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Threat for the survival of wildlife in and around the Desert National Park of Rajasthan

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ABSTRACT

Study was conducted in Desert National Park and its peripheral areas in western Rajasthan to assess threats and conservation problems for the survival of wildlife species from June 2023 to May 2025. Study was conducted with the help of line transect, road transect, direct observation, random opportunistic sampling methods, and schedule survey methods to assess major threats to wildlife survival. Numerous anthropogenic activities, such as illegal grazing, framing, agricultural activity in protected areas, poaching, hunting, disturbance and collection of plant-based products have been observed. Additionally, the replacement of wooden or thorn fencing with iron net fencing also affects the survival of several wildlife species, especially large body-sized animals. Furthermore, Iron net fencing acts as a trapping net and barrier for species movement from one area to adjoining area, as well as reduces habitat availability for cryptic and burrow-dwelling wildlife. Another threat in this region is that the rapidly growing free-ranging dogs pose a substantial threat to wildlife survival. Rapid expansion of liner infrastructure, such as roads, state, and national highways in the western Thar Desert region, has largely contributed to the increasing incidence of wildlife mortality. Water shortages in desert regions pose significant challenges for wildlife survival, affecting various aspects such as the daily need for water intake. Installation of wind turbines and high-tension electric power lines throughout desert regions are largely responsible for the death of numerous bird species. Extensive networks of Indra Gandhi Nahar Pariyojna (IGNP) desert regions have rapidly converted desert areas into agricultural and farmland habitats. Invasion by exotic species significantly affects the habitat characteristics of desert ecosystems.

INTRODUCTION

Currently, the human population is rapidly increasing globally. Due to the fulfilment of daily basis needs, natural resources are exploited at a very fast rate. Due to increasing human demands and dependency on natural resources, they exert negative impacts on ecosystems and wildlife survival (Gaynor *et al.*, 2018; Corlett *et al.*, 2020). Rapid exploitation of natural resources has caused a variety of threats to forest habitats and has affected the survival of different wildlife species. Rapid exploitation of natural resources leads to changes in land use patterns, habitat loss and fragmentation and increased pollution in ecosystems (Lior, 2008; Wilson, 2016).

Rapid establishment of human-dominated areas, likes cities, colonies and industries, and linear infrastructure, such as roads, highways, railway lines, electric power lines, wind turbines and other activities, such as the extraction of natural products from forest areas, pose a significant threat to the survival of different wildlife species and their populations (De Lucas *et al.*, 2008; Miller *et al.*, 2014; Scanes, 2018; Rastandeh and Jarchow, 2021). For instance, wind turbines are largely responsible for the death of bird and bat populations in different regions of United States, Canada and other parts of the world (Kunz *et al.*, 2007; Arneet *et al.*, 2008; Loss *et al.*, 2013; Zimmerling and Francis, 2016; Roy *et al.*, 2025).

Wildlife mortality due to human-made structures and road-vehicle collisions are often linked to a decline in biodiversity due to the death of different animal taxa, including insects, amphibians, reptiles, birds and mammals in particular areas (Bhupathy *et al.*, 2011; Seshadri and Ganesh, 2011; Choudhary and Chishty, 2022a & 2024a; Sushanth *et al.*, 2025). Furthermore, establishment of roads, highways, railway lines, electric power lines and wind power stations has an indirect impact on wildlife survival by causing a variety of impacts, such as habitat fragmentation, electrocution, disturbance in migration routes pattern, and foraging patterns of different bird and bat species (Bhattacharya *et al.*, 2003; Jenkins *et al.*, 2010; Selven *et al.*, 2012; Degregorio *et al.*, 2014; Sur *et al.*, 2022). Furthermore, human-made structures can lead to direct and indirect impacts, such as habitat fragmentation and habitat loss, influencing animal behaviour and reducing space availability, which in turn lowers carrying capacities (Masden *et al.*, 2009; Pruett *et al.*, 2009). Furthermore, frequent human presence in natural habitats affects the habitat utilization patterns and behavioural responses of several wildlife species. Establishment of human structures in and around natural habitats and forest area also affects wildlife behaviour and survival (Slater and Smith, 2010; Marzano and Dandy, 2012; Hovick *et al.*, 2014). Nevertheless, the impact of human presence and its derived structures varies depending on the type and size of the animal

species (Lyon *et al.,* 2003; Pearce *et al.,* 2009; Harju *et al.,* 2010).

