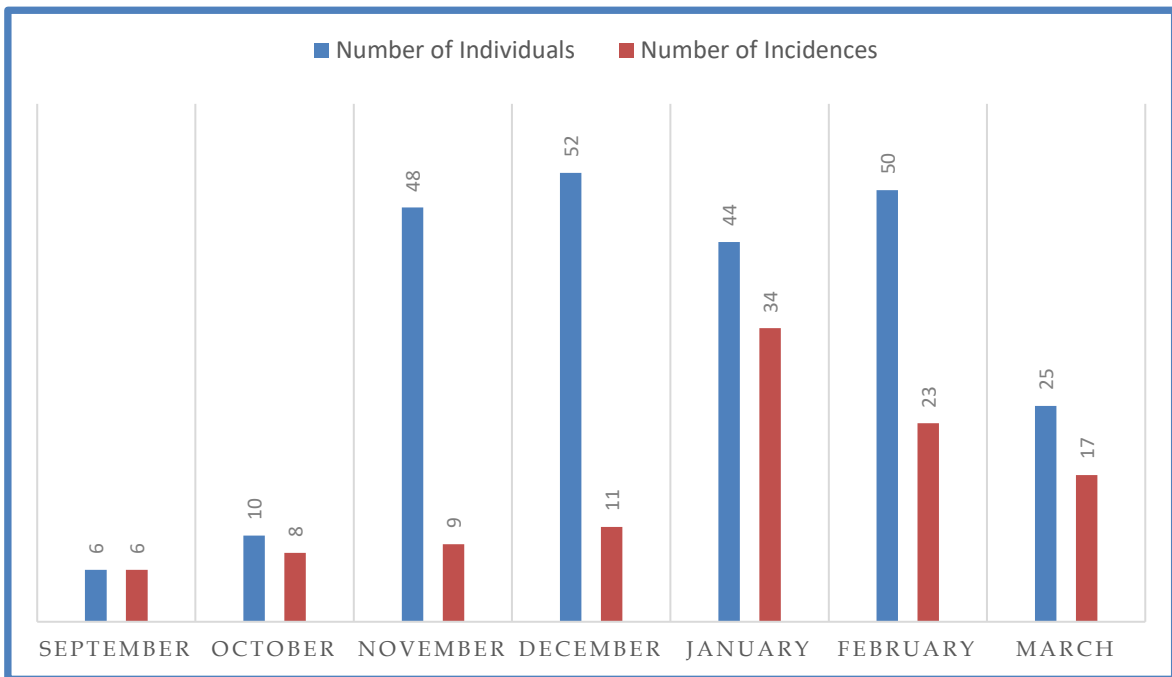


Figure 34 Graph showing month wise injuries in birds at Khichan (data compiled from June 2010 to March 2021)

The above graph depicts that the maximum number of mortalities was caused between November and February, the highest being in the month of January.

5.4.2 Locals in conservation

On several occasions, it was observed that the birds were hunted down by the free-ranging dogs. To resolve this issue, the villagers with the help of the local administration covered the entire waterbodies with chain-linked fencing. Along with this, the local people pressured for a 33-kv powerline passing from Vijaysagar Talab to be laid underground. Sevaram Mali, the shop owner of Khichan, has now become a full-time guardian of these birds. He started taking care of the injured birds, mostly those that were chased by dogs or injured due to collision with the powerlines. Sevaram started documenting the number of injured birds he was rescuing and getting them treated with the help of a local veterinarian. His efforts and legal battle that he fought resulted into successfully undergrounding the powerlines near Chugga Ghar. Sensitization of the government agencies resulted into initiation of a process to declare conservation reserve for the Demoiselle Cranes near Teejaniyo ki Naadi.



Sevaram Mali sensitizing school students, frontline staff of Forest Department, and farmers © BNHS photo archive



Sevaram Mali felicitating local farmers with a notebook containing a *Kurjan* sticker © BNHS archival

कुरजां संरक्षण: हाईटेंशन लाइन शिफ्टिंग 400 बीघा पर योजना बनाने आए अफसर

भास्कर न्यूज | खीचन

खीचन में गुरुवार को मुख्य सचिव के निर्देशानुसार उच्चाधिकारी ने स्थानीय अधिकारियों के साथ खीचन स्थित पक्षी चुग्गाघर, विभिन्न तालाबों व कुरजां संरक्षण के लिए आरक्षित जमीनों का निरीक्षण कर कुरजां के संरक्षण के लिए पुख्ता कार्य योजना बनाने के लिए मंथन किया। संभागीय मुख्य वन संरक्षक एवं सरिस्का के निदेशक जीएस भारद्वाज, संभागीय मुख्य वन संरक्षक जोधपुर रघुवीरसिंह शेखावत, अतिरिक्त जिला कलेक्टर फलोदी राकेश कुमार शर्मा, उप वन संरक्षक हनुमानराम चौधरी, पर्यटन विभाग के उप निदेशक भानुप्रतापसिंह,



खीचन | कई विभागों के अधिकारियों ने कुरजां संरक्षण पर चर्चा की।

डिस्कॉम के अधीक्षण अभियंता अशोक कुमार राजपुरोहित, सहायक वन संरक्षक नरेंद्रसिंह शेखावत, फलोदी रेंजर जेटमल सिंह सोढा, क्षेत्रीय वन अधिकारी धर्मदास, भारतीय वन्य जीव संस्थान के डॉ. सुतीर्थो दत्ता, बॉम्बे नेचुरल हिस्ट्री सोसायटी के सुरजीत नानंबुडी ने पक्षी चुग्गाघर रातड़ी नाडी, विजय सागर तालाब, निंबली नाडी, गंवाई नाडी, 400 केवी की बिजली लाइन व खसरा नं. 151 व 170 में कुरजां संरक्षण के लिए आरक्षित जमीन का निरीक्षण किया व मौके पर उपस्थित संबंधित विभागों के अधिकारियों से विचार-विमर्श किया। इस दौरान अधिशासी अभियंता एचएल परिहार,

सरपंच दिनेश कुमार जैन, पोईओ रामचंद्र व्यास, पक्षी प्रेमी सेवाराम माली, केशव नागौरा, मारवाड़ क्रेन फाउंडेशन के प्रबंधक सत्यनारायण सिंह, मोडाराम मेघवाल, पटवारी पवन जोशी, नायब तहसीलदार फलोदी हरिराम कुलदीप, अधिशेष निरीक्षक मिश्रीलाल, रेंजर नखताराम सहित गणमान्य नागरिक मौजूद थे। सीसीएफ भारद्वाज 400 केवी हाईटेंशन बिजली लाइन के पोल स्थानांतरित करने, वन विभाग के जमीन पर चारदीवारी बनवाने व फेसिंग करवाने, कुरजां पड़ाव स्थल का विस्तार करने, कुरजां संरक्षण के लिए आरक्षित 400 बीघा जमीन की चारदीवारी के बारे अधिकारियों से कार्य योजना पर चर्चा की।

News highlighting Jodhpur High Court's 2017 directive to a committee comprising representatives of Forest Department, BNHS and WII to review the on-ground situation and suggest whether there is a need to shift the powerlines from the resting site of the cranes.

5.5 Recommendations

1. Strict restriction on new high-tension powerlines over the Khichan area.
2. Awareness programmes should be organized in schools regularly to make the students aware of the importance of Demoiselle Crane and other wildlife in the ecosystem and the threats they are facing by Chinese Manja.
3. The contamination of grains with high levels of insecticides is the reason behind the mortality of the highest number individuals in the last 11 years. Therefore, awareness campaign among farmers is recommended to reduce the incidences of food poisoning
4. The injured individuals can be ringed or satellite-tagged before release. A study dedicated to the movement ecology of Demoiselle Crane will provide information on their migration routes, stopover sites and their breeding ground. This study will be helpful for the conservation of this species.
5. Removal of invasive species *Prosopis juliflora* from the landscape.
6. Control on free-ranging dogs from the roosting and foraging ground of Cranes.

DISCUSSION

One of the factors that greatly influenced a change in land use in the Thar region is the development of IGNP, earlier known as Rajasthan Canal (Rahmani 1997b). This resulted in an increase in agriculture in the Thar region with an unprecedented rise in the human population (Rahmani 1997b). The availability of water also influenced the change in agriculture. Traditional crops like Moong *Phaseolus radiatus*, Moth *Vigna acontifolia*, Guar *Cyamopsis tetragonoloba* and Bajra *pennisetum typhoides* got replaced by cash crops like Groundnut *Arachis hypogea*, Cotton *Gossypium* sp., Rice *Oryza sativa* and Sugarcane *Saccharum officinarum* (Sivaperuman and Baqri 2009).

The tremendous changes in the faunal composition of the Thar Desert are an important concern from the point of habitat alteration. Species that are sensitive to such habitat changes decline in population and are vulnerable to extinction. Moreover, the change in the habitat also brings about the introduction of new species that may eventually compete with the desert species for the already scarce resources in the arid terrain. One of the endemic species in the desert, Stoliczka's Bushchat *Saxicola macrorhyncha*, is facing a severe threat, as is the Great Indian Bustard *Ardeotis nigriceps* (Sivaperuman and Baqeri 2009). Moreover, consequent reclamation of land for cultivation has pushed the grazers to the already overgrazed countryside leading to habitat deterioration for the fauna that depend on it (Rahmani 1997b). Species like Wild Boar were seen throughout the study area and is becoming one of the reasons for human-wildlife conflict in many areas.

The Thar Desert is also home to grassland-obligate species like larks such as Bimaculated Lark *Melanocorypha bimaculata*, Greater Short-toed Lark *Calandrella brachydactyla*, and Greater Hoopoe-lark *Alaemon alaudipes*, which are also mass migrant species. The Thar Desert is also very rich in birds of prey, both in terms of the variety and abundance. Tawny Eagle *Aquila rapax*, Common Kestrel *Falco tinnunculus*, Laggar Falcon *Falco jugger*, Steppe Eagle *Aquila nipalensis* and Long-legged Buzzard *Buteo rufinus* are common. The Thar landscape has a very high density of preys like Spiny-tailed Lizards and Desert Jirds that attract a high concentration of these birds of prey.

SITE-WISE RECOMMENDATIONS

SN	Activity	DNP	Deg Rai Mata Oran	PFFR and Pokhran	West part of Thar	Khichan
1.	Capacity building of the community and frontline staff of the forest department for effective conservation actions	✓				
2.	Habitat restoration and grassland development on community-owned areas like Orans and Gauchars			✓		
3.	Bishnoi people are very well known for their contribution in wildlife conservation. Public awareness campaign using their example could inspire more people to take up wildlife conservation			✓		
4.	Revival of degraded grasslands through planned management is recommended for the Thar Desert ecosystem of Rajasthan			✓		✓
5.	Strict ban on further infrastructure development planned in GIB areas (see highly sensitive zones shown in map)			✓		
6.	All existing powerlines should be laid underground and new lines should be rerouted away from the GIB distribution sites	✓	✓	✓	✓	✓
7.	Control over free ranging dogs and Wild Boars (across the sites)	✓	✓	✓	✓	✓
8.	Sensitization of the Indian Army and BSF personnel and initiation of active collaboration to stop poaching activities			✓	✓	
9.	Conservation-oriented research and knowledgebase development	✓	✓	✓	✓	✓
10.	International cooperation to safeguard the population surviving in India-Pakistan border (BSF)				✓	
11.	Strengthening the anti-poaching squad (BSF)			✓	✓	
12.	Habitat conservation and sustainable management			✓		
13.	Effective communication and outreach at landscape- and site-level	✓	✓	✓	✓	✓
14.	Boundary demarcation, notification, and inclusion within land-use records (DNP)	✓				
15.	Cross-sectoral Mechanism - multiple stakeholders involvement setup in non-protected areas	✓	✓	✓	✓	✓

SN	Activity	DNP	Deg Rai Mata Oran	PFFR and Pokhran	West part of Thar	Khichan
16.	Encourage research institutes, civil society, and community-based organizations to act as 'knowledge hubs', custodians or stewards of birds and their habitats.	✓	✓	✓	✓	✓
17.	Strategies for communication and awareness (bird fair, species-specific festivals (GIB, Demoiselle Crane) days	GIB	Raptors	GIB	Raptors	Demoiselle Crane
18.	Promote bird monitoring, including citizen science groups		✓			✓
19.	Conservation initiatives through local community participation	✓	✓	✓		✓
20.	Use conventional ringing and advanced technologies (satellite tagging, GSM tagging) to assess ecology, migration strategies, and population dynamics of migratory birds	GIB, Larks, raptors	Raptors	GIB, ground nesting birds	Raptors	Demoiselle Crane
21.	Conduct studies on the impact of usage of pesticides on migratory birds and developing suitable response options such as modification of farming practices					✓
22.	Plan for periodic assessment and monitoring of the sites to understand the response by the birds to the rapidly changing landscape	✓	✓	✓	✓	✓
23.	Develop outreach materials on birds, key fauna of Thar Desert and their habitats	All sites				
24.	Maintain People's Biodiversity Register and devise strategies for the conservation of birds should feature as a key segment in the District Administrative Plans.	All sites				
25.	Create awareness amongst mass media on the importance of the conservation of migratory birds and their habitats.	All sites				
26.	Analyse existing data for population trends/creating and managing site-specific database and establishing decision supporting system	All sites				

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Web links from where mapping layers sourced

BBBike, Wolfram Schneider Map data, OpenStreetMap.org contributors (<https://extract.bbbike.org/>).

GPS Visualizer, Adam Schneider, (<https://www.gpsvisualizer.com/>)

GIS MAP, (<https://www.igismap.com/>).



Chestnut-bellied Sandgrouse male and female © Sujit Narwade



A lone Sociable Plover seen near Sudasari, DNP as well as Chacha village, Pokhran © Sujit Narwade



Two antelopes Nilgai and Chinkara in one frame © Unmesh Mitra



During non-breeding season, the neck of the male GIB becomes grey © Sujit Narwade

ANNEXURES

Annexure I) Team involved

SN	Name	Designation	SN	Name	Designation
1.	Dr Sujit Narwade	Project Scientist	6	Mr. Alap Bhatt	Project volunteer
2.	Dr Neelkanth Bora	Programme Officer	7	Mr Musa Khan	Local volunteer
3.	Mr Unmesh Mitra	Project Fellow	8	Mr. Nawab Khan	Local volunteer
4.	Mr Pankaj Bishnoi	Field Assistant	9	Mr. Jalam Sain	Local volunteer
5.	Mr Dharmendra Kumar	Site Coordinator	10	Mr. Sachin Bishnoi	Local volunteer

Annexure II - Key bird species of the Thar Desert

Great Indian Bustard *Ardeotis nigriceps*

Local/ Hindi Name - Godawan, Nahar Goonjni (Rajasthan), **Sind:** Gurahna

IUCN Red List status - Critically Endangered (decreasing population)

Estimated Global population - 100-150 (BirdLife International 2020)

Wildlife (Protection) Act, 1972 category - Schedule I (Part III).

Distribution (Global/India/Thar) - Open grasslands of India and Pakistan. Almost extinct from 90% of its former range and now the viable population is confined mainly to the Thar Desert of Rajasthan.

Habitat - Mainly occurs in arid and semi-arid grasslands with short vegetation and low-intensity cultivation in flat or gently undulating terrain.

Diet - omnivorous diet, mainly comprising fruits like *Zizyphus*, insects like grasshopper and beetle, reptiles, and seasonal crops like groundnut and millet (Rahmani 1989).

Breeding- Between mid-summer and monsoon, they congregate to breed (Rahmani 1989). They are polygynous and use lek mating system where dominant males exhibit courtship displays and have fidelity to their display stations. (Rahmani and Manakadan 1986; Rahmani 1989; Johnsgard 1994). The males inflate their gular pouch and make resonating booming sound, reaching a long distance, to attract the females. The expanded gular pouch dangles under the neck of the male, giving it a bigger appearance. Besides, during courtship displays, it also cocks up its tail, reaching almost to the head. After mating, the female does all the parental work and often lays only 1 egg and very rarely two.

