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The Perilous Plight of Great Indian Bustard (*Ardeotis nigriceps*) in the Thar Desert of Rajasthan

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Abstract This paper summarizes the population dynamics and distribution of the Great Indian Bustard (*Ardeotis nigriceps*), in the Thar Desert of Rajasthan from 2018 to 2020. The Scan and focal sampling along with the intensive seasonal survey methodology was adopted to assess the population dynamics and movement pattern of the state bird of Rajasthan. The entire study area is divided into 231 grids consisting of 3 blocks and covered using a transect of 3875.49 km, which helped systematic assessment of the Great Indian Bustard (GIB) population. A total of 54 potential grids for GIB has been identified based on the presence and absence of the species and associated habitat of the region. The authors had observed 42 distinct GIB individuals and a record sighting of 11 GIB in a flock at the Thar landscape of Rajasthan. This paper depicts the importance of seasonal migration, and land use utilization for GIB. Authors had also identified two distinct resident populations of GIB i.e. one each from the Khetoloi-Ramdevra belt and Sudashree-Chohani-Sipla belt. The paper had implicated the transboundary movement of this bird towards the Cholistan Desert of Pakistan and raises concern over the same.

Keywords: *Great Indian Bustard, population dynamics, Thar Desert, Rajasthan*

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1. Introduction

An easternmost extension of the Persian Arabian desert ecosystem the Great Indian Desert or Thar landscape lies on the western side of the Indian subcontinent [1]. The Thar Desert is known to constitute 2.12% of total Indian fauna constituting eight threatened avifauna *viz. Pavo cristatus* (Indian Peafowl), *Galloperdix lunulata* (Painted Spurfowl), *Grus virgo* (Demoiselle crane), *Grus grus* (Common crane), *Chlamydotis undulata* (Houbara bustard/ Macqueen's bustard), *Cursorius cursor* (Cream-coloured Courser), *Saxicola macrorhyncha* (Stoliczka's Bushchat) along with *Ardeotis nigriceps* (Great Indian Bustard) [2]. Great Indian Bustard (GIB) is an endemic bird to the Indian subcontinent [3] now mostly confining itself in the grasslands of the Thar desert. It was given the highest priority status for conservation in India and categorized as schedule I species according to Wildlife Protection Act (1972), Appendix I as per CITES, and critically endangered species as in IUCN red list of species [4,5]. [4] mentioned in their study that according to the Forest Department, Government of Rajasthan, the Bustard population has been marginally increased in due course of time. Contradicting [4], [3] mentioned in his study that GIB has lost its former distribution range and 80% of its population in the last 50 years and these declines have been reported from all regions of its present range. Being lost from its former habitats it has been observed that GIB now only survives in the fewer pockets of Desert National park including in-situ protected enclosures and a few other habitats that are particularly providing undisturbed roosting and feeding sites. A few disturbed habitats like agricultural areas and fallow lands (Orans) are also known to accommodate GIB owing to the provision of good feeding and roosting habitat in winter seasons. [6] have mentioned that this bird prefers arid and semi-arid grasslands and generally doesn't favor agricultural land. This bird is extremely cautious and secretive at all times [7]. GIB once has a stronghold in the Deccan peninsula and the Thar Desert now confines only in a handful of pockets of India like Rajasthan, Gujarat, Maharashtra, Madhya Pradesh, Andhra Pradesh, and Karnataka [4]. The major contribution for assessment of population status of GIB was recorded by [8,9]. The last three decades have been worst for the GIB if considered in terms of occupancy and range of the species [10]. Habitat change due to modified land use pattern is another serious cause that sparked the need for "Project Bustard". [11] defined the necessity of "Project Bustard" to conserve four bustard species in India and their habitat and bring back GIB from extinction. He also recommended adapting grassland conservation with National Grazing Policy. The GIB is a key species for the grasslands of India. It is observed that the magnificent Great Indian Bustard is

maintaining integrity in the grasslands and saving thousands of other small mammals and reptiles and other avian species surviving in these arid grasslands. [11] also stated that conservation of bustard will act as an umbrella to save other species dependent on the same grassland. This paper aims not only to state record sightings but shows concern over saving this beastly gentle bird. "Project Bustard" was launched by the Government of Rajasthan on June 5, 2013. In due course, GIB has declined in forest/open areas of the Western Rajasthan. This decline is mainly caused due to habitat alteration by IGNP and other threats like anthropogenic pressure, loss of breeding sites, rapid urbanization, Powerlines & windmills, agricultural expansion, and road casualties [6,12]. Therefore, ex-situ conservation and breeding center were the need of the hour. Due to the positive implication of "Project Bustard", a breeding center was started at Sam, Jaiselmer. Another incubation center will be opening on the Ramdevra enclosure and is currently under construction. The incubation center is a joint venture of the Forest Department, Government of Rajasthan, MOEFCC (Government of India), and Wildlife Institute of India. The government of Rajasthan, India is trying hard to bring back its state bird alive, from the path of extinction since the launch of "Project Bustard".