Understanding how anthropogenic disturbances can affect wildlife, particularly declining species, is essential for reducing future biodiversity loss and improving the success of conservation efforts. Therefore, the present study was carried out from January 2022 to June 2025 to assess the threat of wildlife survival in the desert national park (DNP) and its peripheral areas of the Western Desert area of Rajasthan.

Study area

Desert National Park (DNP) is a single protected area of western Rajasthan that supports a sustainable population of the critically endangered and state bird Great Indian Bustard (*Ardeotis nigriceps*) and a recently established breeding center of the Great Indian Bustard in the Jailsmer district in the Sundashri and Ramdevra regions (Jaipal and Gehlot, 2015). Furthermore, numerous wildlife species, including reptiles, birds, and mammals, inhabit these protected areas (Rahmani, 1989). Several unique reptilian species such as Spiny tailed Lizard, Desert monitor Lizard, Indian Monitor Lizards, Common Krait and Saw-scaled Viper also resides here. Additionally, more than 100 resident or migratory bird species also reside in this area, including eagles and vultures. Moreover, western Rajasthan, particularly the DNP area, comprises several mammalian species, including Indian Gazelle, Indian fox, desert fox, jungle, and desert cat (Sharma, 2017). Due to arid and sandy soil conditions, Desert National Park experiences significant variation across the temperature, which can rise up to 51 °C in summer and drop in winter up to 0 °C. Furthermore, the desert region receives a small amount of rainfall (less than 250 mm) during the rainy season. During summer, wind speeds can reach up to 125 km/h, with the highest velocities typically recorded in May and June and the lowest in December.

Material and Methods

Study was conducted from June 2023 to May 2025 in and around desert national parks, including the Barmer and Jailsmer districts of Western Rajasthan. Field visits were carried out using line transects, road transects, and direct observation methods during different seasons in study area. Furthermore, direct observation and random opportunistic sampling methods were adopted to assess the mortality of wild animal species, including reptiles, birds, and mammals due to road-vehicle collisions and electrocutions. Wildlife species were identified using a standard field guide *viz.*, Reptiles of Rajasthan (Gupta, 2017), Reptiles of India (Das and Das, 2017), Birds of Rajasthan (Vyas, 2014) and Mammals of India (Grewal and Chakravarty, 2017). A Schedule survey was also conducted to collect information related to illegal wildlife hunting, grazing and framing activities in the study area. Photographs of animals, habitat, and threats related to survival were taken using a Nikon P1000 camera. However, during entire study period, no live or dead animals and their parts were collected for the collection purpose. All observations related to wild animals were taken from a safe distance without disturbing the animals or their habitat. During study, all rules and regulations carefully follow as mentioned in the Wildlife Protection Act 1972, as well as those mentioned in the forest permission letter.

Results and Discussion

I. Anthropogenic pressures in Desert region

Illegal grazing and farming activities pose a significant threat to the survival of wildlife and destroy the natural habitats in this region. During study it was found that the cultivation of Jeera (*Cuminum cyminum*), Isabgoal (*Psyllium h*usk) in winter season while Bajra (*Pennisetum glaucum*) and Guar (*Cyamopsis tetragonoloba*) in monsoon season, illegally grow in forest land of the protected area of Desert National Park in the Jaisalmer and Barmer district. Farming activities, such as growing crops, not only have a direct impact on nesting areas but also alter the surrounding environment, which can affect food supply and the dynamics between predators and their prey. Effects of these agricultural methods go beyond just the immediate loss of habitats. Furthermore, livestock holders damage enclosure fencing and enter cattle for grazing (Figure 1). These practices reduce the foraging and feeding grounds of herbivores in the Thar Desert. Furthermore, frequent grazing by cattle also poses a risk of trampling eggs of ground nesting birds, including the Great Indian bustard, Indian peafowl, Grey Francolin, quails and sand grouse. Various tribal and traditional hunting communities also reside in desert areas, including the Barmer and Jaisalmer. These communities are nomadic, traversing the desert terrain and mainly hunting Indian Gazelle, Desert fox, Indian Monitor Lizards, Spiny-tailed Lizard and several bird species including Sand grouse and Francolin.