Migration - Sedentary, seasonally nomadic.

Threats - The threats to this ground-dwelling bird are mainly habitat loss and degradation caused by agricultural expansion and use of heavy pesticides, infrastructural development and industrialization, poaching and nest predation by free-ranging dogs, pigs and other wild mammals, ill-informed habitat management, lack of community support and involvement (Collar *et al.* 2017). Electricity pylons, wind turbines, solar energy projects and other infrastructures have increased the severity of habitat degradation and disturbance (Anon 2015). Collision with powerlines adds to the growing concerns (Dutta 2018).

MacQueen's Bustard or Asian Houbara *Chlamydotis macqueenii*

Local/ Hindi Name – Tilor, Sindh - Taloor

IUCN Red List status – Vulnerable (decreasing population)

Estimated Global population – 33000-67000 (BirdLife International 2020)

Wildlife (Protection) Act, 1972 category – Schedule I

Distribution (Global/India/Thar) – It is native to the desert and steppe regions of Middle East, Western and Central Asia, from the Sinai Peninsula in Egypt extending across Kazakhstan to Mongolia and N. China (Gobi Desert). It winters from the Persian Gulf to Pakistan (including Cholistan desert), NW India. In Thar, it is a winter migrant, widespread in low density in undisturbed areas, mainly near the borders (Rahmani 1997).

Habitat – It prefer arid desert, semi-desert area with dense cover of scrub vegetation (Heezik and Seddon 1999).

Diet – It is omnivorous, feeding on seeds, shoots, berries, insects, and reptiles. Its intake of animal matter increases prior to breeding towards late winter, but it is mainly plant-based during the non-breeding season (Roberts 1992)

Migration – Migratory (Central Asia Flyway). Northern population from Central Asia (Gobi Desert and E. Kazakhstan) migrate to the Arabian Peninsula, Pakistan and NW India.

Threats – The main threats are rampant poaching and habitat loss due to the degradation of its breeding and wintering grounds for cultivation and infrastructure development (Tourenq *et al.* 1999).

Annexures III) Datasheets used in data collection

Point Count (200m radius) (10 minutes)

Date (DD/MM/YY):

Start time:

End Time:

Name of observer(s):

Weather

Terrain type:

Grid ID:

Point ID:

Land cover

Latitude:

Longitude:

Threats:

Insects:

Dominant grass/tree/bush/crop names	Veg Cover %	Ht (cm)	FL Y/N	FR Y/N

V.C % & Code	0-20 1	20-40 2	40-60 3	60-80 4	80-100 5	
V.H (cm) & Code	0-20 1	20-40 2	40-60 3	60-80 4	80-100 5	>100 6

Weather - Sunny(S), Cloudy(C), Fog(F), Windy(W), Storm (ST), Bright Sunny (BS)

Land Cover/ Habitat - Dunes (Du), Grassland (Gr), Agricultural (Ag), Stony (S)

Terrain type - Flat (F), Sloppy (S), Undulating (U)

Threats - H: Human, D: Dogs, S: Solar Energy W: Wind Energy, PW: Powerline, R: Roads, G: Grazers

Sex - M: Male, F: Female, J: Juvenile, U: Unidentified

Activity: FR: Foraging, N: Nesting, D: Display, FL: Flight, PG: Preening, IC:

Incubating, PC: Perching, R: Roosting, C: Calling, FS: Flushing, RE: Resting, DW:

Drinking Water, RU: Running

S N	Time	Species	No. of ind.	Sex				Act	B/R/M
				M	F	J	U		
1									
2									
3									

Sign Survey

(Species: GIB, MacQueen's Bustard, Fox, Desert Cat, Chinkara)

Type of Sign (Feather/ Foot print/ Excreta/ Burrows)	Name of the species	Remarks

Notes:

Occupancy survey

Date (DD/MM/YY):

Start time:

End Time:

Grid ID:

Name of observer(s): Species of interest: Great Indian Bustard: GIB, MacQueen's Bustard: MQB, Vultures, Chinkara: C, Stoliczka's Bushchat: SB, Painted Sandgrouse: PS, Pin-tailed Sandgrouse: PTS, Desert Fox: DF, Indian Fox: IF, Spiny-tailed Lizard: STL, Raptors (congregation >3)

Latitude	Longitude	Name of Species	P. D	S. D	Number of Individuals	Remarks

Notes:

Wildlife Mortality survey

Date:

Grid ID:

Observers:

Sr. no.	Latitude	Longitude	Name of the species	Reason of mortality

Reason of mortality: RK: Roadkill, PL: Powerline, P: Poisoning, D: Disease, U: Unknown

Notes:

Waterbody survey (50 metres periphery for sign survey)

Site details

Wetland name (village):

wetland area in Ha:

Date (DD/MM/YY):

Season:

GPS coordinates:

Start time:

End Time:

Weather

Bird/animal count and behaviour study

Sr. No.	Time	Species	No. of birds	Sex				Act	Disturbance	Dist	Flight ht	Rem
				M	F	J	U					

Sex: - M- Male, F: Female, J: - Juvenile, U: Unidentified

Activity: FR: Foraging, N: Nesting, D: Display, FL: Flight, PG: Preening, IC:

Incubating, PC: Perching, R: Roosting, C: Calling

Disturbances: H: Human, N: Noise, PR: Predator, I: Industry, PW: Powerline, R:

Roads, G: Grazing

Season - Summer(S), Winter(W), Monsoon(M);

Weather - Sunny(S), Cloudy(C), Fog(F), Windy(W), Storm (ST), Bright Sunny (BS)

Annexure IV) Common plants seen in the study area

1. Leafless Milk Hedge *Euphorbia caducifolia*

Local/Hindi Name – Thor

Belonging to the Euphorbiaceae family, a multi-stemmed succulent that grows to a large circumference (up to 3 metres tall and 10 metres wide), bears small red flowers on its head. Occupies arid stony terrain. Easily mistaken for cactus as it has a cactus-like form. It creates a micro habitat/protected zone within its stems where rodents, small mammals, birds, and a host of other plants find refuge for shelter and shade. The milky, latex-like sap is also used by local inhabitants for treatment of bleeding wounds, skin-related eruptions, and diseases (Goyal *et al.* 2012).

1. Toothbrush Tree *Salvadora persica*

Local/Hindi Name – Jaal, Meswak, Pilu

A small tree or shrub growing up to a height of 6–7 metres and rarely more than a foot in diameter. It has a crooked trunk with rough, scaly bark and its fibrous branches have been used to make toothpaste. It is popularly called Meswak in India. It is a resilient tree that can tolerate a very dry climate (Orwa *et al.* 2009). Leaves are almost circular, light to dark green, and rather fleshy. Tiny greenish to yellowish flowers in branching clusters and spherical. Bears fleshy berry-like fruit that varies from very light pink to scarlet, used as cattle fodder as well as for cooking (Orwa *et al.* 2009).

2. Vilaytati Babul *Prosopis juliflora*

An exotic plant species that was introduced in the Thar Desert as it shows resilience towards hot and dry/xerophytic conditions. An evergreen leguminous tree typically found in arid and semi-arid regions, with a large open type of canopy (Nazir 2013). The stem is green or brown in colour, twisted in shape; thorns are long and strong ((1.2–5 cm long). Leaves are pinnately compound with 13 to 25 leaves arranged on 1 or 2 pendulous rachis. Leaflets are oblong. Flowers are greenish-yellow in colour, cylindrically arranged spikes that are 5 to 10 cm long and 1.5 cm wide. Fruits are flattened curved, indehiscent pods 4mm thick, 1-1.5 cm wide, and 15-20 cm long (Nazir 2013). It is a xerophytic plant and adapts to different soil types under a wide range of moisture conditions. (Orwa *et al.* 2009). It can adapt to extreme saline and acidic soil conditions and can withstand seasonal waterlogging (Orwa *et al.* 2009). The pods are considered as rich source of protein as well as sugar and are used as fodder (Van der Maesen and Oyen 1997). It has spread across the Thar desert and has caused a major negative impact on the local ecology resulted into loss of suitable habitat.

3. Khejri *Prosopis cineraria*

Naturally occurring plant of the Thar Desert, it plays a great role in food, fuel, and timber. It is a leguminous plant, and the pod (locally known as *Sangri*) is used as a vegetable. It has been found to improve the organic material content of the soil like nitrogen, phosphorous, calcium, and also said to reduce the soil's acidic nature (Mann and Shankarnarayan 1980). It has a phreatophytic root system (deep roots able to reach the water table) which does not interfere with the crop system (Ahuja

1981). Crops are known to show more yield when grown in combination with Khejri (Ahuja 1981). Besides, Khejri helps to reduce water loss by alleviating understory temperature and evapotranspiration (Belsky and Amundson 1992).

4. Ber *Ziziphus mauritiana*

A native fruit-bearing plant of the Indian subcontinent, it is extremely drought resistant. It has multiple uses such as food, fodder, fuel, medicinal, etc. It is a piny evergreen shrub; the trunk is around 30-40 cm in diameter and has an open crown structure. Leaves are variable and alternate and the inflorescence is axillary cymes with 7 to 20 flowers in it. It is a very efficient fuel as it has a high heat content of almost 4,900 kcal per kg (Morton 1987).

5. Giant Milkweed *Calotropis procera*

Local name - Aakado or Aakra

A flowering plant in the family of Apocynaceae, it is also known as Rubber Bush or French Rubber Tree. It is a spreading shrub that grows from 2.5 to 6 m in height. The leaves are big, fleshy, about 15-30 cm long and 2-10 cm broad. It has a succulent (fleshy with more water) and waxy appearance. It bears small pink/purple flowers in clusters. The stem yields a fibre useful for making ropes, bags, nets, etc. (Orwa *et al.* 2009). It is also used as a fodder. Its young pods, leaves, and flower can be fed to goats, camels, and sheep in times of scarcity. It is found growing widely in dry sandy areas and along roads and highways.

6. Kair *Capparis decidua*

The plant rarely exceeds a height of 5 m (Burdak 1982). It is a dense clump of leafless branches. The plant flowers twice a year mostly during the months March–April, and August–September. The flowers are bright red/orange in colour. Its berry-like fruits of reddish-pink colour are eaten by birds as well as used by people for cooking. The leaves are tiny and shed quickly in less than a month. It is a common plant throughout the area and is found on rocks, gravel, and sandy plains on exposed habitats. Sometimes it occurs on sand-dunes where it forms the chief feature of the landscape. It is a sand binder that stabilizes sand dunes (Burdak 1982).

7. Tarameer *Eruca sativa*

It is from family Brassicaceae and originated in the Mediterranean region. It is known as Rocket, Rocket Salad, Arugula, Roquette, or White Pepper. It is found from Southern Europe to North Africa, Iran, India, and Pakistan (Garg and Sharma 2014). An annual growing plant (all roots, stem, and leaves die annually except dormant seeds), it reaches 10 to 100 cm in height, having a slender taproot and erect, stiff, and elongated branching system. The roots are of spindle form with a few secondary roots; the stem is branched and leaves are compound. The species is a hermaphrodite, flowers are 2 to 4 cm in diameter, bisexual, large and occur in small numbers and in small terminal racemes (Garg and Sharma 2014). Seeds are 1.5 to 2 mm, yellow-brown or reddish, spherical or ovoid in two rows in each cell (Garg and Sharma 2014).

8. **Khimp** *Leptadenia pyrotechnica*

The herb is a strong soil-binder and as such is one of the pioneer species in sand dune fixation (Alyemeni 2000) and found in western India (Shetty and Singh 1991). It is a leafless, erect and evergreen shrub, commonly known as Khimp, Kheep, or Khip (Singh *et al.* 2007). It is a perennial, ascendingly growing, profusely branched shrub that is 0.5 to 3 metre in height; stem is smooth, green to pale yellow in colour and has watery fluid/sap (Idrees *et al.* 2016). The flowers are yellowish-green, bisexual, pentamerous, and actinomorphic. Blooming and fruiting time is August to January (Verma *et al.* 2014). It has pod-like fruits that are used as a vegetable (Idrees *et al.* 2016). Its seeds are hairy in the form of tufts.

9. **Senna** *Cassia angustifolia*

Extends from Africa eastwards to Sind and Punjab states of Pakistan and India. It grows in the arid and semi-arid parts of Gujarat and Rajasthan in India (Bentley and Trimen 1992, Ghazanfar and Al-Sabahi 1993). A small, erect, perennial shrub growing to 100-120 cm in height. Leaves of the plant are pinnate, with narrow acute lanceolate and glabrous leaflets of pale green colour (Tripathi 1999). The bright yellow flowers with racemose inflorescence 30-45 cm, pods are 4-7 cm long, containing 5-7 obovate, dark brown and nearly smooth seeds (Tripathi 1999).

11. **Phog** *Calligonum polygonoides*

Calligonum polygonoides Linnaeus, shrub found in dunes of Thar Desert; of the *Calligonum* genus include more than 80 xerophyte species distributed throughout Southern Europe, North Africa and southern Asia. *Calligonum polygonoides* Linnaeus, leafless stem, slow growing, 1-2-metres height (Samejo *et al.* 2013). Plant roots are deeply penetrated into the soil effectively; work as Sand Binder and prevent soil erosion. Roots, stems, flower buds, flowers and fruits are used as fodder, medicine and food (Vyas *et al.* 2012).

12. **Sania** *Crotalaria burhia*

Local/Hindi Name – Sanio, Jhunda, Chag. *Crotalaria burhia* Buch-Ham. Ex Benth., is a perennial shrub found in Thar Desert. It mainly grows in the monsoon season, and matures in early winter. It is a small shrub of one-metre height with small yellow flower. Plant is a member of family Leguminosae, known for its symbiotic relation with root nodules – rhizobia. Some people consider it as a keynote species of the region, which play an important role in maintaining soil fertility through nitrogen fixation and root structure, stabilizing the sand dunes (Sankhla *et al.*, 2018). It also contains high percent of fibre. Traditionally local people are used to making rope out of it; the plant functions as a construction material for rooftops (Dave *et al.* 2017).

13. **Sewan** *Lasiurus scindicus*

Lasiurus scindicus Henrard is a drought tolerant grass species, adopted to grow in saline soil (Naz *et al.*, 2014). It is a bushy, multi-branched desert grass; forms thickets in sandy grassland. It is found in dry open plains, rocky ground, gravelly soil and sandy desert areas (Heuze *et al.* 2015).

14. Dhamasa *Fagonia indica*

Fagonia indica Burm. F., is a small spiny shrub. It grows up to 60 cm height, is widely distributed in open arid desert of Asia and Africa (Ali et al., 2019). *Fagonia indica* is a member of family Zygophyllaceae, found in dry habitat. It is often used in folk medicine mainly in the treatment of various skin lesions (Shaker et al. 1999).

15. Gathia *Dactyloctenium scindicum*

Dactyloctenium scindicum Bioss. is a perennial grass species found in dry grassland, open bushes and is an important food species for the Spiny-tailed Lizard *Uromastix hardwickii* as well as fodder for the cattle (Parihar and Kumar 2016).