2. Study Area

The study was carried out in the Thar Desert extending from 22°30' N and 32°05' N latitudes and 68°05' E to 75°45' E longitudes and surrounding environments with an elevation range from 350-450 m ASL. The desert Landscape surrounds an area of about 2,25,680 km^2. Here exists scorching heat and average temperature and can reach up to a whopping 50◦C in summer. This region receives scanty and erratic precipitation of 100mm. The relative humidity of the region can drop about zero. This region is dominated by scrubs and grasslands and generally devoid of large tree species. A few tree species of the region are *Prosopis cineraria*, *Salvadora persica*, and *Acacia senegal* etc. The scrubland of this region is dominated by shrub species like *Capparis decidua*, *Zizyphus mauritiana*, *Aerva javanica*, *calligonum polygonoides*, *Leptadenia pyrotechnica*, etc. and grasslands are dominated by *Crotalaria*, *Sewan (Lasiurus scindicus)*, and *Fagonia Arabica*, etc. The Thar landscape is diverse in terms of faunal species too and offered us nature's most unique flora like the desert cat (*Felis sylvetris*), desert fox (*Vulpes vulpes pusilla*), Indian Fox (*Vulpes bengalensis*), Indian gazelle (*Gazella bennettii*), blue bull (*Boselaphus tragocamelus*), and wild boar (*Sus scrofa*).

3. Methodology

Road transect-based grid sampling method was adopted for the study. The total landscape was divided into major grids (12x12 km^2) and minor grids (interrupted by the boundary region). The survey was conducted in two phases. The first phase is a road or line transect using a four/two-wheel drive and the second phase is an intensive survey, conducted on extracted potential grids from the first phase by both walking and vehicular transect. The field duration was between 5 AM to 11 AM and 3 PM to 6:30 PM. The scan and focal sampling method [13] were adopted to record population information. Bushnell binoculars (8x42mm), Canon 700 D camera with lens 55-300 mm, Global Positing System (GARMIN Oregon 650), and Range finder (Bushnell NITRO, 6x20mm) are used as field equipment. GPS data from the field are extracted using Garmin Base camp software and converted using ArcGIS (10.8) toolbox. Processed tracks and data from GPS will be used in extracting locational information and used for delineating GIB habitat. Delineated habitats can be visualized using Google Earth software. Questioner survey serves as an important tool for the social survey and gaining knowledge from local inhabitants to delineate sighting information of majestic Great Indian Bustard.

4. Result and Discussion

A total of the landscape area 31440.77 km^2 has been divided into 231 major grids and minor grids. These grids are divided into 3 blocks i.e. DNP block, IGNP block, and Pokaran Block (Figure 1). DNP block is extended over an area of 9637.79 km^2 with 67 grids (Figure 2). Similarly, the IGNP block has an area of 14694.49 sq. km with 112 grids and the Pokaran block has an area of 7108.49 km^2 with 54 grids (Figure 3, Figure 4). These grids are extensively surveyed using road/line transect covering 3875.49 km. During the survey, the presence and absence of GIB and associated vegetation criteria were used for delineating 54 potential grids with an area of 7388.09 km^2 (Figure 5). Despite being only 19 potential grids, the DNP block has the highest concentration of GIB and forest enclosures. IGNP block being the largest has 34 potential grids and the Pokaran block has only one potential grid. Along with these potential grids, special focus is also laid on all 72 in-situ forest enclosures for the conservation of GIB. The forest enclosures are characterized by wired fences laid by the forest department of Rajasthan over a large area and are under constant surveillance by the forest guards of the region. Out of 72 enclosures, 40 are of prime location for GIB. Among the Forty, Sudashree, Chouhani, Sipla enclosure, Gajaimata, Chelasar Nadi, Digga Magra, Kanoi, and Ramdevra enclosures of DNP serve as a good roosting and feeding habitat for the GIB. Sudashree, Chouhani, and Sipla enclosures are the roosting and feeding paradise for Great Indian Bustard and are known to congregate large groups of GIB over time. We had sighted about 42 distinct GIBs during the field survey (Table 1). Out of these, 22 were sighted in these three enclosures. Along with these enclosures, agricultural lands of Karya Magri, Chouhani village and Sipla, and orans like Nath Ji Ka Tanka, and Khetoloi are the sites of utmost importance for the long-term survival of GIB. Over the study duration, 17 GIB's are recorded from these regions. Different sighting locations for GIB in our study area were demonstrated (Figure 5) along with a record sighting of 11 GIB (Figure 6) in the Sudashree enclosure during the winter of January. GIB sighting can also vary according to the season. We have carried out an intensive survey on a

seasonal basis. Out of total sighting, 10 % of GIB were sighted in Summer and the rest in winter (Figure 7). Thus, GIB can be best sighted during the Winter season in the Thar landscape.