According to a schedule survey with local people and villages in the peripheral region of desert national parks, hunting practices of above-mentioned species are still occurs. During schedule survey, it was found that the mainly Indian Gazelle (*Gazella bennettii*), Desert fox (*Vulpes vulpes pusilla*), Spiny-tailed Lizard (Sanda) (*Uromastyx aegyptia*) and Grey francolin *(Ortygornis pondicerianus*) are main target species of hunter groups in these regions. Desert areas, especially Sam Sand dunes Jaisalmer, are favorite places for national and international tourists, especially during the winter season. Numerous visitors visited the Sam sand dunes and surrounding areas during the winter (Islam and Rahmani, 2011). However, uncontrolled tourism activities, such as movement in forest areas, cooking of foods, jeep riding and dumping of waste material, also degrade the habitat quality of these regions.

During the New Year and the desert festival celebration, as well as the organization of night cultural programs by hostlers and resorts of Sam sand dunes also cause light and sound pollution. Movement and activity pattern of nocturnal wildlife species are also affected due sound and light pollution. During field visits, it was found that numerous people were involved in artificial food provision for wildlife species, including Indian Gazelle (*Gazella bennettii*) and Indian Peafowl (*Pavo cristatus*). Artificial food-provisioning particles change the feeding behavior of these animals. Furthermore, the collection of firewood and plant products from forest areas also degrades the habitat quality of desert ecosystems. Canal system is a significant factor in Chinkara (Indian Gazelle) fatalities, as it is unable to escape once it falls. Additionally, open water holes, known locally as "tanka," sometimes contribute to Lizard, Fox, Snake and Chinkaras' deaths due to falling in these open structures (Chishty *et al.,* 2021).

II. Iron net fencing

In the past decades, people have constructed wooden and thorn fencing with the help of dried parts of plants around the agricultural field to provide suitable shelter, roosting and nesting habitats for several wildlife species, including reptiles, aves and mammals. However, the currently establishment of iron wire fencing around agricultural land areas as well as road site areas also acts as a barrier and death network for the survival of wildlife species, especially for large-sized birds and mammals.

During study, it was found that mammalian species, including Indian Gazelle (*Gazella bennettii*), Desert Hare (*Lepus tibetanus*), Bluebull (*Boselaphus tragocamelus*) and Wild Boar (*Sus scrofa*) are frequently trapped in iron nets or wire fencing. At trapping time, these species have a higher risk of predation by feral or free-ranging dogs. Moreover, iron fencing reduced habitat availability for surviving cryptic and burrow-dwelling wildlife species. Numerous birds, including francolin, peafowls, quail, house sparrows and bulbuls, utilize wooden and thorn fencing for the nesting sites (Gehlot *et al.,* 2025); however, replacement of these traditional thorns fencing with iron net fencing ultimately reduces the breeding habitat for several species. Chishty *et al.* (2021) also observed that the installation of iron net fencing surrounding the agricultural landscape negatively influenced survival of Indian Gazelle in the Barmer district, Rajasthan.

III. Free-ranging or feral dogs

Free-ranging or feral dog populations are rapidly growing worldwide owing to their high reproductive rates. This increase also occurs in India and leads to significant ecological concerns, affects human health, and is responsible for the decline of several wild species. A significant abundance of dogs poses a substantial threat to wildlife survival, particularly affecting herbivore, reptile and bird species (Figure 2). Impact of feral fog on the population of birds and mammalian taxa, including Indian Gazelle, has also been observed in the state (Chishty *et al.,*

2021; Choudhary and Chishty, 2022 b& 2024b). Based on direct and indirect evidence, such as dogs directly feeding on carcasses of wild animals, chasing with ungulates as well as questionnaire surveys indicate that dogs predominately kill numerous wild species, including Indian Peafowl, Chinkara, Desert hare and sometime Desert fox also. These conditions indicate a broader issue of dogs in desert areas and significantly influence the survival of wildlife.