Annexure V) Birds documented in Thar Desert (literature review)

SN	Common name	Scientific name	Migratory status	IUCN status	Rahmani (1997)	Sivaperumal et al (2009)	E-bird (2014-2020)
ORDER PODICIPEDIFORMES							
FAMILY Podicipedidae							
1	Eared Grebe	<i>Podiceps nigricollis</i>	M	LC			✓
2	Great Crested Grebe	<i>Podiceps cristatus</i>	M	LC			✓
3	Little Grebe	<i>Tachybaptus ruficollis</i>	R	LC	✓	✓	✓
ORDER PELECANIFORMES							
FAMILY Pelecanidae							
4	Dalmatian Pelican	<i>Pelecanus crispus</i>	M	NT		✓	✓
5	Great White Pelican	<i>Pelecanus onocrotalus</i>	M	LC		✓	✓
FAMILY Phalacrocoracidae							
6	Great Cormorant	<i>Phalacrocorax carbo</i>	R	LC		✓	✓
7	Indian Cormorant	<i>Phalacrocorax fuscicollis</i>	R	LC	✓	✓	✓
8	Little Cormorant	<i>Microcarbo niger</i>	R	LC	✓	✓	✓
FAMILY Anhingidae							
9	Oriental Darter	<i>Anhinga melanogaster</i>	R	NT	✓	✓	✓
ORDER CICONIIFORMES							
FAMILY Ardeidae							
10	Grey Heron	<i>Ardea cinerea</i>	R	LC		✓	✓
11	Green-backed Heron	<i>Butorides striata</i>	R	LC	✓		
12	Black-crowned Night-Heron	<i>Nycticorax nycticorax</i>	R	LC		✓	✓
13	Indian Pond-Heron	<i>Ardeola grayii</i>	R	LC		✓	✓
14	Purple Heron	<i>Ardea purpurea</i>	R	LC		✓	✓
15	Western Reef-Heron	<i>Egretta gularis</i>	R	LC			✓
16	Great Egret	<i>Ardea alba</i>	R	LC			✓
17	Cattle Egret	<i>Bubulcus ibis</i>	R	LC		✓	✓
18	Intermediate Egret	<i>Ardea intermedia</i>	R	LC		✓	✓
19	Little Egret	<i>Egretta garzetta</i>	R	LC		✓	✓
20	Black Bittern	<i>Ixobrychus flavicollis</i>	R	LC		✓	✓
21	Cinnamon Bittern	<i>Ixobrychus cinnamomeus</i>	R	LC	✓		
FAMILY Ciconiidae							
22	Asian Openbill	<i>Anastomus oscitans</i>	R	LC	✓	✓	✓
23	Asian Woollyneck	<i>Ciconia episcopus</i>	R	VU	✓		✓
24	Black Stork	<i>Ciconia nigra</i>	M	LC	✓	✓	✓
25	Black-necked Stork	<i>Ephippiorhynchus asiaticus</i>	LM	NT	✓	✓	✓
26	Painted Stork	<i>Galloperdix lunulata</i>	R	LC	✓	✓	✓
FAMILY Threskiornithidae							
27	Black-headed Ibis	<i>Threskiornis melanocephalus</i>	R	NT		✓	✓
28	Glossy Ibis	<i>Plegadis falcinellus</i>	R	LC		✓	✓
29	Red-naped Ibis	<i>Pseudibis papillosa</i>	LM	LC			✓

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30	Eurasian Spoonbill	<i>Platalea leucorodia</i>	M	LC	✓	✓	✓
ORDER PHOENICOPTERIFORMES							
FAMILY Phoenicopteridae							
31	Greater Flamingo	<i>Phoenicopterus roseus</i>	M,R	LC	✓	✓	✓
32	Lesser Flamingo	<i>Phoenicopterus minor</i>	M	NT		✓	
ORDER ANSERIFORMES							
FAMILY Anatidae							
33	Bar-headed Goose	<i>Anser indicus</i>	LM	LC	✓	✓	✓
34	Cotton Pygmy-Goose	<i>Nettapus coromandelianus</i>	R	LC		✓	✓
35	Graylag Goose	<i>Anser anser</i>	M	LC	✓	✓	✓
36	African Comb Duck or Knob-billed Duck	<i>Sarkidiornis melanotos</i>	M	LC		✓	✓
37	Tufted Duck	<i>Aythya fuligula</i>	M	LC	✓	✓	✓
38	Common Shelduck	<i>Tadorna tadorna</i>	M	LC	✓	✓	✓
39	Indian Spot-billed Duck	<i>Anas poecilorhyncha</i>	R	LC	✓		✓
40	Lesser Whistling-Duck	<i>Dendrocygna javanica</i>	R	LC		✓	✓
41	Ferruginous Duck	<i>Aythya nyroca</i>	R	NT	✓	✓	✓
42	Ruddy Shelduck	<i>Tadorna ferruginea</i>	M	LC	✓		✓
43	Garganey	<i>Spatula querquedula</i>	M	LC	✓	✓	✓
44	Gadwall	<i>Mareca strepera</i>	M	LC		✓	✓
45	Common Pochard	<i>Aythya ferina</i>	M	VU		✓	✓
46	Red-crested Pochard	<i>Netta rufina</i>	M	LC		✓	✓
47	Mallard	<i>Anas platyrhynchos</i>	M	LC		✓	✓
48	Marbled Teal	<i>Marmaronetta angustirostris</i>	M	VU		✓	
49	Green-winged Teal	<i>Anas carolinensis</i>	M				✓
50	Northern Shoveler	<i>Spatula clypeata</i>	M	LC	✓	✓	✓
51	Northern Pintail	<i>Anas acuta</i>	M	LC		✓	✓
52	Greater Scaup	<i>Aythya marila</i>	M	LC		✓	✓
53	Eurasian Wigeon	<i>Mareca penelope</i>	M	LC	✓	✓	✓
ORDER FALCONIFORMES							
FAMILY Accipitridae							
54	Eurasian Sparrowhawk	<i>Accipiter nisus</i>	R,M	LC		✓	✓
55	Greater Spotted Eagle	<i>Clanga clanga</i>	M	VU	✓	✓	✓
56	Imperial Eagle	<i>Aquila heliaca</i>	M	VU			✓
57	Bonelli's Eagle	<i>Aquila fasciata</i>	R	LC		✓	✓
58	Booted Eagle	<i>Hieraaetus pennatus</i>	LM	LC			✓
59	Crested Serpent-Eagle	<i>Spilornis cheela</i>	R	LC			✓
60	Indian Spotted Eagle	<i>Clanga hastata</i>	R	VU			✓
61	Changeable Hawk-Eagle	<i>Nisaetus cirrhatus</i>	R	LC			✓
62	Lesser Spotted Eagle	<i>Clanga pomarina</i>	R	LC		✓	
63	Pallas's Fish-Eagle	<i>Haliaeetus leucoryphus</i>	R	EN		✓	✓
64	Steppe Eagle	<i>Aquila nipalensis</i>	M	EN	✓	✓	✓
65	Tawny Eagle	<i>Aquila rapax</i>	R	VU	✓	✓	✓
66	Short-toed Snake-Eagle	<i>Circaetus gallicus</i>	R	LC	✓	✓	✓

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67	White-tailed Sea-Eagle	<i>Haliaeetus albicilla</i>	M	LC			✓
68	White-eyed Buzzard	<i>Butastur teesa</i>	R	LC		✓	✓
69	Eurasian Buzzard	<i>Buteo buteo</i>	R	LC	✓	✓	✓
70	Long-legged Buzzard	<i>Buteo rufinus</i>	M	LC			✓
71	Oriental Honey-buzzard	<i>Pernis ptilorhynchus</i>	R	LC			✓
71	Eurasian Griffon	<i>Gyps fulvus</i>	R	LC		✓	✓
73	Himalayan Griffon	<i>Gyps himalayensis</i>	R	NT		✓	✓
74	Cinereous Vulture	<i>Aegypius monachus</i>	LM	NT		✓	✓
75	Egyptian Vulture	<i>Neophron percnopterus</i>	R	EN		✓	✓
76	Indian Vulture	<i>Gyps indicus</i>	R	CR	✓	✓	✓
77	Red-headed Vulture	<i>Sarcogyps calvus</i>	R	CR	✓	✓	✓
78	White-rumped Vulture	<i>Gyps bengalensis</i>	R	CR			✓
79	Black Kite	<i>Milvus migrans</i>	R	LC		✓	✓
80	Black-winged Kite	<i>Elanus caeruleus</i>	R	LC			✓
81	Brahminy Kite	<i>Haliastur indus</i>	R	LC			✓
82	Western Marsh-harrier	<i>Circus aeruginosus</i>	M	LC		✓	
83	Montagu's Harrier	<i>Circus pygargus</i>	M	LC		✓	✓
84	Eurasian Marsh-Harrier	<i>Circus aeruginosus</i>	M	LC			✓
85	Hen Harrier	<i>Circus cyaneus</i>	M	LC	✓	✓	
86	Pallid Harrier	<i>Circus macrourus</i>	M	NT		✓	✓
87	Shikra	<i>Accipiter badius</i>	R	LC		✓	✓
FAMILY Pandionidae							
88	Osprey	<i>Pandion haliaetus</i>	M	LC		✓	✓
FAMILY Falconidae							
89	Laggar Falcon	<i>Falco jugger</i>	R	NT		✓	✓
90	Peregrine Falcon	<i>Falco peregrinus</i>	R,M	LC			✓
91	Red-necked Falcon	<i>Falco ruficollis</i>	R	LC	✓		✓
92	Lesser Kestrel	<i>Falco naumanni</i>	R	LC			✓
93	Eurasian Kestrel	<i>Falco tinnunculus</i>	R	LC		✓	✓
94	Eurasian Hobby	<i>Falco subbuteo</i>	R,M	LC			✓
ORDER GALLIFORMES							
FAMILY Phasianidae							
95	Indian Peafowl	<i>Pavo cristatus</i>	R	LC		✓	✓
96	Black Francolin	<i>Francolinus francolinus</i>	R	LC	✓	✓	✓
97	Gray Francolin	<i>Francolinus pondicerianus</i>	R	LC		✓	✓
98	Common Quail	<i>Coturnix coturnix</i>	M	LC		✓	✓
99	Jungle Bush-Quail	<i>Perdica asiatica</i>	R	LC			✓
100	Rain Quail	<i>Coturnix coromandelica</i>	R	LC	✓		
101	Rock Bush-Quail	<i>Perdica argoondah</i>	R	LC			✓
FAMILY Gruidae							
102	Common Crane	<i>Grus grus</i>	M	LC			✓
103	Demoiselle Crane	<i>Anthropoides virgo</i>	M	LC		✓	✓

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104	Sarus Crane	<i>Antigone antigone</i>	R	VU		✓	
FAMILY Rallidae							
105	Western Water Rail	<i>Rallus aquaticus</i>	R	LC			✓
106	Baillon's Crake	<i>Zapornia pusilla</i>	M	LC			✓
107	Brown Crake	<i>Zapornia akool</i>	M	LC			✓
108	Eurasian Moorhen	<i>Gallinula chloropus</i>	M	LC			✓
109	Eurasian Coot	<i>Fulica atra</i>	R,M	LC		✓	✓
110	Gray-headed Swamphen	<i>Porphyrio poliocephalus</i>	R				✓
111	White-breasted Waterhen	<i>Amaurornis phoenicurus</i>	R	LC		✓	✓
FAMILY Otididae							
112	Asian Houbara or MacQueen's Bustard	<i>Chlamydotis macqueenii</i>	M	VU			✓
113	Great Indian Bustard	<i>Ardeotis nigriceps</i>	R	CR		✓	
ORDER CHARADRIIFORMES							
FAMILY Jacanidae							
114	Bronze-winged Jacana	<i>Metopidius indicus</i>	R	LC		✓	✓
115	Pheasant-tailed Jacana	<i>Hydrophasianus chirurgus</i>	R	LC		✓	✓
FAMILY Charadriidae							
116	Kentish Plover	<i>Charadrius alexandrinus</i>	R	LC	✓	✓	✓
117	Lesser Sand-Plover	<i>Charadrius mongolus</i>	R	LC	✓	✓	✓
118	Little Ringed Plover	<i>Charadrius dubius</i>	R	LC		✓	✓
119	Northern Lapwing	<i>Vanellus vanellus</i>	M	NT		✓	✓
120	Pacific Golden-Plover	<i>Pluvialis fulva</i>	R	LC			✓
121	Red-wattled Lapwing	<i>Vanellus indicus</i>	R	LC		✓	✓
122	White-tailed Lapwing	<i>Vanellus leucurus</i>	M	LC	✓	✓	✓
123	Yellow-wattled Lapwing	<i>Vanellus malabaricus</i>	R	LC	✓	✓	✓
FAMILY Scolopacidae							
124	Common Snipe	<i>Gallinago gallinago</i>	M	LC	✓	✓	✓
125	Greater Painted-Snipe	<i>Rostratula benghalensis</i>	M	LC		✓	✓
126	Black-tailed Godwit	<i>Limosa limosa</i>	M	NT	✓	✓	✓
127	Eurasian Curlew	<i>Eurasian Curlew</i>	M	NT		✓	✓
128	Buff-breasted Sandpiper	<i>Calidris subruficollis</i>	M	NT		✓	
129	Green Sandpiper	<i>Tringa ochropus</i>	M	LC		✓	✓
130	Marsh Sandpiper	<i>Tringa stagnatilis</i>	M	LC		✓	✓
131	Common Sandpiper	<i>Actitis hypoleucos</i>	LM	LC		✓	✓
132	Terek Sandpiper	<i>Xenus cinereus</i>	M	LC			✓
133	Curlew Sandpiper	<i>Calidris ferruginea</i>	M	NT		✓	✓
134	Wood Sandpiper	<i>Tringa glareola</i>	M	LC	✓	✓	✓
135	Common Redshank	<i>Tringa totanus</i>	M	LC	✓	✓	✓
136	Common Greenshank	<i>Tringa nebularia</i>	M	LC		✓	✓
137	Spotted Redshank	<i>Tringa erythropus</i>	M	LC		✓	✓

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138	Little Stint	<i>Calidris minuta</i>	M	LC		✓	✓
139	Temminck's Stint	<i>Calidris temminckii</i>	M	LC	✓	✓	✓
140	Dunlin	<i>Calidris alpina</i>	M	LC			✓
141	Ruff	<i>Calidris pugnax</i>	M	LC	✓	✓	✓
FAMILY Recurvirostridae							
142	Pied Avocet	<i>Recurvirostra avosetta</i>	M	LC		✓	✓
143	Black-winged Stilt	<i>Himantopus himantopus</i>	R	LC		✓	✓
FAMILY Phalaropodidae							
144	Red-necked Phalarope	<i>Phalaropus lobatus</i>	M	LC			✓
145	Beach Thick-knee	<i>Esacus magnirostris</i>	M	NT		✓	
146	Eurasian thick-knee	<i>Burhinus oedicephalus</i>	R	LC	✓		
147	Indian Thick-knee	<i>Burhinus indicus</i>	R	LC			✓
FAMILY Glareolidae							
148	Collared Pratincole	<i>Glareola pratincola</i>	M	LC	✓		
149	Little Pratincole	<i>Glareola lactea</i>	R	LC		✓	✓
150	Oriental Pratincole	<i>Glareola maldivarum</i>	R	LC			✓
151	Indian Courser	<i>Cursorius coromandelicus</i>	R	LC	✓	✓	✓
152	Cream-colored Courser	<i>Cursorius cursor</i>	R,M	LC	✓	✓	✓
FAMILY Laridae							
153	Black-headed Gull	<i>Larus ridibundus</i>	M	LC	✓	✓	✓
154	Brown-headed Gull	<i>Larus brunnicephalus</i>	M	LC			✓
155	Pallas's Gull	<i>Larus ichthyaetus</i>	M	LC	✓	✓	✓
156	Lesser Black-backed Gull	<i>Larus fuscus</i>	M	LC			✓
157	Common Gull-billed Tern	<i>Gelochelidon nilotica</i>	M	LC			✓
158	River Tern	<i>Sterna aurantia</i>	R	NT	✓	✓	✓
159	Whiskered Tern	<i>Chlidonias hybrida</i>	R	LC		✓	✓
ORDER COLUMBIFORMES							
FAMILY Pteroclididae							
160	Chestnut-bellied Sandgrouse	<i>Pterocles exustus</i>	R	LC		✓	✓
161	Painted Sandgrouse	<i>Pterocles indicus</i>	R	LC		✓	✓
162	Pallas's Sandgrouse	<i>Syrrhaptes paradoxus</i>	M	LC			✓
163	Spotted sandgrouse	<i>Pterocles senegallus</i>	M	LC	✓		
FAMILY Columbidae							
164	Eastern Spotted Dove	<i>Spilopelia chinensis</i>	R	LC		✓	✓
165	Eurasian Collared-Dove	<i>Streptopelia decaocto</i>	R	LC		✓	✓
166	Laughing Dove	<i>Spilopelia senegalensis</i>	R	LC		✓	✓
167	Oriental Turtle-Dove	<i>Streptopelia orientalis</i>	R	LC		✓	✓
168	Red Turtle-dove	<i>Streptopelia tranquebarica</i>	R	LC	✓	✓	✓
169	Rock Dove	<i>Columba livia</i>	R	LC		✓	✓