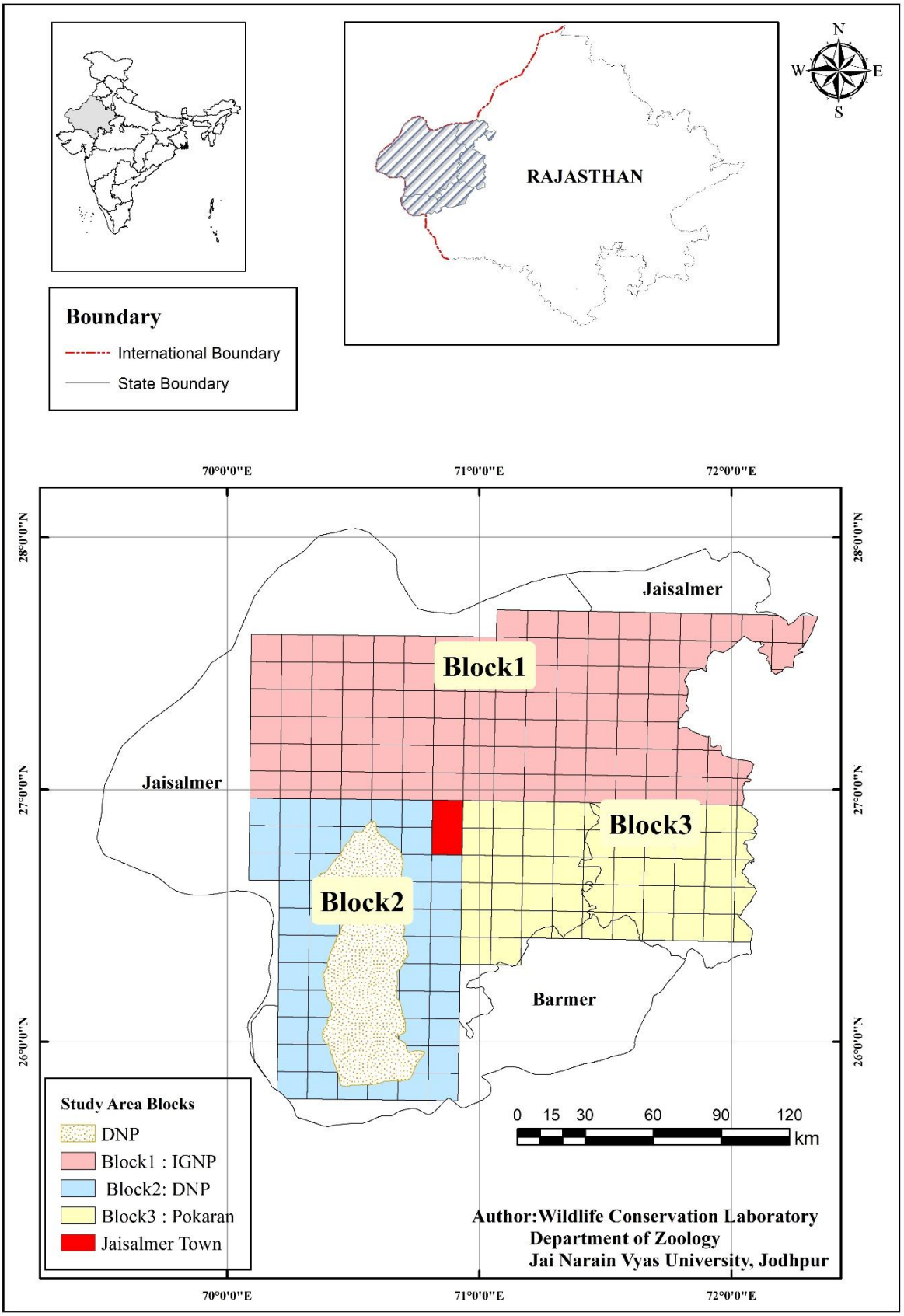

Figure 1. Study Area

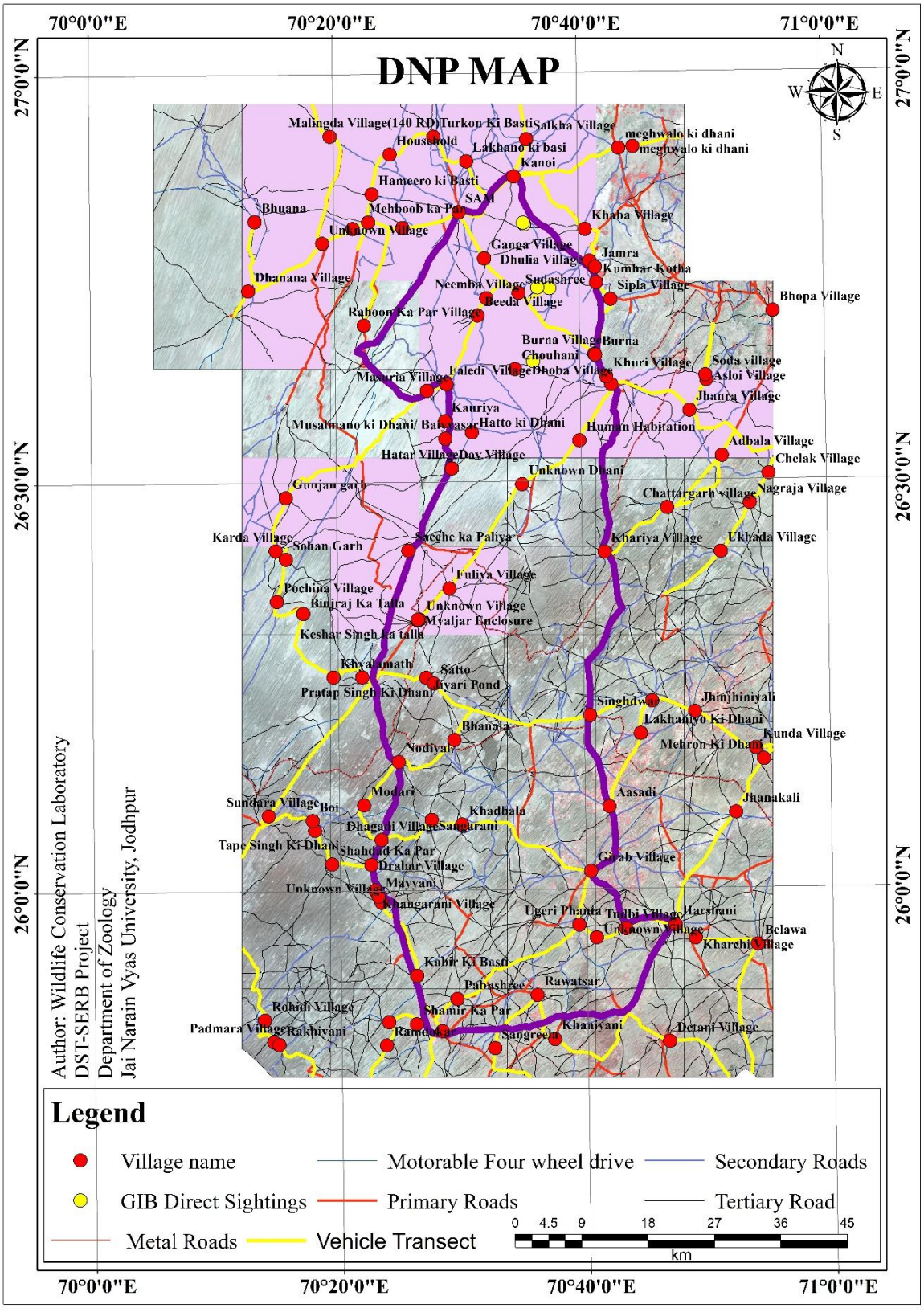

Figure 2. DNP Block with Potential Grid and Transect

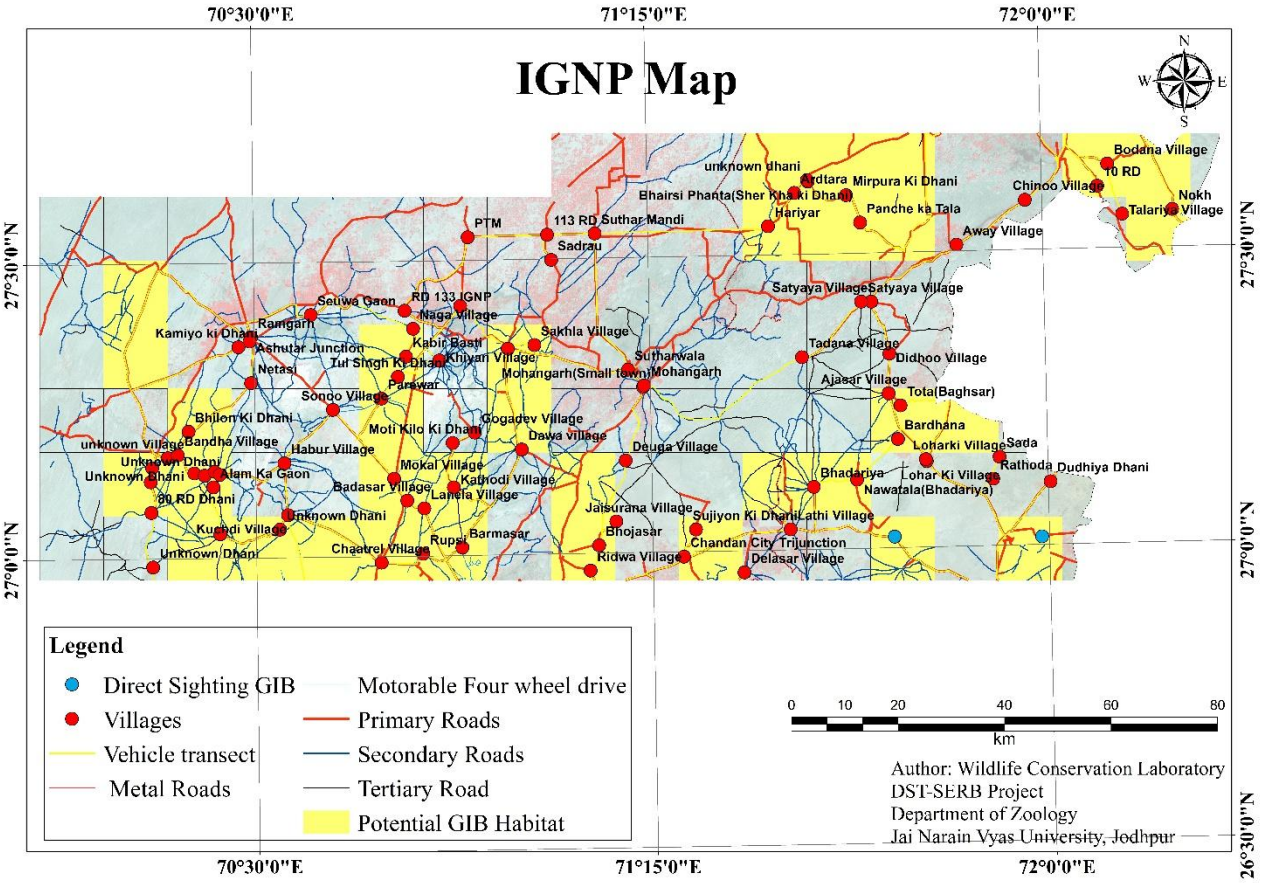

Figure 3. IGNP Block with Potential Grid and Transect

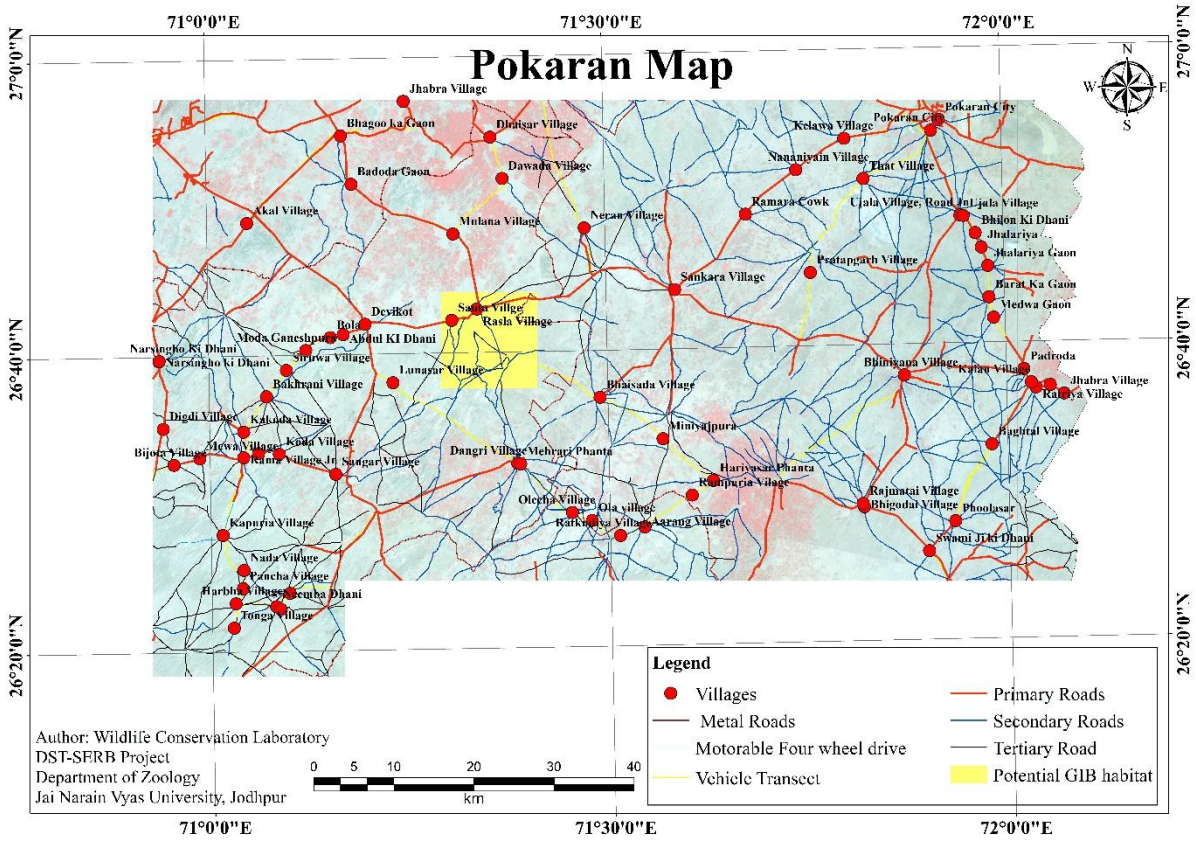

Figure 4. Pokaran Block with Potential Grid and Transect

Table 1. Distribution patterns of Great Indian Bustard in the Thar Desert

Serial Number	Name of the place	Number of Individual	Habitat		Season	
			Enclosure (+/-)	Others	Summer (+/-)	Winter (+/-)
1	Gajoimata	02	+		-	+
2	Sudashree	11	+		-	+
3	Khetoloi	01	-	Oran	-	+
4	Chouhani	02	+		-	+
5	Chouhani	02	+		-	+
6	Ramdevra	03	+		-	+
7	Karya Magri	03	-	Agriculture	+	-
8	Nagadodiya	01	+		+	-
9	Khetoloi	05	-	Oran	-	+
10	Sudashree	04	+		-	+
11	Chouhani	03	-	Oran	-	+
12	Sipla	05	-	Agriculture	-	+