IV. Habitat fragmentation and alteration

Rapid expansion of liner infrastructure such as roads, state and national highways in the western Thar Desert region has largely contributed to increasing incidence of wildlife mortality, including amphibians, reptiles, birds and mammalian species (Figure 3). As these road networks expand and are established, they often intersect or fragment with natural habitats and affect the movement of wildlife from one area to another. Numerous vertebrate species are vulnerable to collision with fast-moving vehicles. Increasing incidence of road-vehicle collisions in wildlife not only impacts the survival of these species and population dynamics, but also disrupts the local ecosystem. Furthermore, establishment of railway networks and IGNP canals breaks large intake areas into fragmented habitats and restricts movement from one place to another place of wildlife. Habitat fragmentation due to linear infrastructure development has a significant impact on ecosystem health and wildlife populations. This fragmentation can significantly affect the movement and population dynamics of animals. Species usually depend on large, uninterrupted territories that may experience small restricted ranges. Furthermore, habitat fragmentation leads to isolation of populations because of the breakage of large intake areas into smaller fragments due to establishment of roads, tracks and canals. Isolation of populations due to habitat fragmentation can lead to diminished gene flow between groups, potentially reducing genetic diversity and increasing species vulnerability to environmental changes and diseases (Forman *et al.,* 2003; Slabbekoorn and Ripmeester, 2008). Impact of roads on wildlife extends beyond habitat alteration, with direct mortality from vehicle collisions being a major concern (Choudhary and Chishty, 2024a). This mortality can have a severe impact on the population size of species that have low reproductive rates or already face other environmental pressures (Forman *et al.,* 2003; Oddone Aquino and Nkomo, 2021). Furthermore, presence of roads can create edge effects, altering the microclimates and vegetation patterns along roadsides, which may further influence species distribution and ecosystem functioning.

V. Lack of Adequate water supplies

Water shortages in desert regions pose significant challenges for wildlife survival, affecting various aspects such as the daily need of water intake. Lack of water availability directly impacts animal access to drinking water, leading to the drying of natural water bodies such as Talab, Nadi (Village Pond) and Tanka (Traditional water collection source) in desert areas during the summer season. Water scarcity accelerated cascade effects on wildlife communities, including habitat degradation through vegetation loss and diminished the availability of food resources for wildlife, especially for herbivores. Consequently, animals are forced to concentrate on limited water sources, intensify competition, and increase the risk of predation. Moreover, several times, animals fell into open water holes, water storage tanks, canals, and tanka to search for water. Because of the depth of these water storage structures, wild animals are unable to reach out, ultimately leading to the death of animals due to food starvation and water shortage. These challenges ultimately influence the survival of wildlife, affect predator-prey relationships and disrupt the delicate balance of desert ecosystems.

VI. Wind turbines and electric power lines

Installation of wind turbines and high-voltage electric power lines throughout desert regions are largely responsible for the death of numerous bird species, including the Great Indian Bustards, Vultures and other Raptors (Figure 4, 5). During entire period of study following species *viz.,* Egyptian Vulture, Black Kite, Black Shoulder Kite, Tawny Eagle and Steppe Eagle, Shikra, House Crow and Indian Peafowl carcass was found along the wind turbines areas as well as electric power lines. Furthermore, flight movements of numerous bird species were observed along these structures, possibly colloid with these structures during adverse climatic conditions. Observations indicated that the presence of wind turbines and high-voltage electric power lines significantly influenced the survival of large-sized birds, such as bustards, vultures, and other raptors.