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170	Yellow-eyed Pigeon	<i>Columba eversmanni</i>	M	VU			✓
171	Yellow-footed Green-Pigeon	<i>Treron phoenicopterus</i>	R	LC	✓		✓
ORDER PSITTACIFORMES							
FAMILY Psittacidae							
172	Alexandrine Parakeet	<i>Psittacula eupatria</i>	R	NT			✓
173	Plum-headed Parakeet	<i>Psittacula cyanocephala</i>	R	LC		✓	✓
174	Rose-ringed Parakeet	<i>Psittacula krameri</i>	R	LC		✓	✓
ORDER CUCULIFORMES							
FAMILY Cuculidae							
175	Asian Koel	<i>Eudynamys scolopaceus</i>	R	LC		✓	✓
176	Common Hawk-Cuckoo	<i>Hierococyx varius</i>	R	LC			✓
177	Pied Cuckoo	<i>Clamator jacobinus</i>	R	LC		✓	✓
178	Jacobin Cuckoo	<i>Clamator jacobinus</i>	R,M	LC	✓		
179	Sirkeer Malkoha	<i>Taccocua leschenaultii</i>	R	LC			✓
180	Greater Coucal	<i>Centropus sinensis</i>	R	LC	✓	✓	✓
ORDER STRIGIFORMES							
FAMILY Strigidae							
181	Brown Fish-Owl	<i>Ketupa zeylonensis</i>	R	LC			✓
182	Collared scops owl	<i>Otus lettia</i>	R	LC	✓		
183	Indian Scops-Owl	<i>Otus bakkamoena</i>	R	LC			✓
184	Short-eared Owl	<i>Asio flammeus</i>	M	LC	✓		✓
185	Spotted Owlet	<i>Athene brama</i>	R	LC		✓	✓
ORDER CAPRIMULGIFORMES							
FAMILY Caprimulgidae							
186	European Nightjar	<i>Caprimulgus europaeus</i>	R	LC	✓		
ORDER APODIFORMES							
FAMILY Apodidae							
187	Asian Palm-Swift	<i>Cypsiurus balasiensis</i>	R	LC			✓
188	Common Swift	<i>Apus apus</i>	M	LC		✓	
189	House Swift	<i>Apus nipalensis</i>	R	LC	✓	✓	
190	Little Swift	<i>Apus affinis</i>	R	LC			✓
ORDER CORACIIFORMES							
FAMILY Alcedinidae							
191	Black-capped Kingfisher	<i>Halcyon pileata</i>	R	LC	✓		
192	Common Kingfisher	<i>Alcedo atthis</i>	R	LC	✓	✓	✓
193	Pied Kingfisher	<i>Ceryle rudis</i>	R	LC	✓	✓	✓
194	White-throated Kingfisher	<i>Halcyon gularis</i>	R	LC	✓	✓	✓
FAMILY Meropidae							
195	Asian Green Bee-eater	<i>Merops orientalis</i>	R	LC		✓	✓

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196	Blue-cheeked Bee-eater	<i>Merops persicus</i>	R	LC	✓	✓	✓
197	Blue-tailed Bee-eater	<i>Merops philippinus</i>	LM	LC			✓
FAMILY Coraciidae							
198	European Roller	<i>Coracias garrulus</i>	R	LC	✓	✓	✓
199	Indian Roller	<i>Coracias benghalensis</i>	R	LC		✓	✓
FAMILY Upupidae							
200	Eurasian Hoopoe	<i>Upupa epops</i>	R	LC		✓	✓
FAMILY Bucerotidae							
201	Indian Gray Hornbill	<i>Ocyrceros birostris</i>	R	LC			✓
ORDER PICIFORMES							
FAMILY Capitonidae							
202	Brown-headed Barbet	<i>Psilopogon zeylanicus</i>	R	LC		✓	
203	Coppersmith Barbet	<i>Psilopogon haemacephalus</i>	R	LC		✓	✓
204	Crimson-throated Barbet	<i>Megalaima rubricapilla</i>	R	LC		✓	
FAMILY Picidae							
205	Black-rumped Flameback	<i>Dinopium benghalense</i>	R	LC	✓	✓	✓
206	Yellow-crowned Woodpecker	<i>Leiopicus mahrattensis</i>	R	LC	✓		✓
207	Eurasian Wryneck	<i>Jynx torquilla</i>	M	LC	✓		✓
ORDER PASSERIFORMES							
FAMILY Pittidae							
208	Indian Pitta	<i>Pitta brachyura</i>	R	LC		✓	
FAMILY Alaudidae							
209	Ashy-crowned Sparrow-Lark	<i>Eremopterix griseus</i>	R	LC	✓	✓	✓
210	Bengal Bush Lark or Indian Bush Lark	<i>Mirafra assamica</i>	R	LC		✓	
211	Bimaculated Lark	<i>Melanocorypha bimaculata</i>	M	LC	✓		✓
212	Black-crowned Sparrow-Lark	<i>Eremopterix nigriceps</i>	R	LC	✓		✓
213	Calandra lark	<i>Melanocorypha calandra</i>	R	LC		✓	
214	Crested Lark	<i>Galerida cristata</i>	R	LC	✓	✓	✓
215	Desert Lark	<i>Ammomanes deserti</i>	R	LC		✓	✓
216	Eastern Short-toed Lark	<i>Calandrella dukhunensis</i>	M	LC			✓
217	Greater hoopoe-lark	<i>Alaemon alaudipes</i>	R	LC	✓		
218	Greater Short-toed Lark	<i>Calandrella brachydactyla</i>	M	LC	✓	✓	✓
219	Indian Bushlark	<i>Mirafra erythroptera</i>	R	LC	✓		✓
220	Oriental Skylark	<i>Alauda gulgula</i>	R	LC	✓		✓
221	Rufous-tailed Lark	<i>Ammomanes phoenicura</i>	R	LC	✓	✓	✓
222	Sand Lark	<i>Alaudala raytal</i>	R	LC			✓

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FAMILY Hirundinidae							
223	Red-rumped Swallow	<i>Cecropis daurica</i>	R	LC		✓	✓
224	Bank Swallow	<i>Riparia riparia</i>	R	LC			✓
225	Barn Swallow	<i>Hirundo rustica</i>	R	LC	✓	✓	✓
226	Streak-throated Swallow	<i>Petrochelidon fluvicola</i>	R	LC	✓	✓	✓
227	Wire-tailed Swallow	<i>Hirundo smithii</i>	R	LC	✓	✓	✓
228	Northern House-martin	<i>Delichon urbica</i>	M	LC		✓	
229	Pale Sand Martin	<i>Riparia diluta</i>	R	LC		✓	✓
230	Dusky Crag-Martin	<i>Ptyonoprogne concolor</i>	R	LC		✓	✓
231	Gray-throated Martin	<i>Riparia chinensis</i>	R	LC			✓
232	Plain Martin	<i>Riparia paludicola</i>	R	LC	✓		✓
FAMILY Motacillidae							
233	White-browed Wagtail	<i>Motacilla maderaspatensis</i>	R	LC	✓		✓
234	Citrine Wagtail	<i>Motacilla citreola</i>	LM	LC	✓	✓	✓
235	Gray Wagtail	<i>Motacilla cinerea</i>	R	LC	✓	✓	✓
236	Western Yellow Wagtail	<i>Motacilla flava</i>	R	LC	✓		✓
237	White Wagtail	<i>Motacilla alba</i>	M	LC	✓	✓	✓
238	Paddyfield Pipit	<i>Anthus rufulus</i>	R	LC		✓	✓
239	Tawny Pipit	<i>Anthus campestris</i>	M	LC	✓	✓	✓
240	Tree Pipit	<i>Anthus trivialis</i>	M	LC			✓
241	Water Pipit	<i>Anthus spinoletta</i>	M	LC		✓	✓
242	Olive-backed Pipit	<i>Anthus hodgsoni</i>	R	LC			✓
243	Long-billed Pipit	<i>Anthus similis</i>	R	LC	✓		✓
244	Buff-bellied Pipit	<i>Anthus rubescens</i>	M	LC			✓
FAMILY Campephagidae							
245	Small Minivet	<i>Pericrocotus cinnamomeus</i>	R	LC	✓	✓	✓
246	White-bellied Minivet	<i>Pericrocotus erythropygius</i>	R	LC	✓		✓
247	Common Woodshrike	<i>Tephrodornis pondicerianus</i>	R	LC	✓	✓	✓
FAMILY Pycnonotidae							
248	Red-vented Bulbul	<i>Pycnonotus cafer</i>	R	LC		✓	✓
249	White-eared Bulbul	<i>Pycnonotus leucotis</i>	R	LC		✓	✓
FAMILY Irenidae							
250	Common Iora	<i>Aegithina tiphia</i>	R	LC			✓
251	Marshall's Iora	<i>Aegithina nigrolutea</i>	R	LC		✓	
FAMILY Laniidae							
252	Bay-backed Shrike	<i>Lanius vittatus</i>	R	LC	✓	✓	✓
253	Brown Shrike	<i>Lanius cristatus</i>	M	LC		✓	
254	Great Gray Shrike	<i>Lanius excubitor</i>	R	LC	✓	✓	✓
255	Isabelline Shrike	<i>Lanius isabellinus</i>	M	LC	✓		✓
256	Long-tailed Shrike	<i>Lanius schach</i>	R	LC	✓	✓	✓
257	Red-tailed Shrike	<i>Lanius phoenicuroides</i>	M	LC		✓	✓

SN	Common name	Scientific name	Migratory status	IUCN status	Rahmani (1997)	Sivaperumal et al (2009)	E-bird (2014-2020)
FAMILY Bombycillidae							
258	Hypocolius	<i>Hypocolius ampelinus</i>	M	LC			✓
FAMILY Muscicapidae							
259	Black-throated Thrush	<i>Turdus atrogularis</i>	R	LC			✓
260	Rufous-tailed Rock-Thrush	<i>Monticola saxatilis</i>	M	LC			✓
261	Bluethroat	<i>Cyanecula svecica</i>	M	LC	✓	✓	✓
262	Indian Robin	<i>Saxicoloides fulicatus</i>	R	LC		✓	✓
263	Oriental Magpie-Robin	<i>Copsychus saularis</i>	R	LC	✓	✓	✓
264	Rufous-tailed Scrub-Robin	<i>Cercotrichas galactotes</i>	M	LC	✓	✓	✓
265	White-capped Water-redstart	<i>Phoenicurus leucocephalus</i>	M	LC		✓	
266	Black Redstart	<i>Phoenicurus ochruros</i>	R	LC	✓	✓	✓
267	Pied Bushchat	<i>Saxicola caprata</i>	R	LC	✓	✓	✓
268	White-browed Bushchat	<i>Saxicola macrorhynchus</i>	R	VU	✓		✓
269	Common Stonechat	<i>Saxicola torquatus</i>	R	LC	✓		
270	Siberian Stonechat	<i>Saxicola torquatus</i>	M	LC			✓
271	Brown Rock Chat	<i>Oenanthe fusca</i>	R	LC		✓	✓
272	Variable Wheatear	<i>Oenanthe picata</i>	M	LC	✓	✓	✓
273	Desert Wheatear	<i>Oenanthe deserti</i>	M	LC	✓	✓	✓
274	Isabelline Wheatear	<i>Oenanthe isabellina</i>	R	LC	✓		✓
275	Kurdish Wheatear	<i>Oenanthe xanthopyrma</i>	M	LC		✓	
276	Persian Wheatear	<i>Oenanthe chrysopygia</i>	R	LC			✓
277	Yellow-eyed Babbler	<i>Chrysomma sinense</i>	R	LC		✓	✓
278	Common Babbler	<i>Argya caudata</i>	R	LC		✓	✓
279	Jungle Babbler	<i>Turdoides striata</i>	R	LC	✓	✓	✓
280	Large Grey Babbler	<i>Argya malcolmi</i>	R	LC	✓		✓
281	Striated Babbler	<i>Argya earlei</i>	R	LC	✓	✓	✓
282	Asian Desert Warbler	<i>Sylvia nana</i>	M	LC		✓	✓
283	Dusky Warbler	<i>Phylloscopus fuscatus</i>	M	LC		✓	
284	Blyth's Reed Warbler	<i>Acrocephalus dumetorum</i>	M	LC			✓
285	Booted Warbler	<i>Iduna caligata</i>	LM	LC	✓	✓	✓
286	Eastern Orphean Warbler	<i>Sylvia crassirostris</i>	M	LC	✓		✓
287	Clamorous Reed Warbler	<i>Acrocephalus stentoreus</i>	M	LC	✓	✓	✓
288	Green Warbler	<i>Phylloscopus nitidus</i>	M	LC			✓
289	Greenish Warbler	<i>Phylloscopus trochiloides</i>	M	LC		✓	✓
290	Hume's Leaf-Warbler	<i>Phylloscopus humei</i>	R	LC			✓
291	Moustached Warbler	<i>Acrocephalus melanopogon</i>	M	LC			✓
292	Paddyfield Warbler	<i>Acrocephalus agricola</i>	M	LC			✓
293	Plain Leaf Warbler	<i>Phylloscopus neglectus</i>	M	LC		✓	✓

SN	Common name	Scientific name	Migratory status	IUCN status	Rahmani (1997)	Sivaperumal et al (2009)	E-bird (2014-2020)
294	Common Chiffchaff	<i>Phylloscopus collybita</i>	R	LC	✓	✓	✓
295	Smoky Warbler	<i>Phylloscopus fuligiventer</i>	R	LC		✓	
296	Sulphur-bellied Warbler	<i>Phylloscopus griseolus</i>	M	LC			✓
297	Sykes's Warbler	<i>Iduna rama</i>	M	LC			✓
298	Thick-billed Warbler	<i>Acrocephalus aedon</i>	M	LC		✓	
299	Common Tailorbird	<i>Orthotomus sutorius</i>	R	LC	✓	✓	✓
300	Lesser Whitethroat	<i>Sylvia curruca</i>	M	LC			✓
301	Ashy Prinia	<i>Prinia socialis</i>	R	LC		✓	✓
302	Graceful Prinia	<i>Prinia gracilis</i>	R	LC	✓	✓	✓
303	Gray-breasted Prinia	<i>Prinia hodgsonii</i>	R	LC			✓
304	Plain Prinia	<i>Prinia inornata</i>	R	LC	✓	✓	✓
305	Rufous-fronted Prinia	<i>Prinia buchanani</i>	R	LC	✓	✓	✓
306	Jungle Prinia	<i>Prinia sylvatica</i>	R	LC			✓
307	Indian paradise-flycatcher	<i>Terpsiphone paradisi</i>	R	LC	✓		
308	Gray-headed Canary-Flycatcher	<i>Culicicapa ceylonensis</i>	R	LC		✓	✓
309	Red-breasted Flycatcher	<i>Ficedula parva</i>	M	LC		✓	✓
310	Red-throated Flycatcher	<i>Ficedula albicilla</i>	R	LC		✓	✓
311	Rusty-tailed Flycatcher	<i>Ficedula ruficauda</i>	R	LC		✓	
312	Spotted Flycatcher	<i>Muscicapa striata</i>	M	LC			✓
313	White-browed Fantail	<i>Rhipidura aureola</i>	R	LC	✓	✓	✓
314	Zitting Cisticola	<i>Cisticola juncidis</i>	R	LC	✓		✓
FAMILY Paridae							
315	Cinereous Tit	<i>Parus cinereus</i>	R	LC			✓
FAMILY Certhiidae							
316	Indian Spotted Creeper	<i>Salpornis spilonota</i>	R	LC			✓
FAMILY Nectariniidae							
317	Purple Sunbird	<i>Cinnyris asiaticus</i>	R	LC			✓
FAMILY Zosteropidae							
318	Indian White-eye	<i>Zosterops palpebrosus</i>	R	LC			✓
FAMILY Emberizidae							
319	Black-headed Bunting	<i>Emberiza melanocephala</i>	M	LC			✓
320	Striolated Bunting	<i>Emberiza striolata</i>	R	LC	✓		✓
321	Crested Bunting	<i>Emberiza lathamii</i>	R	LC	✓	✓	✓
322	Gray-necked Bunting	<i>Emberiza buchanani</i>	M	LC	✓		✓
323	Red-headed Bunting	<i>Emberiza bruniceps</i>	M	LC	✓		✓
FAMILY Estrildidae							
324	Scaly-breasted Munia	<i>Lonchura punctulata</i>	R	LC			✓
325	Green Avadavat	<i>Amandava formosa</i>	R	VU	✓		
326	Red Avadavat	<i>Amandava amandava</i>	R	LC			✓
327	Indian Silverbill	<i>Euodice malabarica</i>	R	LC	✓	✓	✓