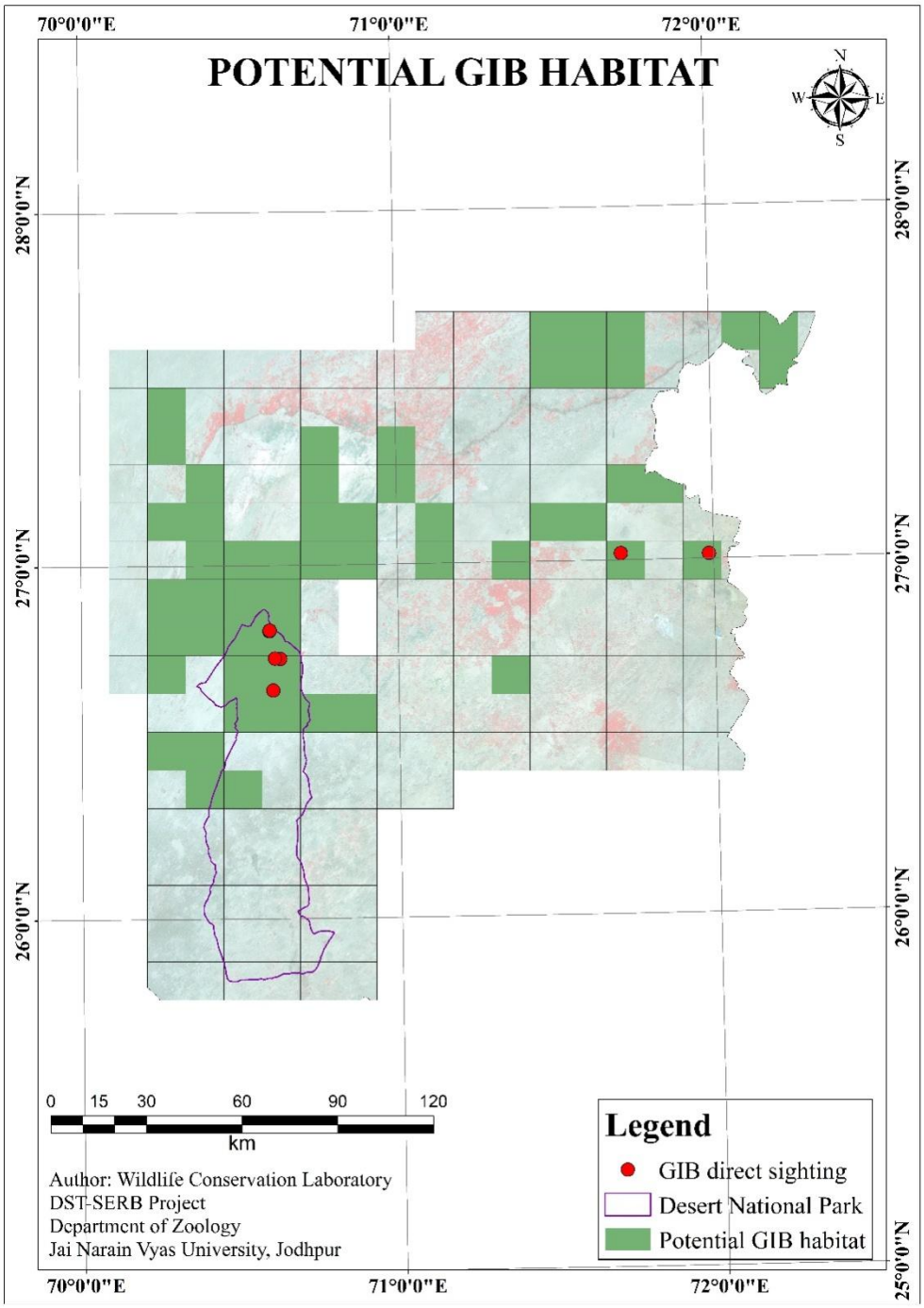

Figure 5. Sighting Locations GIB with potential habitat

Figure 6. Record sighting of GIB from Sudashree Enclosure (7 captured in the photograph)