VII. Changes in habitat across Thar Desert

Extensive network of IGNP (Indra Gandhi Nahar Pariyojna), entire desert regions have been rapidly converted desert area into agricultural and farmland area. Desert habitat rapidly transforms into greenery patches and habitats; they significantly alter the habitat conditions and composition of floral and faunal species in entire desert region along the IGNP. Furthermore, plantations of *Eucalyptus* and other invasive species along the IGNP also alter the habitat and ecology of entire desert ecosystem. Several unique species native to the desert ecosystem may become extinct in the near future due to these changes in habitat.

Invasion of exotic species such as *Prosopis juliflora*, *Acacia tortilis*, *Parthenium hysterophorous* significantly affect habitat characteristics features of desert ecosystem (Figure 6). These invasive floral species compete with the native desert floral species, particularly grasses and herbs. Desert region consisted significant population of several herbivore species including Indian Gazelle, Blue bull, Desert Hare and Wild boar, but due to rapid invasion and proliferation of *Prosopis juliflora*, *Acacia tortilis*, *Parthenium hysterophorous* significantly altered favorable habitat for these herbivore species. As these exotic species spread, they alter habitat composition and reduce the availability of foraging grounds for these herbivorous ungulate species.

Habitat alternation and degradation not only influenced herbivorous food resources but also affected their ability to find suitable shelters to maintain their natural behavior. Rapid invasion of these exotic plant species in the Thar Desert is creating an increasingly challenging environment for ungulate population, potentially leading to declining numbers and forcing animals to seek out new, potentially less suitable territories. Human activities continue to have a profound and often harmful impact on wildlife and their environments, leading to permanent alterations in natural ecosystems. These activities have far-reaching consequences, with many species at risk of local extinction due to the degradation and loss of their natural habitats. Reasons behind this decline are complex and interconnected, including overuse of resources, rapid urban growth, industrial development, encroachment by human settlements and introduction of invasive foreign species. Together, these pressures degrade habitat quality, upset the delicate balance of ecosystems, and threaten the survival of native plants and animals (Barnosky, 2008; Vignieri, 2014; Choudhary and Chishty, 2020).

VIII. Excessive use of pesticides

Recently, excessive use of pesticides and insecticides in agricultural areas has posed a threat to wildlife survival, with impacts ranging from direct toxicity to complex ecological distributions. Chemical composition of pesticides and insecticides can cause immediate mortality in non-target species from invertebrates, such as butterflies, to vertebrates, including mammals, and lead to long-term health issues through bioaccumulation in the food chain (Gonzalez-Rodriguez *et al.,* 2011; Singh *et al.,* 2022; Ray and Shaju, 2023). These effects extend beyond particular members of species or organisms, altering habitat and declining abundance of food sources and sometimes also affecting the reproductive processes of organisms (Saif *et al.,* 2020; Hashimi *et al.,* 2020; Choudhary and Chishty, 2021; Poisson *et al.,* 2021). Pesticides can be particularly used for the control of insect populations, but they also cause the death of non-targeted insect species, which can affect the population of insectivorous species and pollinators, potentially triggering trophic cascades throughout the food chain and food web. Ecological impact of pesticides is further exacerbated by water contamination from agricultural runoff, which can affect the diversity and ecological conditions of aquatic ecosystems, weaken the animal immune system, alter

their behavior, and interrupt various biological and metabolic processes (Vyas, 1999; Berny, 2007; Agrawal *et al.*, 2010; Brain and Anderson, 2020). During the questionnaire survey and field visits, it was found that numerous types of pesticides, herbicides, and insecticides are regularly applied to monsoon and winter crops in entire Thar Desert region.

XI. Lack of sufficient monitoring staffs

Desert National Park (DNP) is an extensive and vast protected region spanning 3162 km^2 across two districts in Rajasthan State, India. It covers 1900 km^2 in the Jaisalmer district and 1262 km^2 in the Barmer district, making up a substantial part of the Thar Desert ecosystem. This large area is a vital habitat for a variety of desert-adapted plant and animal species, including endangered and endemic species. Nevertheless, the vast size of DNP presents considerable challenges for effective management and conservation. Large geographical area of park, combined with a shortage of forest personnel, has made it susceptible to various human-induced threats. These threats include illegal hunting, uncontrolled cattle grazing, unauthorized logging and tree cutting and land encroachment, which further reduces quality of forest habitats.