SN	Common name	Scientific name	Migratory status	IUCN status	Rahmani (1997)	Sivaperumal et al (2009)	E-bird (2014-2020)
FAMILY Passeridae							
328	House Sparrow	<i>Passer domesticus</i>	R	LC		✓	✓
329	Yellow-throated Sparrow	<i>Gymnoris supercilialis</i>	R	LC			✓
330	Sind Sparrow	<i>Passer pyrrhonotus</i>	R	LC			✓
331	Spanish Sparrow	<i>Passer hispaniolensis</i>	M	LC	✓	✓	✓
332	Streaked Weaver	<i>Ploceus manyar</i>	R	LC	✓		
333	Baya Weaver	<i>Ploceus philippinus</i>	R	LC	✓	✓	✓
334	Black-breasted Weaver	<i>Ploceus benghalensis</i>	R	LC			
FAMILY Sturnidae							
335	Bank Myna	<i>Acridotheres ginginianus</i>	R	LC	✓	✓	✓
336	Common Myna	<i>Acridotheres tristis</i>	R	LC		✓	✓
337	Jungle Myna	<i>Acridotheres fuscus</i>	R	LC		✓	
338	Asian Pied Starling	<i>Gracupica contra</i>	R	LC	✓	✓	✓
339	European Starling	<i>Sturnus vulgaris</i>	R	LC		✓	✓
340	Rosy Starling	<i>Pastor roseus</i>	R	LC	✓	✓	✓
341	Brahminy Starling	<i>Sturnia pagodarum</i>	R	LC	✓	✓	✓
FAMILY Oriolidae							
342	Indian Golden Oriole	<i>Oriolus kundoo</i>	R	LC			✓
FAMILY Dicruridae							
343	Ashy Drongo	<i>Dicrurus leucophaeus</i>	LM	LC		✓	✓
344	Black Drongo	<i>Dicrurus macrocercus</i>	R	LC		✓	✓
345	White-bellied Drongo	<i>Dicrurus caerulescens</i>	R	LC			✓
FAMILY Corvidae							
346	Common Raven	<i>Corvus corax</i>	LM	LC	✓	✓	✓
347	House Crow	<i>Corvus splendens</i>	R	LC		✓	✓
348	Large-billed Crow	<i>Corvus macrorhynchos</i>	R	LC		✓	✓
349	Rufous Treepie	<i>Dendrocitta vagabunda</i>	R	LC	✓		✓

Annexure VI) Birds seen in the survey areas (BNHS 2020-2021)

Sr. No.	Common name	Scientific name	Migratory status	IUCN status
ORDER PODICIPEDIFORMES				
FAMILY Podicipedidae				
1.	Little Grebe	<i>Tachybaptus ruficollis</i>	R	LC
ORDER PELECANIFORMES				
FAMILY Phalacrocoracidae				
2.	Great Cormorant	<i>Phalacrocorax carbo</i>	R	LC
3.	Indian Cormorant	<i>Phalacrocorax fuscicollis</i>	R	LC
4.	Little Cormorant	<i>Microcarbo niger</i>	R	LC
ORDER CICONIIFORMES				
FAMILY Ardeidae				
5.	Black-crowned Night-Heron	<i>Nycticorax nycticorax</i>	R	LC
6.	Gray Heron	<i>Ardea cinerea</i>	R	LC
7.	Western Reef-Heron	<i>Egretta gularis</i>	R	LC
8.	Purple Heron	<i>Ardea purpurea</i>	R	LC
9.	Indian Pond-Heron	<i>Ardeola grayii</i>	R	LC
10.	Cattle Egret	<i>Bubulcus ibis</i>	R	LC
11.	Great Egret	<i>Ardea alba</i>	R	LC
12.	Intermediate Egret	<i>Ardea intermedia</i>	R	LC
13.	Little Egret	<i>Egretta garzetta</i>	R	LC
14.	Cinnamon Bittern	<i>Ixobrychus cinnamomeus</i>	R	LC
FAMILY Ciconiidae				
15.	Asian Openbill	<i>Anastomus oscitans</i>	R	LC
16.	Asian Woollyneck	<i>Ciconia episcopus</i>	R	VU
17.	Black Stork	<i>Ciconia nigra</i>	M	LC
18.	Painted Stork	<i>Galloperdix lunulata</i>	R	LC
FAMILY Threskiornithidae				
19.	Black-headed Ibis	<i>Threskiornis melanocephalus</i>	R	NT
20.	Glossy Ibis	<i>Plegadis falcinellus</i>	R	LC
21.	Red-naped Ibis	<i>Pseudibis papillosa</i>	LM	LC
22.	Eurasian Spoonbill	<i>Platalea leucorodia</i>	M	LC
ORDER ANSERIFORMES				
FAMILY Anatidae				
23.	Bar-headed Goose	<i>Anser indicus</i>	LM	LC
24.	Graylag Goose	<i>Anser anser</i>	M	LC
25.	African Comb Duck or Knob-billed Duck	<i>Sarkidiornis melanotos</i>	M	LC
26.	Ruddy Shelduck	<i>Tadorna ferruginea</i>	M	LC
27.	Common Shelduck	<i>Tadorna tadorna</i>	M	LC
28.	Lesser Whistling-Duck	<i>Dendrocygna javanica</i>	R	LC
29.	Ferruginous Duck	<i>Aythya nyroca</i>	R	NT
30.	Indian Spot-billed Duck	<i>Anas poecilorhyncha</i>	R	LC
31.	Green-winged Teal	<i>Anas carolinensis</i>	M	
32.	Garganey	<i>Spatula querquedula</i>	M	LC
33.	Gadwall	<i>Mareca strepera</i>	M	LC
34.	Mallard	<i>Anas platyrhynchos</i>	M	LC
35.	Northern Pintail	<i>Anas acuta</i>	M	LC
36.	Northern Shoveler	<i>Spatula clypeata</i>	M	LC
37.	Eurasian Wigeon	<i>Mareca penelope</i>	M	LC

Sr. No.	Common name	Scientific name	Migratory status	IUCN status
38.	Common Pochard	<i>Aythya ferina</i>	M	VU
ORDER FALCONIFORMES				
FAMILY Accipitridae				
39.	Eurasian Sparrowhawk	<i>Accipiter nisus</i>	R,M	LC
40.	Greater Spotted Eagle	<i>Clanga clanga</i>	M	VU
41.	Bonelli's Eagle	<i>Aquila fasciata</i>	R	LC
42.	Booted Eagle	<i>Hieraetus pennatus</i>	LM	LC
43.	White-tailed Sea-Eagle	<i>Haliaeetus albicilla</i>	M	LC
44.	Indian Spotted Eagle	<i>Clanga hastata</i>	R	VU
45.	Imperial Eagle	<i>Aquila heliaca</i>	M	VU
46.	Lesser Spotted Eagle	<i>Clanga pomarina</i>	R	LC
47.	Short-toed Snake-Eagle	<i>Circaetus gallicus</i>	R	LC
48.	Steppe Eagle	<i>Aquila nipalensis</i>	M	EN
49.	Tawny Eagle	<i>Aquila rapax</i>	R	VU
50.	White-eyed Buzzard	<i>Butastur teesa</i>	R	LC
51.	Long-legged Buzzard	<i>Buteo rufinus</i>	M	LC
52.	Egyptian Vulture	<i>Neophron percnopterus</i>	R	EN
53.	Hen Harrier	<i>Circus cyaneus</i>	M	LC
54.	Himalayan Griffon	<i>Gyps himalayensis</i>	R	NT
55.	Eurasian Griffon	<i>Gyps fulvus</i>	R	LC
56.	Indian Vulture	<i>Gyps indicus</i>	R	CR
57.	Cinereous Vulture	<i>Aegypius monachus</i>	LM	NT
58.	Red-headed Vulture	<i>Sarcogyps calvus</i>	R	CR
59.	White-rumped Vulture	<i>Gyps bengalensis</i>	R	CR
60.	Black Kite	<i>Milvus migrans</i>	R	LC
61.	Black-winged Kite	<i>Elanus caeruleus</i>	R	LC
62.	Eurasian Marsh-Harrier	<i>Circus aeruginosus</i>	M	LC
63.	Montagu's Harrier	<i>Circus pygargus</i>	M	LC
64.	Pallid Harrier	<i>Circus macrourus</i>	M	NT
65.	Western Marsh-harrier	<i>Circus aeruginosus</i>	M	LC
66.	Shikra	<i>Accipiter badius</i>	R	LC
FAMILY Falconidae				
67.	Laggar Falcon	<i>Falco jugger</i>	R	NT
68.	Peregrine Falcon	<i>Falco peregrinus</i>	R,M	LC
69.	Eurasian Hobby	<i>Falco subbuteo</i>	R,M	LC
70.	Eurasian Kestrel	<i>Falco tinnunculus</i>	R	LC
ORDER GALLIFORMES				
FAMILY Phasianidae				
71.	Indian Peafowl	<i>Pavo cristatus</i>	R	LC
72.	Common Quail	<i>Coturnix coturnix</i>	M	LC
73.	Jungle Bush-Quail	<i>Perdica asiatica</i>	R	LC
74.	Rock Bush-Quail	<i>Perdica argoondah</i>	R	LC
75.	Gray Francolin	<i>Francolinus pondicerianus</i>	R	LC
FAMILY Gruidae				
76.	Common Crane	<i>Grus grus</i>	M	LC
77.	Demoiselle Crane	<i>Anthropoides virgo</i>	M	LC
FAMILY Rallidae				
78.	Brown Crake	<i>Zapornia akoool</i>	M	LC
79.	Eurasian Coot	<i>Fulica atra</i>	R,M	LC
80.	Eurasian Moorhen	<i>Gallinula chloropus</i>	M	LC
81.	Gray-headed Swamphen	<i>Porphyrio poliocephalus</i>	R	
82.	White-breasted Waterhen	<i>Amaurornis phoenicurus</i>	R	LC

Sr. No.	Common name	Scientific name	Migratory status	IUCN status
FAMILY Otididae				
83.	Asian Houbara or MacQueen's Bustard	<i>Chlamydotis macqueenii</i>	M	VU
84.	Great Indian Bustard	<i>Ardeotis nigriceps</i>	R	CR
ORDER CHARADRIIFORMES				
FAMILY Jacanidae				
85.	Bronze-winged Jacana	<i>Metopidius indicus</i>	R	LC
86.	Pheasant-tailed Jacana	<i>Hydrophasianus chirurgus</i>	R	LC
FAMILY Charadriidae				
87.	Kentish Plover	<i>Charadrius alexandrinus</i>	R	LC
88.	Lesser Sand-Plover	<i>Charadrius mongolus</i>	R	LC
89.	Little Ringed Plover	<i>Charadrius dubius</i>	R	LC
90.	Pacific Golden-Plover	<i>Pluvialis fulva</i>	R	LC
91.	Northern Lapwing	<i>Vanellus vanellus</i>	M	NT
92.	Red-wattled Lapwing	<i>Vanellus indicus</i>	R	LC
93.	White-tailed Lapwing	<i>Vanellus leucurus</i>	M	LC
94.	Yellow-wattled Lapwing	<i>Vanellus malabaricus</i>	R	LC
FAMILY Scolopaciidae				
95.	Common Sandpiper	<i>Actitis hypoleucos</i>	LM	LC
96.	Green Sandpiper	<i>Tringa ochropus</i>	M	LC
97.	Buff-breasted Sandpiper	<i>Calidris subruficollis</i>	M	NT
98.	Greater Painted-Snipe	<i>Rostratula benghalensis</i>	M	LC
99.	Common Greenshank	<i>Tringa nebularia</i>	M	LC
100.	Common Redshank	<i>Tringa totanus</i>	M	LC
101.	Black-tailed Godwit	<i>Limosa limosa</i>	M	NT
102.	Little Stint	<i>Calidris minuta</i>	M	LC
103.	Ruff	<i>Calidris pugnax</i>	M	LC
FAMILY Recurvirostridae				
104.	Pied Avocet	<i>Recurvirostra avosetta</i>	M	LC
105.	Black-winged Stilt	<i>Himantopus himantopus</i>	R	LC
FAMILY Phalaropodidae				
106.	Indian Thick-knee	<i>Burhinus indicus</i>	R	LC
FAMILY Glareolidae				
107.	Cream-colored Courser	<i>Cursorius cursor</i>	R,M	LC
108.	Indian Courser	<i>Cursorius coromandelicus</i>	R	LC
109.	Small Pratincole	<i>Glareola lactea</i>	R	LC
110.	Oriental Pratincole	<i>Glareola maldivarum</i>	R	LC
111.	Collared Pratincole	<i>Glareola pratincola</i>	M	LC
FAMILY Laridae				
112.	Black-headed Gull	<i>Larus ridibundus</i>	M	LC
113.	Brown-headed Gull	<i>Larus brunnicephalus</i>	M	LC
114.	River Tern	<i>Sterna aurantia</i>	R	NT
ORDER COLUMBIFORMES				
FAMILY Pteroclididae				
115.	Chestnut-bellied Sandgrouse	<i>Pterocles exustus</i>	R	LC
FAMILY Columbidae				
116.	Eurasian Collared-Dove	<i>Streptopelia decaocto</i>	R	LC
117.	Laughing Dove	<i>Spilopelia senegalensis</i>	R	LC
118.	Rock Dove	<i>Columba livia</i>	R	LC
119.	Yellow-eyed Pigeon	<i>Columba eversmanni</i>	M	VU
120.	Yellow-footed Green-Pigeon	<i>Treron phoenicopterus</i>	R	LC
ORDER PSITTACIFORMES				