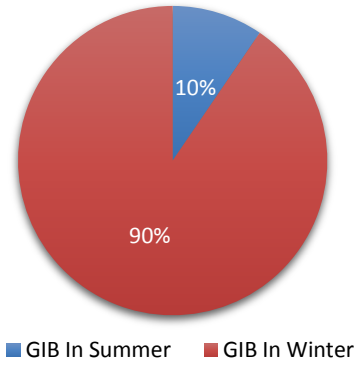

Figure 7. Comparative assessment of Seasonal Sighting

GIB is an endemic species of the Thar landscape along with both location and sighting information, understanding local migration pattern is key for the survival of this state bird of Rajasthan. The two distinct belts *i.e.* the Khetoloi-Ramdevra and Sudashree-Chouhani-Sipla accommodate the maximum resident GIB. The Khetoloi-Ramdevra belt accommodates maximum GIB in Winter because dominant vegetation of the region *Ziziphus nummularia* starts fruiting. During Summer, the same birds move towards the firing ranges of Indian Armed Force at Khetoloi, Lathi, and Chandan in search of safe breeding ground. The Sudashree-Chouhani-Sipla belt are already covered under the protected region as forest enclosure. The birds move towards these places in Winter having lush desert grassland of Sewan (*Lasiurus scindicus*), interspersed by shrub and tree species like Phog (*Calligonum polygonoides*) and Ker (*Capparis decidua*). During Summer, these GIB's either make a move towards the Shahgarh region and the Cholistan region, a transboundary movement in search of undisturbed habitat. It is also observed that during the first quarter of the year this bird feeds at the agricultural field of Karya Magri, Chouhani, and Sipla Village. During survey we recorded 4 episode of mating display of this species in the agricultural field as well as our questioner survey implicates these birds are moving towards any agricultural fields in the vicinity of Desert National Park and shows some amazing mating display.

Along with the Great Indian Bustard, we sighted a diverse array of vertebral fauna in the Thar landscape (Figure 8, Figure 9 & Figure 10). DNP block has the highest Great Indian Bustard sighting due to the presence of protected enclosures and continuous monitoring by forest guards. The Pokaran block has no GIB sighting due to the dense human population and aggressive urbanization. The Indira Gandhi Nahar Paryojana (IGNP) brought rapid change in the landuse causing a decline in the number of GIB due to the expansion of agricultural activities. IGNP block had 9 GIB sightings along with a good number of Vulture, and Demoiselle crane. DNP block also shows a huge vulture population along with a good number of iconic Indian Gazelle. Desert cat, Indian fox, Desert fox are some mesmerizing fauna that can also be observed in this region. The Pokaran block although densest of all blocks shows a good thriving population of Peafowl and Vulture.