Sr. No.	Common name	Scientific name	Migratory status	IUCN status
FAMILY Psittacidae				
121.	Rose-ringed Parakeet	<i>Psittacula krameri</i>	R	LC
ORDER CUCULIFORMES				
FAMILY Cuculidae				
122.	Asian Koel	<i>Eudynamis scolopaceus</i>	R	LC
123.	Common Hawk-Cuckoo	<i>Hierococcyx varius</i>	R	LC
124.	Jacobin Cuckoo	<i>Clamator jacobinus</i>	R,M	LC
125.	Greater Coucal	<i>Centropus sinensis</i>	R	LC
ORDER STRIGIFORMES				
FAMILY Strigidae				
126.	Short-eared Owl	<i>Asio flammeus</i>	M	LC
127.	Spotted Owlet	<i>Athene brama</i>	R	LC
ORDER CAPRIMULGIFORMES				
FAMILY Caprimulgidae				
128.	European Nightjar	<i>Caprimulgus europaeus</i>	R	LC
ORDER APODIFORMES				
FAMILY Apodidae				
129.	House Swift	<i>Apus nipalensis</i>	R	LC
ORDER CORACIIFORMES				
FAMILY Alcedinidae				
130.	Common Kingfisher	<i>Alcedo atthis</i>	R	LC
131.	Pied Kingfisher	<i>Ceryle rudis</i>	R	LC
132.	White-throated Kingfisher	<i>Halcyon gularis</i>	R	LC
FAMILY Meropidae				
133.	Asian Green Bee-eater	<i>Merops orientalis</i>	R	LC
134.	Blue-cheeked Bee-eater	<i>Merops persicus</i>	R	LC
135.	Blue-tailed Bee-eater	<i>Merops philippinus</i>	LM	LC
FAMILY Coraciidae				
136.	European Roller	<i>Coracias garrulus</i>	R	LC
137.	Indian Roller	<i>Coracias benghalensis</i>	R	LC
FAMILY Upupidae				
138.	Eurasian Hoopoe	<i>Upupa epops</i>	R	LC
FAMILY Bucerotidae				
139.	Indian Gray Hornbill	<i>Ocyrceros birostris</i>	R	LC
ORDER PICIFORMES				
FAMILY Picidae				
140.	Eurasian Wryneck	<i>Jynx torquilla</i>	M	LC
ORDER PASSERIFORMES				
FAMILY Alaudidae				
141.	Ashy-crowned Sparrow-Lark	<i>Eremopterix griseus</i>	R	LC
142.	Bengal Bush Lark or Indian Bush Lark	<i>Mirafra assamica</i>	R	LC
143.	Bimaculated Lark	<i>Melanocorypha bimaculata</i>	M	LC
144.	Black-crowned Sparrow-Lark	<i>Eremopterix nigriceps</i>	R	LC
145.	Crested Lark	<i>Galerida cristata</i>	R	LC
146.	Desert Lark	<i>Ammomanes deserti</i>	R	LC
147.	Eastern Short-toed Lark	<i>Calandrella dukhunensis</i>	M	LC
148.	Greater hoopoe-lark	<i>Alaemon alaudipes</i>	R	LC
149.	Greater Short-toed Lark	<i>Calandrella brachydactyla</i>	M	LC
150.	Indian Bushlark	<i>Mirafra erythroptera</i>	R	LC
151.	Rufous-tailed Lark	<i>Ammomanes phoenicura</i>	R	LC
FAMILY Hirundinidae				
152.	Plain Martin	<i>Riparia paludicola</i>	R	LC

Sr. No.	Common name	Scientific name	Migratory status	IUCN status
153.	Barn Swallow	<i>Hirundo rustica</i>	R	LC
154.	Red-rumped Swallow	<i>Cecropis daurica</i>	R	LC
155.	Streak-throated Swallow	<i>Petrochelidon fluvicola</i>	R	LC
156.	Wire-tailed Swallow	<i>Hirundo smithii</i>	R	LC
FAMILY Motacillidae				
157.	Citrine Wagtail	<i>Motacilla citreola</i>	LM	LC
158.	Gray Wagtail	<i>Motacilla cinerea</i>	R	LC
159.	Western Yellow Wagtail	<i>Motacilla flava</i>	R	LC
160.	White Wagtail	<i>Motacilla alba</i>	M	LC
161.	White-browed Wagtail	<i>Motacilla maderaspatensis</i>	R	LC
162.	Long-billed Pipit	<i>Anthus similis</i>	R	LC
163.	Paddyfield Pipit	<i>Anthus rufulus</i>	R	LC
164.	Tawny Pipit	<i>Anthus campestris</i>	M	LC
FAMILY Campephagidae				
165.	Common Woodshrike	<i>Tephrodornis pondicerianus</i>	R	LC
166.	Small Minivet	<i>Pericrocotus cinnamomeus</i>	R	LC
FAMILY Pycnonotidae				
167.	Red-vented Bulbul	<i>Pycnonotus cafer</i>	R	LC
168.	White-eared Bulbul	<i>Pycnonotus leucotis</i>	R	LC
FAMILY Irenidae				
169.	Common Iora	<i>Aegithina tiphia</i>	R	LC
FAMILY Laniidae				
170.	Bay-backed Shrike	<i>Lanius vittatus</i>	R	LC
171.	Brown Shrike	<i>Lanius cristatus</i>	M	LC
172.	Great Gray Shrike	<i>Lanius excubitor</i>	R	LC
173.	Isabelline Shrike	<i>Lanius isabellinus</i>	M	LC
174.	Long-tailed Shrike	<i>Lanius schach</i>	R	LC
FAMILY Muscipidae				
175.	Indian Robin	<i>Saxicoloides fulicatus</i>	R	LC
176.	Oriental Magpie-Robin	<i>Copsychus saularis</i>	R	LC
177.	Bluethroat	<i>Cyanecula svecica</i>	M	LC
178.	Black Redstart	<i>Phoenicurus ochruros</i>	R	LC
179.	White-browed Bushchat	<i>Saxicola macrorhynchus</i>	R	VU
180.	Pied Bushchat	<i>Saxicola caprata</i>	R	LC
181.	Common Stonechat	<i>Saxicola torquatus</i>	R	LC
182.	Variable Wheatear	<i>Oenanthe picata</i>	M	LC
183.	Desert Wheatear	<i>Oenanthe deserti</i>	M	LC
184.	Isabelline Wheatear	<i>Oenanthe isabellina</i>	R	LC
185.	Yellow-eyed Babbler	<i>Chrysomma sinense</i>	R	LC
186.	Common Babbler	<i>Argya caudata</i>	R	LC
187.	Jungle Babbler	<i>Turdoides striata</i>	R	LC
188.	Large Grey Babbler	<i>Argya malcolmi</i>	R	LC
189.	Blyth's Reed Warbler	<i>Acrocephalus dumetorum</i>	M	LC
190.	Booted Warbler	<i>Iduna caligata</i>	LM	LC
191.	Brown Rock Chat	<i>Oenanthe fusca</i>	R	LC
192.	Clamorous Reed Warbler	<i>Acrocephalus stentoreus</i>	M	LC
193.	Dusky Warbler	<i>Phylloscopus fuscatus</i>	M	LC
194.	Eastern Orphean Warbler	<i>Sylvia crassirostris</i>	M	LC
195.	Asian Desert Warbler	<i>Sylvia nana</i>	M	LC
196.	Common Tailorbird	<i>Orthotomus sutorius</i>	R	LC
197.	Lesser Whitethroat	<i>Sylvia curruca</i>	M	LC
198.	Graceful Prinia	<i>Prinia gracilis</i>	R	LC

Sr. No.	Common name	Scientific name	Migratory status	IUCN status
199.	Ashy Prinia	<i>Prinia socialis</i>	R	LC
200.	Plain Prinia	<i>Prinia inornata</i>	R	LC
201.	Rufous-fronted Prinia	<i>Prinia buchanani</i>	R	LC
202.	Gray-breasted Prinia	<i>Prinia hodgsonii</i>	R	LC
203.	Gray-headed Canary-Flycatcher	<i>Culicicapa ceylonensis</i>	R	LC
204.	Red-breasted Flycatcher	<i>Ficedula parva</i>	M	LC
205.	White-browed Fantail	<i>Rhipidura aureola</i>	R	LC
206.	Common Chiffchaff	<i>Phylloscopus collybita</i>	R	LC
207.	Zitting Cisticola	<i>Cisticola juncidis</i>	R	LC
FAMILY Nectariniidae				
208.	Indian Spotted Creeper	<i>Salpornis spilonota</i>	R	LC
FAMILY Certhiidae				
209.	Purple Sunbird	<i>Cinnyris asiaticus</i>	R	LC
FAMILY Emberizidae				
210.	Crested Bunting	<i>Emberiza lathami</i>	R	LC
FAMILY Estrildidae				
211.	Indian Silverbill	<i>Euodice malabarica</i>	R	LC
212.	Red Avadavat	<i>Amandava amandava</i>	R	LC
213.	Scaly-breasted Munia	<i>Lonchura punctulata</i>	R	LC
FAMILY Passeridae				
214.	House Sparrow	<i>Passer domesticus</i>	R	LC
215.	Yellow-throated Sparrow	<i>Gymnoris supercilialis</i>	R	LC
216.	Sind Sparrow	<i>Passer pyrrhonotus</i>	R	LC
217.	Baya Weaver	<i>Ploceus philippinus</i>	R	LC
218.	Bank Myna	<i>Acridotheres ginginianus</i>	R	LC
219.	Common Myna	<i>Acridotheres tristis</i>	R	LC
220.	Brahminy Starling	<i>Sturnia pagodarum</i>	R	LC
221.	Asian Pied Starling	<i>Gracupica contra</i>	R	LC
222.	Rosy Starling	<i>Pastor roseus</i>	R	LC
FAMILY Oriolidae				
223.	Indian Golden Oriole	<i>Oriolus kundoo</i>	R	LC
FAMILY Dicuridae				
224.	Black Drongo	<i>Dicrurus macrocercus</i>	R	LC
FAMILY Corvidae				
225.	Common Raven	<i>Corvus corax</i>	LM	LC
226.	House Crow	<i>Corvus splendens</i>	R	LC
227.	Large-billed Crow	<i>Corvus macrorhynchos</i>	R	LC
228.	Rufous Treepie	<i>Dendrocitta vagabunda</i>	R	LC

Annexure VII Birds seen in and around DNP

S No.	Name of the species	Scientific Name	IUCN Red Data List Status	No of sightings	No of individuals
ORDER PODICIPEDIFORMES					
FAMILY Podicipedidae					
1	Little Grebe	<i>Tachybaptus ruficollis</i>	LC	10	10
ORDER CICONIIFORMES					
FAMILY Ardeidae					
2	Grey Heron	<i>Ardea cinerea</i>	LC	1	1
3	Indian Pond- heron	<i>Ardeola grayii</i>	LC	1	1
4	Cattle Egret	<i>Bubulcus ibis</i>	LC	1	6
FAMILY Ciconiidae					
5	Painted Stork	<i>Mycteria leucocephala</i>	NT	1	1
FAMILY Threskiornithidae					
6	Red-naped Ibis	<i>Pseudibis papillosa</i>	LC	19	24
ORDER ANSERIFORMES					
FAMILY Anatidae					
7	Gadwall	<i>Mareca strepera</i>	LC	1	1
8	Gargany	<i>Spatula querquedula</i>	LC	1	1
9	Mallard	<i>Anas platyrhynchos</i>	LC	1	2
10	Common Teal	<i>Anas crecca</i>	LC	5	5
ORDER FALCONIFORMES					
FAMILY Accipitridae					
11	Eurasian Sparrowhawk	<i>Accipiter nisus</i>	LC	2	2
12	Greater Spotted Eagle	<i>Clanga clanga</i>	VU	2	2
13	Eastern Imperial Eagle	<i>Aquila heliaca</i>	VU	4	4
14	Bonelli's Eagle	<i>Aquila fasciata</i>	LC	2	2
15	Booted Eagle	<i>Hieraaetus pennatus</i>	LC	14	14
16	Indian Spotted Eagle	<i>Clanga hastata</i>	VU	10	10
17	Changeable Hawk-eagle	<i>Nisaetus cirrhatius</i>	LC	1	1
18	Steppe Eagle	<i>Aquila nipalensis</i>	EN	19	19
19	Tawny Eagle	<i>Aquila rapax</i>	VU	23	23
20	Short-toed Snake-eagle	<i>Circaetus gallicus</i>	LC	2	2
21	White-eyed Buzzard	<i>Butastur teesa</i>	LC	2	2
22	Eurasian Buzzard	<i>Buteo buteo</i>	LC	18	18
23	Long-legged Buzzard	<i>Buteo rufinus</i>	LC	15	19
24	Griffon Vulture	<i>Gyps fulvus</i>	LC	10	13
25	Himalayan Griffon	<i>Gyps himalayensis</i>	NT	13	15
26	Cinereous Vulture	<i>Aegypius monachus</i>	NT	4	5
27	Egyptian Vulture	<i>Neophron percnopterus</i>	EN	9	18
28	Indian Vulture	<i>Gyps indicus</i>	CR	11	11
29	Red-headed Vulture	<i>Sarcogyps calvus</i>	CR	16	17
30	White-rumped Vulture	<i>Gyps bengalensis</i>	CR	5	11
31	Black Kite	<i>Milvus migrans</i>	LC	13	13
32	Black-winged Kite	<i>Elanus caeruleus</i>	LC	5	5
33	Western Marsh-harrier	<i>Circus aeruginosus</i>	LC	1	1
34	Montagu's Harrier	<i>Circus pygargus</i>	LC	4	4
35	Pallid Harrier	<i>Circus macrourus</i>	NT	5	5
36	Pied Harrier	<i>Circus melanoleucos</i>	LC	1	1
37	Shikra	<i>Accipiter badius</i>	LC	14	14
FAMILY Pandionidae					

S No.	Name of the species	Scientific Name	IUCN Red Data List Status	No of sightings	No of individuals
38	Osprey	<i>Pandion haliaetus</i>	LC	LC	5
FAMILY Falconidae					
39	Laggar Falcon	<i>Falco jugger</i>	NT	18	18
40	Red-headed Falcon	<i>Falco chicquera</i>	NT	8	8
41	Lesser Kestrel	<i>Falco naumanni</i>	LC	13	13
42	Common Kestrel	<i>Falco tinnunculus</i>	LC	27	31
43	Merlin	<i>Falco columbarius</i>	LC	5	5
44	Saker Falcon	<i>Falco cherrug</i>	EN	6	6
ORDER GALLIFORMES					
FAMILY Phasianidae					
45	Grey Francolin	<i>Francolinus pondicerianus</i>	LC	11	15
46	Common Quail	<i>Coturnix coturnix</i>	LC	2	2
FAMILY Gruidae					
47	Common Crane	<i>Grus grus</i>	LC	18	34
48	Demoiselle Crane	<i>Anthropoides virgo</i>	LC	4	530
FAMILY Rallidae					
49	Common Coot	<i>Fulica atra</i>	LC	9	9
FAMILY Otidae					
50	Great Indian Bustard	<i>Ardeotis nigriceps</i>	CR	35	45
ORDER CHARADRIIFORMES					
FAMILY Charadriidae					
51	Kentish Plover	<i>Charadrius alexandrinus</i>	LC	1	1
52	Little Ringed Plover	<i>Charadrius dubius</i>	LC	4	4
53	Common Ringed Plover	<i>Charadrius hiaticula</i>	LC	1	1
54	Greater Sandplover	<i>Charadrius leschenaultii</i>	LC	4	4
55	Red-wattled Lapwing	<i>Vanellus indicus</i>	LC	11	19
56	Sociable Lapwing	<i>Vanellus gregarius</i>	CR	1	1
FAMILY Scolopacidae					
57	Green Sandpiper	<i>Tringa ochropus</i>	LC	1	1
58	Common Sandpiper	<i>Actitis hypoleucos</i>	LC	3	3
59	Wood Sandpiper	<i>Tringa glareola</i>	LC	1	1
FAMILY Recurvirostridae					
60	Black-winged Stilt	<i>Himantopus himantopus</i>	LC	1	3
FAMILY Glareolidae					
61	Indian Courser	<i>Cursorius coromandelicus</i>	LC	5	9
62	Cream-coloured Courser	<i>Cursorius cursor</i>	LC	30	42
ORDER COLUMBIFORMES					
FAMILY Pteroclididae					
63	Chestnut-bellied Sandgrouse	<i>Pterocles exustus</i>	LC	33	259
64	Spotted Sandgrouse	<i>Pterocles senegallus</i>	LC	9	9
FAMILY Columbidae					
65	Indian Spotted Dove	<i>Spilopelia chinensis</i>	VU	5	5
66	Eurasian Collard-dove	<i>Streptopelia decaocto</i>	LC	56	162
67	Laughing Dove	<i>Spilopelia senegalensis</i>	LC	2	4
68	Rock Dove	<i>Columba livia</i>	LC	5	9
69	Yellow-eyed Pigeon	<i>Columba eversmanni</i>	VU	2	91
ORDER PSITTACIFORMES					

S No.	Name of the species	Scientific Name	IUCN Red Data List Status	No of sightings	No of individuals
FAMILY Psittacidae					
70	Rose-ringed Parakeet	<i>Alexandrinus krameri</i>	LC	1	7
ORDER STRIGIFORMES					
FAMILY Strigidae					
71	Rock Eagle-Owl	<i>Bubo bengalensis</i>	LC	3	3
72	Spotted Owlet	<i>Athene brama</i>	LC	3	3
ORDER APODIFORMES					
FAMILY Apodidae					
73	House Swift	<i>Apus nipalensis</i>	LC	2	2
ORDER CORACIIFORMES					
FAMILY Alcedinidae					
74	Pied Kingfisher	<i>Ceryle rudis</i>	LC	3	3
75	White-breasted Kingfisher	<i>Halcyon smyrnensis</i>	LC	1	1
FAMILY Meropidae					
76	Asian Green Bee-eater	<i>Merops orientalis</i>	LC	26	45
77	Blue-cheeked Bee-eater	<i>Merops persicus</i>	LC	1	1
FAMILY Coraciidae					
78	European Roller	<i>Coracias garrulus</i>	LC	11	11
79	Indian Roller	<i>Coracias benghalensis</i>	LC	23	23
FAMILY Upupidae					
80	Common Hoopoe	<i>Upupa epops</i>	LC	23	32
FAMILY Bucerotidae					
81	Indian Grey Hornbill	<i>Ocyrceros birostris</i>	LC	2	2
ORDER PICIFORMES					
FAMILY Picidae					
82	Eurasian Wryneck	<i>Jynx torquilla</i>	LC	1	1
FAMILY Alaudidae					
83	Indian Bushlark	<i>Mirafraga erythroptera</i>	LC	6	6
84	Bimaculated Lark	<i>Melanocorypha bimaculata</i>	LC	14	92
85	Black-crowned Sparrow-lark	<i>Eremopterix nigriceps</i>	LC	15	34
86	Crested Lark	<i>Galerida cristata</i>	LC	10	12
87	Desert Lark	<i>Ammomanes deserti</i>	LC	22	48
88	Greater Short-toed Lark	<i>Calandrella brachydactyla</i>	LC	49	472
89	Greater Hoopoe-lark	<i>Alaemon alaudipes</i>	LC	12	13
90	Sykes's Lark	<i>Galerida deva</i>	LC	1	7
FAMILY Hirundinidae					
91	Barn swallow	<i>Hirundo rustica</i>	LC	6	7
FAMILY Motacillidae					
92	White wagtail	<i>Motacilla alba</i>	LC	11	11
93	Long-billed Pipit	<i>Anthus similis</i>	LC	26	33
94	Paddyfield Pipit	<i>Anthus rufulus</i>	LC	1	1
95	Tawny Pipit	<i>Anthus campestris</i>	LC	24	39
96	Water Pipit	<i>Anthus spinoletta</i>	LC	1	6
FAMILY Pycnonotidae					
97	Red-vented Bulbul	<i>Pycnonotus cafer</i>	LC	18	33
98	White-eared Bulbul	<i>Pycnonotus leucotis</i>	LC	67	166
FAMILY Laniidae					
99	Bay-backed Shrike	<i>Lanius vittatus</i>	LC	3	11

S No.	Name of the species	Scientific Name	IUCN Red Data List Status	No of sightings	No of individuals
100	Isabelline Shrike	<i>Lanius isabellinus</i>	LC	6	6
101	Long-tailed Shrike	<i>Lanius schach</i>	LC	3	3
102	Red-tailed Shrike	<i>Lanius phoenicuroides</i>	LC	1	1
FAMILY Muscicapidae					
103	Indian Robin	<i>Saxicoloides fulicatus</i>	LC	3	3
104	White-browed Bushchat	<i>Saxicola macrorhynchus</i>	VU	6	7
105	Pied Bushchat	<i>Saxicola caprata</i>	LC	2	2
106	Common Stonechat	<i>Saxicola torquatus</i>	LC	3	3
107	Variable Wheatear	<i>Oenanthe picata</i>	LC	53	66
108	Desert Wheatear	<i>Oenanthe deserti</i>	LC	45	49
109	Isabelline Wheatear	<i>Oenanthe isabellina</i>	LC	26	27
110	Red-tailed Wheatear	<i>Oenanthe chrysopygia</i>	LC	7	8
111	Common Babbler	<i>Argya caudata</i>	LC	45	122
112	Spotted Flycatcher	<i>Muscicapa striata</i>	LC	2	2
113	Jungle Babbler	<i>Turdoides striata</i>	LC	3	9
114	Asian Desert Warbler	<i>Syloia nana</i>	LC	44	4
115	Finsch's Wheatear	<i>Oenanthe finschii</i>	LC	4	4
116	Eastern Orphean Warbler	<i>Syloia crassirostris</i>	LC	5	5
117	Rufous-fronted Prinia	<i>Prinia buchanani</i>	LC	2	2
FAMILY Certhiidae					
118	Purple Sunbird	<i>Cinnyris asiaticus</i>	LC	5	7
FAMILY Estrildidae					
119	Indian Silverbill	<i>Euodice malabarica</i>	LC	4	5
FAMILY Passeridae					
120	House Sparrow	<i>Passer domesticus</i>	LC	27	211
121	Yellow-throated Sparrow	<i>Gymnoris superciliaris</i>	LC	15	94
122	Sind Sparrow	<i>Passer pyrrhonotus</i>	LC	1	1
123	Spanish Sparrow	<i>Passer hispaniolensis</i>	LC	6	6
FAMILY Sturnidae					
124	Common Starling	<i>Sturnus vulgaris</i>	LC	11	20
125	Common Myna	<i>Acridotheres tristis</i>	LC	7	8
126	Rosy Starling	<i>Pastor roseus</i>	LC	24	35
FAMILY Dicruridae					
127	Black Drongo	<i>Dicrurus macrocercus</i>	LC	9	15
FAMILY Corvidae					
128	Common Raven	<i>Corvus corax</i>	LC	27	27
129	House Crow	<i>Corvus splendens</i>	LC	11	26
FAMILY Fringillidae					
130	Trumpeter Finch	<i>Bucanetes githagineus</i>	LC	3	16

Annexure VIII) Birds seen in PFFR and surroundings

Sr. No.	Common Name	Scientific name	IUCN Red Data List
ORDER PODICIPEDIFORMES			
Family Podicipedidae			
1.	Little Grebe	<i>Tachybaptus ruficollis</i>	LC
ORDER PELECANIFORMES			
Family Phalacrocoracidae			
2.	Indian Cormorant	<i>Phalacrocorax fuscicollis</i>	LC
Family Sulidae			
3.	Asian Desert Warbler	<i>Sylvia nana</i>	LC
ORDER CICONIIFORMES			
Family Ardeidae			
4.	Indian Pond-heron	<i>Ardeola grayii</i>	LC
5.	Cattle Egret	<i>Bubulcus ibis</i>	LC
Family Threskiornithidae			
6.	Eurasian Spoonbill	<i>Platalea leucorodia</i>	LC
7.	Red-naped Ibis	<i>Pseudibis papillosa</i>	LC
ORDER ANSERIFORMES			
Family Anatidae			
8.	Common Pochard	<i>Aythya farina</i>	VU
9.	Common Teal	<i>Anas crecca</i>	LC
10.	Mallard	<i>Anas platyrhynchos</i>	LC
11.	Northern Shoveler	<i>Spatula clypeata</i>	LC
ORDER FALCONIFORMES			
Family Accipitridae			
12.	Eurasian Sparrow-hawk	<i>Accipiter nisus</i>	LC
13.	Short-toed Snake-eagle	<i>Circaetus gallicus</i>	LC
14.	Steppe Eagle	<i>Aquila nipalensis</i>	EN
15.	Tawny Eagle	<i>Aquila rapax</i>	VU
16.	Eastern Imperial Eagle	<i>Aquila heliaca</i>	VU
17.	Long-legged Buzzard	<i>Buteo rufinus</i>	LC
18.	Common Buzzard	<i>Buteo buteo</i>	LC
19.	Griffon Vulture	<i>Gyps fulvus</i>	LC
20.	Cinereous Vulture	<i>Aegyptius monachus</i>	NT
21.	Egyptian Vulture	<i>Aquila heliaca</i>	EN
22.	Montagu's Harrier	<i>Circus pygargus</i>	LC
23.	Black-winged Kite	<i>Elanus caeruleus</i>	LC
24.	Pallid Harrier	<i>Circus macrourus</i>	NT
25.	Shikra	<i>Accipiter badius</i>	LC
Family Falconidae			
26.	Common Kestrel	<i>Falco tinnunculus</i>	LC
27.	Laggar Falcon	<i>Falco jugger</i>	NT
28.	Lesser Kestrel	<i>Falco naumanni</i>	LC
29.	Merlin	<i>Falco columbarius</i>	LC
ORDER GALLIFORMES			
Family Phasianidae			
30.	Grey Francolin	<i>Francolinus pondicerianus</i>	LC
31.	Indian Peafowl	<i>Pavo cristatus</i>	LC
Family Gruidae			
32.	Common Crane	<i>Grus grus</i>	LC

Sr. No.	Common Name	Scientific name	IUCN Red Data List
33.	Demoiselle Crane	<i>Grus virgo</i>	LC
Family Rallidae			
34.	Common Coot	<i>Fulica atra</i>	LC
Family Otidae			
35.	Great Indian Bustard	<i>Ardeotis nigriceps</i>	CR
36.	MacQueen's Bustard	<i>Chlamydotis macqueenii</i>	VU
ORDER CHARADRIIFORMES			
Family Charadriidae			
37.	Little Ringed Plover	<i>Charadrius dubius</i>	LC
38.	Sociable Lapwing	<i>Vanellus gregarius</i>	CR
Family Scolopacidae			
39.	Common Sandpiper	<i>Actitis hypoleucos</i>	LC
40.	Common Greenshank	<i>Tringa nebularia</i>	LC
41.	Spotted Redshank	<i>Tringa erythropus</i>	LC
Family Recurvirostridae			
42.	Black-winged Stilt	<i>Himantopus himantopus</i>	LC
43.	Pied Avocet	<i>Recurvirostra avosetta</i>	LC
Family Glareolidae			
44.	Cream-coloured Courser	<i>Cursorius cursor</i>	LC
45.	Indian Courser	<i>Cursorius coromandelicus</i>	LC
Family Laridae			
46.	River Tern	<i>Sterna aurantia</i>	VU
ORDER COLUMBIFORMES			
Family Pteroclididae			
47.	Chestnut-bellied Sandgrouse	<i>Pterocles exustus</i>	LC
Family Columbidae			
48.	Eurasian Collared-dove	<i>Streptopelia decaocto</i>	LC
49.	Laughing Dove	<i>Spilopelia senegalensis</i>	LC
50.	Rock Dove	<i>Columba livia</i>	LC
51.	Yellow-eyed Pigeon	<i>Columba eversmanni</i>	VU
ORDER PSITTACIFORMES			
Family Psittacidae			
52.	Rose-ringed Parakeet	<i>Psittacula krameri</i>	LC
ORDER CORACIIFORMES			
Family Meropidae			
53.	Asian Green Bee-eater	<i>Merops orientalis</i>	LC
54.	Blue-cheeked Bee-eater	<i>Merops superciliosus</i>	LC
Family Coraciidae			
55.	European Roller	<i>Coracias garrulus</i>	LC
Family Upupidae			
56.	Common Hoopoe	<i>Upupa epops</i>	LC
57.	Red-wattled Lapwing	<i>Vanellus indicus</i>	LC
ORDER PICIFORMES			
Family Picidae			
58.	Black-rumped Flameback	<i>Dinopium benghalense</i>	LC
ORDER PASSERIFORMES			
Family Alaudidae			
59.	Ashy-crown Sparrow-lark	<i>Eremopterix griseus</i>	LC
60.	Bimaculated Lark	<i>Melanocorypha bimaculata</i>	LC
61.	Black-crowned Sparrow-lark	<i>Eremopterix nigriceps</i>	LC
62.	Crested Lark	<i>Galerida cristata</i>	LC
63.	Desert Lark	<i>Ammomanes deserti</i>	LC

Sr. No.	Common Name	Scientific name	IUCN Red Data List
64.	Greater Short-toed Lark	<i>Calandrella brachydactyla</i>	LC
Family Hirundinidae			
65.	Plain Martin	<i>Riparia paludicola</i>	LC
66.	Barn Swallow	<i>Hirundo rustica</i>	LC
Family Motacillidae			
67.	Tawny Pipit	<i>Anthus campestris</i>	LC
68.	White Wagtail	<i>Motacilla alba</i>	LC
Family Pycnonotidae			
69.	Red-vented Bulbul	<i>Pycnonotus cafer</i>	LC
70.	White-eared Bulbul	<i>Pycnonotus leucotis</i>	LC
Family Laniidae			
71.	Great Grey Shrike	<i>Laniusexcubitor</i>	LC
72.	Southern Grey Shrike	<i>Lanius meridionalis</i>	VU
Family Muscicapidae			
73.	Black Redstart	<i>Phoenicurus ochruros</i>	LC
74.	Desert Wheatear	<i>Oenanthe deserti</i>	LC
75.	Isabelline Wheatear	<i>Oenanthe isabellina</i>	LC
76.	Variable Wheatear	<i>Oenanthe picata</i>	LC
77.	Large Grey Babbler	<i>Turdoides malcolmi</i>	LC
78.	Common Babbler	<i>Turdoidescaudata</i>	LC
79.	White-browed Fantail	<i>Rhipidura aureola</i>	LC
Family Sylviidae			
80.	Common Chiffchaff	<i>Phylloscopus collybita</i>	LC
81.	Ashy Prinia	<i>Priniasocialis</i>	LC
82.	Lesser Whitethroat	<i>Sylvia curruca</i>	LC
Family Nectariniidae			
83.	Purple Sunbird	<i>Cinnyris asiaticus</i>	LC
Family Estrildidae			
84.	Indian Silverbill	<i>Euodice malabarica</i>	LC
Family Passeridae			
85.	Yellow-throated Sparrow	<i>Petronia xanthocollis</i>	LC
86.	House Sparrow	<i>Passer domesticus</i>	LC
Family Sturnidae			
87.	Rosy Starling	<i>Pastor roseus/ Sturnus roseus</i>	LC
88.	Common Starling	<i>Sturnus vulgaris</i>	LC
Family Dicruridae			
89.	Black Drongo	<i>Dicrurus macrocercus</i>	LC
Family Corvidae			
90.	House Crow	<i>Corvus splendens</i>	LC
91.	Rufous Treepie	<i>Dendrocitta vagabunda</i>	LC