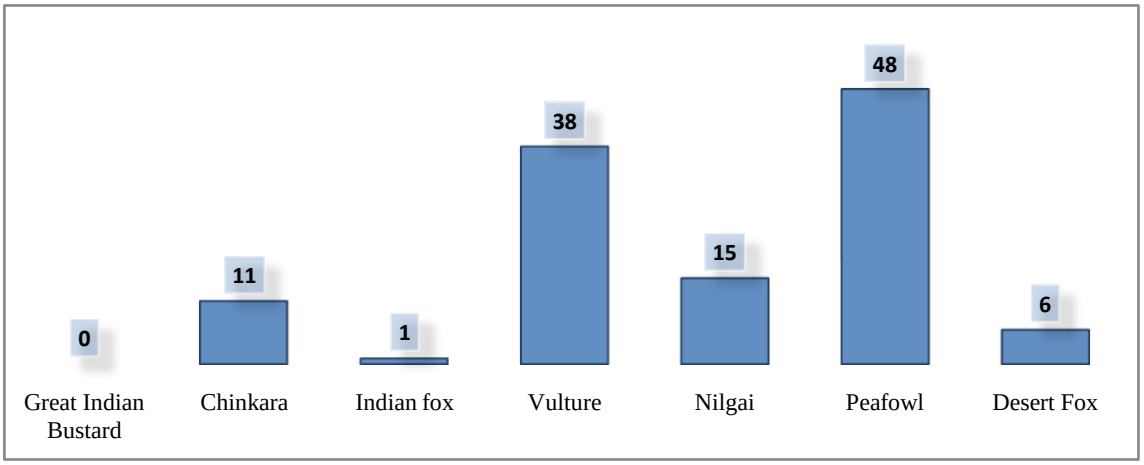

Figure 8. Recorded wild fauna in Pokaran Block

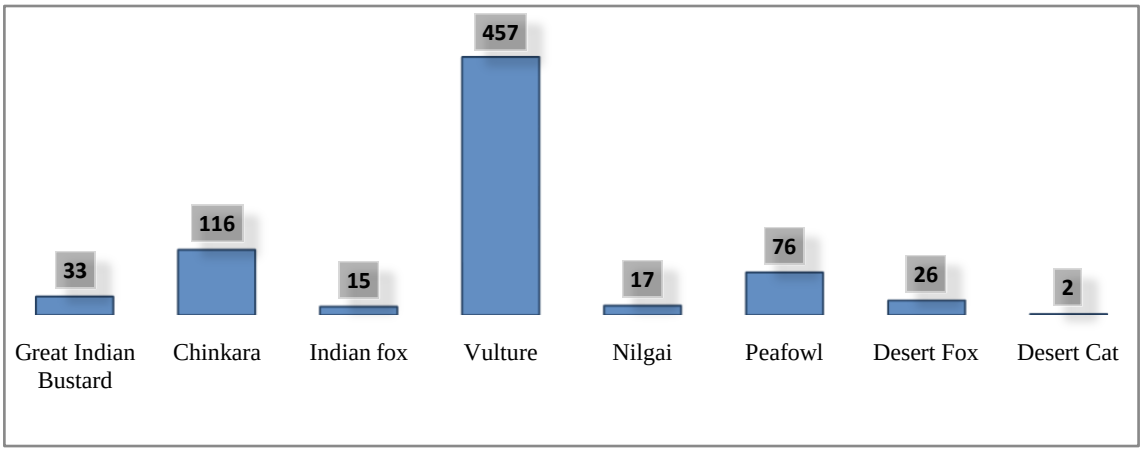

Figure 9. Recorded wild fauna in DNP Block

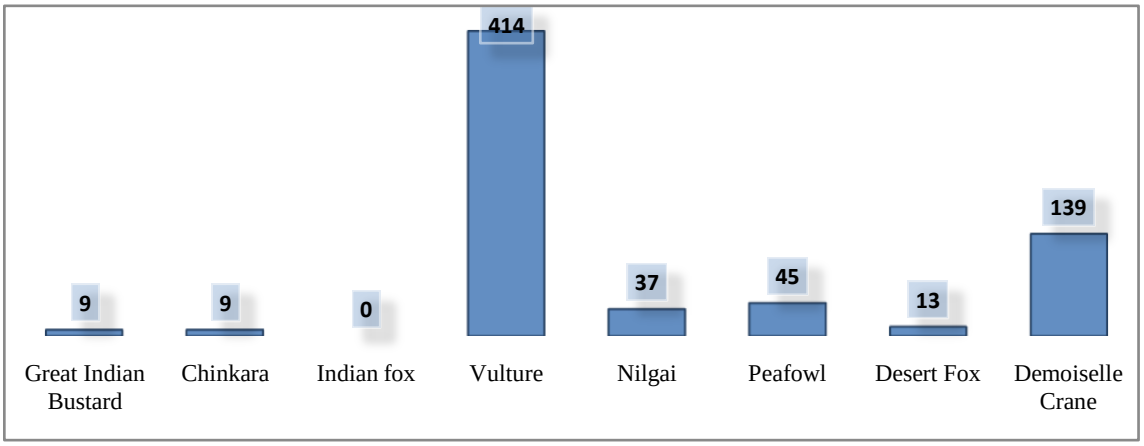

Figure 10. Recorded wild fauna in IGNP Block

[4] has also mentioned such good record of GIB sightings up to 2007, which shows with an average flock size of GIB, is almost equal to 12, and the largest groups of GIB were seen in the year of 1993 and 2007 with a flock size of 33 and 31 respectively since 1981. While from 2007 to 2020, there was no record of sighting such a large flock size of GIB in the desert landscape. The Sudashree is one of such enclosures that believe to concentrate large groups of GIB over time. As stated by [14] the Sudashree enclosure is considered the heaven for GIB. [4] mentioned out of 35 total sightings initiating from the year 1981 till 2007, 21 record sightings were from the winter season, 8 were from summer, and 4 were from the monsoon. [9] has recorded a minimum of 38, 40, and 37 distinct GIBs during their extensive survey in 2014, 2015, and 2016 respectively. Similarly, [15] said that the flocks of 20 GIB's in the grasslands of India are a common sight in the 19th century, but even three to sight are rarest nowadays. The transboundary movement also shows a huge concern. [16] had mentioned that from 2001 to 2004, 49 out of 63 GIB sighted were killed in the Cholistan region, Pakistan. [17,18] had noted a thriving population of 1260 GIB in the western region of India which has drastically declined almost by half in two decades. Worsening the scenario, the population further declined to 600 in 2001 [19] while, the Thar Desert holds about 83 % of total population of Chinkara along with many unique birds [20]. The worst GIB population status of 100-125 had recorded by [10]. Slightly different population status GIB had been recorded by the Forest department of Rajasthan from 1993 to 2010. The numbers are continuously increasing from lowest 39 in 1995 and highest 110 in 2004.

5. Conclusion

Great Indian Bustard being a critically endangered bird according to the IUCN red list found majorly in the isolated pockets of the Sudashree-Chouhani-Sipla belt and Ketoloi-Ramdevra belt in the Thar Desert Landscape of Rajasthan. The Thar desert holds the major population of GIB in the country which is facing threats for survival. It needs more proper monitoring and better conservation strategies for its population to bloom again. Conservation priority zone and the inclusion of villagers can bring a positive transformation in the population of the species. Desert regions being harsh need a larger workforce for the conservation of species. If possible, the collaboration of diplomatic forces from India and Pakistan through transboundary cooperation for the protection of this gentle beastly bird as well other desert wildlife will be helpful for its survival in the long run.

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