Annexure IX) Birds seen at Deg Rai Mata Oran during survey

Sr. No	Common name of the species	Scientific name	IUCN Red List
ORDER PODICIPEDIFORMES			
Family Podicipedidae			
1.	Little Grebe	<i>Tachybaptus ruficollis</i>	LC
ORDER PELECANIFORMES			
Family Pelecanidae			
2.	Dalmatian Pelican	<i>Pelecanus crispus</i>	NT
ORDER CICONIIFORMES			
Family Ardeidae			
3.	Grey Heron	<i>Ardea cinerea</i>	LC
4.	Indian Pond-heron	<i>Ardeola grayii</i>	LC
5.	Little Egret	<i>Egretta garzetta</i>	LC
Family Threskiornithidae			
6.	Black-headed Ibis	<i>Threskiornis melanocephalus</i>	NT
7.	Eurasian Spoonbill	<i>Platalea leucorodia</i>	LC
ORDER ANSERIFORMES			
Family Anatidae			
8.	Common Pochard	<i>Aythya ferina</i>	VU
9.	Common Teal	<i>Anas crecca</i>	LC
10.	Gadwall	<i>Mareca strepera</i>	LC
11.	Northern Shoveler	<i>Spatula clypeata</i>	LC
12.	Red-crested Pochard	<i>Netta rufina</i>	LC
ORDER FALCONIFORMES			
Family Accipitridae			
13.	Eurasian Sparrowhawk	<i>Accipiter nisus</i>	LC
14.	Tawny Eagle	<i>Aquila rapax</i>	VU
15.	Long-legged Buzzard	<i>Buteo rufinus</i>	LC
16.	MacQueen's Bustard	<i>Chlamydotis macqueenii</i>	VU
17.	Cinereous Vulture	<i>Aegypius monachus</i>	NT
18.	Egyptian Vulture	<i>Neophron percnopterus</i>	EN
19.	Indian Vulture	<i>Gyps indicus</i>	CR
20.	Pallid Harrier	<i>Circus macrourus</i>	NT
Family Falconidae			
21.	Common Kestrel	<i>Falco tinnunculus</i>	LC
22.	Laggar Falcon	<i>Falco jugger</i>	NT
ORDER GALLIFORMES			
Family Phasianidae			
23.	Indian Peafowl	<i>Pavo cristatus</i>	LC
24.	Grey Francolin	<i>Francolinus pondicerianus</i>	LC
Family Gruidae			
25.	Demoiselle Crane	<i>Grus virgo</i>	LC
Family Rallidae			
26.	Common Moorhen	<i>Gallinula chloropus</i>	LC
27.	Common Coot	<i>Fulica atra</i>	LC
Family Otididae			
28.	Great Indian Bustard	<i>Ardeotis nigriceps</i>	CR
29.	MacQueen's Bustard	<i>Chlamydotis macqueenii</i>	VU
ORDER CHARADRIIFORMES			
Family Charadriidae			
30.	Little Ringed Plover	<i>Charadrius dubius</i>	LC

Sr. No	Common name of the species	Scientific name	IUCN Red List
31.	Red-wattled Lapwing	<i>Vanellus indicus</i>	LC
Family Scolopacidae			
32.	Wood Sandpiper	<i>Tringa glareola</i>	LC
Family Recurvirostridae			
33.	Black-winged Stilt	<i>Himantopus himantopus</i>	LC
Family Glareolidae			
34.	Indian Courser	<i>Cursorius coromandelicus</i>	LC
ORDER COLUMBIFORMES			
Family Pteroclididae			
35.	Chestnut-bellied Sandgrouse	<i>Pterocles exustus</i>	LC
Family Columbidae			
36.	Rock Dove	<i>Columba livia</i>	LC
37.	Eurasian Collared-dove	<i>Streptopelia decaocto</i>	LC
38.	Laughing Dove	<i>Spilopelia senegalensis</i>	LC
39.	Red Turtle-dove	<i>Streptopelia tranquebarica</i>	LC
ORDER CORACIIFORMES			
Family Alcedinidae			
40.	White-breasted Kingfisher	<i>Halcyon smyrnensis</i>	LC
Family Meropidae			
41.	Asian Green Bee-eater	<i>Merops orientalis</i>	LC
42.	Blue-cheeked Bee-eater	<i>Merops superciliosus</i>	LC
Family Coraciidae			
43.	European Roller	<i>Coracias garrulus</i>	LC
Family Upupidae			
44.	Common Hoopoe	<i>Upupa epops</i>	LC
ORDER PASSERIFORMES			
Family Alaudidae			
45.	Ashy-crowned Sparrow-lark	<i>Eremopterix griseus</i>	LC
46.	Black-crowned Sparrow-lark	<i>Eremopterix nigriceps</i>	LC
47.	Greater Short-toed Lark	<i>Calandrella brachydactyla</i>	LC
48.	Rufous-tailed Lark	<i>Ammomanes phoenicura</i>	LC
Family Hirundinidae			
49.	Common Swallow	<i>Hirundo rustica</i>	LC
Family Motacillidae			
50.	White Wagtail	<i>Motacilla alba</i>	LC
51.	Tawny Pipit	<i>Anthus campestris</i>	LC
Family Pycnonotidae			
52.	Red-vented Bulbul	<i>Pycnonotus cafer</i>	LC
53.	White-eared Bulbul	<i>Pycnonotus leucotis</i>	LC
Family Laniidae			
54.	Bay-backed Shrike	<i>Lanius vittatus</i>	LC
55.	Great Grey Shrike	<i>Lanius excubitor</i>	LC
56.	Grey Shrike	<i>Lanius meridionalis</i>	VU
Family Muscicapidae			
57.	Desert Wheatear	<i>Oenanthe deserti</i>	LC
58.	Variable Wheatear	<i>Oenanthe picata</i>	LC
59.	Common Babbler	<i>Turdoides caudata</i>	LC
60.	White-browed Fantail	<i>Rhipidura aureola</i>	LC
61.	Lesser Whitethroat	<i>Sylvia curruca</i>	LC
Family Nectariniidae			
62.	Purple Sunbird	<i>Cinnyris asiaticus</i>	LC
Family Estrildidae			

Sr. No	Common name of the species	Scientific name	IUCN Red List
63.	Indian Silverbill	<i>Euodice malabarica</i>	LC
Family Passeridae			
64.	House Sparrow	<i>Passer domesticus</i>	LC
Family Sturnidae			
65.	Rosy Starling	<i>Pastor roseus</i>	LC
Family Dicruridae			
66.	Black Drongo	<i>Dicrurus macrocercus</i>	LC
Family Corvidae			
67.	House Crow	<i>Corvus splendens</i>	LC



Chestnut-bellied Sandgrouse © Ashley Chiu

Annexure X) Birds seen in the western part of the survey area

Sr. No.	Common name	Scientific name	Migratory status	IUCN status
ORDER PODICIPEDIFORMES				
FAMILY Podicipedidae				
1	Little Grebe	<i>Tachybaptus ruficollis</i>	R	LC
ORDER CICONIIFORMES				
FAMILY Ardeidae				
2	Gray Heron	<i>Ardea cinerea</i>	R	LC
3	Indian Pond-Heron	<i>Ardeola grayii</i>	R	LC
4	Little Egret	<i>Egretta garzetta</i>	R	LC
FAMILY Ciconiidae				
5	Black Stork	<i>Ciconia nigra</i>	M	LC
FAMILY Threskiornithidae				
6	Red-naped Ibis	<i>Pseudibis papillosa</i>	LM	LC
7	Eurasian Spoonbill	<i>Platalea leucorodia</i>	M	LC
ORDER ANSERIFORMES				
FAMILY Anatidae				
8	Gadwall	<i>Mareca strepera</i>	M	LC
9	Northern Shoveler	<i>Spatula clypeata</i>	M	LC
10	Common Pochard	<i>Aythya ferina</i>	M	VU
ORDER FALCONIFORMES				
FAMILY Accipitridae				
11	Eurasian Sparrowhawk	<i>Accipiter nisus</i>	R,M	LC
12	Greater Spotted Eagle	<i>Clanga clanga</i>	M	VU
13	Bonelli's Eagle	<i>Aquila fasciata</i>	R	LC
14	Booted Eagle	<i>Hieraetus pennatus</i>	LM	LC
15	Indian Spotted Eagle	<i>Clanga hastata</i>	R	VU
16	Short-toed Snake-Eagle	<i>Circaetus gallicus</i>	R	LC
17	Steppe Eagle	<i>Aquila nipalensis</i>	M	EN
18	Tawny Eagle	<i>Aquila rapax</i>	R	VU
19	White-eyed Buzzard	<i>Butastur teesa</i>	R	LC
20	Long-legged Buzzard	<i>Buteo rufinus</i>	M	LC
21	Egyptian Vulture	<i>Neophron percnopterus</i>	R	EN
22	Himalayan Griffon	<i>Gyps himalayensis</i>	R	NT
23	Eurasian Griffon	<i>Gyps fulvus</i>	R	LC
24	Cinereous Vulture	<i>Aegypius monachus</i>	LM	NT
25	Red-headed Vulture	<i>Sarcogyps calvus</i>	R	CR
26	White-rumped Vulture	<i>Gyps bengalensis</i>	R	CR
27	Black Kite	<i>Milvus migrans</i>	R	LC
28	Black-winged Kite	<i>Elanus caeruleus</i>	R	LC
29	Eurasian Marsh-Harrier	<i>Circus aeruginosus</i>	M	LC
30	Montagu's Harrier	<i>Circus pygargus</i>	M	LC
31	Pallid Harrier	<i>Circus macrourus</i>	M	NT
32	Pied Harrier	<i>Circus melanoleucos</i>	M	LC
33	Western Marsh-harrier	<i>Circus aeruginosus</i>	M	LC
34	Shikra	<i>Accipiter badius</i>	R	LC
FAMILY Falconidae				
35	Laggar Falcon	<i>Falco jugger</i>	R	NT
36	Eurasian Kestrel	<i>Falco tinnunculus</i>	R	LC

Sr. No.	Common name	Scientific name	Migratory status	IUCN status
ORDER GALLIFORMES				
FAMILY Phasianidae				
37	Gray Francolin	<i>Francolinus pondicerianus</i>	R	LC
FAMILY Gruidae				
38	Demoiselle Crane	<i>Anthropoides virgo</i>	M	LC
FAMILY Rallidae				
39	Eurasian Coot	<i>Fulica atra</i>	R,M	LC
FAMILY Otididae				
40	Asian Houbara or MacQueen's Bustard	<i>Chlamydotis macqueenii</i>	M	VU
41	Great Indian Bustard	<i>Ardeotis nigriceps</i>	R	CR
ORDER CHARADRIIFORMES				
FAMILY Charadriidae				
42	Red-wattled Lapwing	<i>Vanellus indicus</i>	R	LC
FAMILY Scolopacidae				
43	Common Sandpiper	<i>Actitis hypoleucos</i>	LM	LC
FAMILY Recurvirostridae				
44	Black-winged Stilt	<i>Himantopus himantopus</i>	R	LC
ORDER COLUMBIFORMES				
FAMILY Pteroclididae				
45	Chestnut-bellied Sandgrouse	<i>Pterocles exustus</i>	R	LC
FAMILY Columbidae				
46	Eurasian Collared-Dove	<i>Streptopelia decaocto</i>	R	LC
47	Laughing Dove	<i>Spilopelia senegalensis</i>	R	LC
48	Rock Dove	<i>Columba livia</i>	R	LC
ORDER STRIGIFORMES				
FAMILY Strigidae				
49	Spotted Owlet	<i>Athene brama</i>	R	LC
ORDER CORACIIFORMES				
FAMILY Alcedinidae				
50	White-throated Kingfisher	<i>Halcyon gularis</i>	R	LC
FAMILY Meropidae				
51	Asian Green Bee-eater	<i>Merops orientalis</i>	R	LC
FAMILY Coraciidae				
52	Indian Roller	<i>Coracias benghalensis</i>	R	LC
FAMILY Upupidae				
53	Eurasian Hoopoe	<i>Upupa epops</i>	R	LC
ORDER PICIFORMES				
FAMILY Picidae				
54	Eurasian Wryneck	<i>Jynx torquilla</i>	M	LC
ORDER PASSERIFORMES				
FAMILY Alaudidae				
55	Black-crowned Sparrow-Lark	<i>Eremopterix nigriceps</i>	R	LC
56	Crested Lark	<i>Galerida cristata</i>	R	LC
57	Greater Short-toed Lark	<i>Calandrella brachydactyla</i>	M	LC
58	Rufous-tailed Lark	<i>Ammomanes phoenicura</i>	R	LC
FAMILY Hirundinidae				
59	Barn Swallow	<i>Hirundo rustica</i>	R	LC

Sr. No.	Common name	Scientific name	Migratory status	IUCN status
FAMILY Motacillidae				
60	Citrine Wagtail	<i>Motacilla citreola</i>	LM	LC
61	White Wagtail	<i>Motacilla alba</i>	M	LC
62	Tawny Pipit	<i>Anthus campestris</i>	M	LC
FAMILY Pycnonotidae				
63	Red-vented Bulbul	<i>Pycnonotus cafer</i>	R	LC
64	White-eared Bulbul	<i>Pycnonotus leucotis</i>	R	LC
FAMILY Laniidae				
65	Bay-backed Shrike	<i>Lanius vittatus</i>	R	LC
66	Great Gray Shrike	<i>Lanius excubitor</i>	R	LC
FAMILY Muscicapidae				
67	White-browed Bushchat	<i>Saxicola macrorhynchus</i>	R	VU
68	Pied Bushchat	<i>Saxicola caprata</i>	R	LC
69	Common Stonechat	<i>Saxicola torquatus</i>	R	LC
70	Common Babbler	<i>Argya caudata</i>	R	LC
71	Brown Rock Chat	<i>Oenanthe fusca</i>	R	LC
72	Common Tailorbird	<i>Orthotomus sutorius</i>	R	LC
73	Lesser Whitethroat	<i>Sylvia curruca</i>	M	LC
74	Plain Prinia	<i>Prinia inornata</i>	R	LC
75	Red-breasted Flycatcher	<i>Ficedula parva</i>	M	LC
76	White-browed Fantail	<i>Rhipidura aureola</i>	R	LC
FAMILY Certhiidae				
77	Purple Sunbird	<i>Cinnyris asiaticus</i>	R	LC
FAMILY Passeridae				
78	House Sparrow	<i>Passer domesticus</i>	R	LC
79	Yellow-throated Sparrow	<i>Gymnoris superciliaris</i>	R	LC
80	Common Myna	<i>Acridotheres tristis</i>	R	LC
81	Brahminy Starling	<i>Sturnia pagodarum</i>	R	LC
82	Rosy Starling	<i>Pastor roseus</i>	R	LC
FAMILY Dicruridae				
83	Black Drongo	<i>Dicrurus macrocercus</i>	R	LC
FAMILY Corvidae				
84	Common Raven	<i>Corvus corax</i>	LM	LC
85	House Crow	<i>Corvus splendens</i>	R	LC
86	Rufous Treepie	<i>Dendrocitta vagabunda</i>	R	LC

Annexure XI) Mammalian fauna observed in PFFR

Sr. No.	Common name of the species	Scientific name	Wildlife (Protection) Act, 1972 Schedule
1.	Chinkara	<i>Gazella bennettii</i>	Schedule I
2.	Nilgai	<i>Boselaphus tragocamelus</i>	Schedule III
3.	Desert Fox or Red Fox	<i>Vulpes vulpes pusilla</i>	Schedule I
4.	Indian Fox	<i>Vulpes bengalensis</i>	Schedule II
5.	Indian Long-eared Hedgehog	<i>Hemiechinus auritus</i>	Schedule IV
6.	Asiatic Wildcat	<i>Felis lybica ornata</i>	Schedule I
7.	Indian Grey Mongoose	<i>Herpestes edwardsi</i>	Schedule II
8.	Wild Boar	<i>Sus scrofa</i>	Schedule III
9.	Indian Desert Jird	<i>Meriones hurrianae</i>	Schedule IV

Annexure XII) - List of mammals seen in Deg Rai Mata Oran

Sr. No.	Common name of the species	Scientific name	Schedule according to Wildlife (Protection) Act, 1972
1.	Chinkara	<i>Gazella bennettii</i>	Schedule I
2.	Nilgai	<i>Boselaphus tragocamelus</i>	Schedule III
3.	Indian Desert Fox	<i>Vulpes vulpes pusilla</i>	Schedule I
4.	Indian Long-eared Hedgehog	<i>Hemiechinus collaris</i>	Schedule IV
5.	Indian Desert Jird	<i>Meriones hurrianae</i>	Schedule IV



Thar Desert is a home to many threatened species including Critically Endangered Great Indian Bustard (sketch by Sushmita Karmakar)



GIB male walking majestically in PFFR © Ashley Chiu