Recommendation for the enhancing survival of wildlife in study area

Traditional hunting communities are native to Western Rajasthan including the Thar Desert and they have not yet given up their traditional hunter-gatherer lifestyle. Poaching of wildlife occurs in entire desert landscape of Rajasthan state in a secretive manner. Owing to the vast expanse of landscape and shortage of forest staff and vehicles, complete control of poaching has not been achieved. Proper monitoring and surveillance of entire desert area by the forest department with the help of villages and peoples can be effectively controlled the hunting of Indian Peafowl, Grey Francolin, Indian Gazelle, Indian Spiny Tailed Lizard, Desert Monitor Lizard, Indian Monitor Lizard and other wild species. Furthermore, the complete ban on illegal human activities, such as cattle grazing, collection of plant-based products from forests, and scared grooves (Orans) can be helpful for the management of habitats and entire desert ecosystems.

Installation of sign and speed limit boards in entire desert national parks and their surrounding areas may help mitigate the problem of wildlife mortality due to collisions with roads and vehicles. Furthermore, establishment of wildlife rescue and rehabilitation centres in each forest range may be efficiently helpful to save injured and sick animals. Incorporation of "wildlife ambulance" for the rescue of injured wild animals may be helpful for the saving numerous of animal life every year. Furthermore, appointment of wildlife biologists, naturalists and veterinarian doctors in each protected area is helpful for the long-term conservation of threatened and endangered wildlife species, including bustards, vultures, and antelopes.

Desert regions face a lack of water availability, particularly in summer. Mitigating these problems by establishing water holes and guzzlers at a particular distance in entire desert national park ensure plentiful amounts of water throughout the year. Recently, solid waste and garbage problems have also increased in desert areas due to a high tourist influx. Installation of Trans or dust bins, particularly high tourism areas, it is helpful to clean the entire desert ecosystem from solid waste and garbage. Furthermore, the control of invasion of exotic plant species by mechanical and biological means will be helpful for the maintenance of entire ecosystem integrity of the desert region. Organization of wildlife conservation programs and campaigns among local people and villages, especially among tribal groups, may become helpful for the mitigation of poaching and hunting activities in this region.

Organization of large level plantation program for native tree species Khejri (*Prosopis cineraria*), Rohida (*Tecomella undulata*), Ker (*Capparis decidua*) and other native plant species and grasses, will be provide suitable habitat for the desert wild animals (Chishty *et al.*, 2021). Establishment of local and regional corroders under road networks minimizes the effects of habitat fragmentation and population isolation in desert ecosystem. Proper control and management strategies are required to control free-ranging or feral dog populations in and around the Desert National Park area of Western Rajasthan. Organization of educational programs, guided nature walks, wildlife watching events, and wildlife festivals can develop interest among locals and tourists in the conservation of wildlife. Moreover, systematic implementation of regular surveys and wildlife population counting census is essential for monitoring annual variation in populations of threatened and endangered wildlife species, which will be helpful in creating long-term conservation plans for particular species. Conservation and monitoring of forest areas, as well as scared grooves (Orans) and common cattle grazing land (Gaucher) will be helpful for maintaining long-term integrity and stability of entire Desert ecosystem of Rajasthan. Installing high-voltage electric power lines underground can significantly reduce the chances of birds colliding with these structures. This approach effectively eliminates the risk of birds striking overhead wires, towers and other aboveground components involved in power.

CONCLUSION

Degradation of desert ecosystems and fragmentation in the Thar Desert have intensified due to various anthropogenic activities, including overgrazing by livestock, excessive collection of fodder and fuel wood and encroachment on traditional scared groves (Orans) and communal grazing lands (Gauchars). Consequently, essential habitats for various wildlife species, such as herbivores, have been degraded and lost due to invasion of exotic species and habitat fragmentation. Due to lack of proper management of traditional water bodies like Nadis (village ponds), Talabs (lakes) and other small reservoirs are at risk of vanishing. Degradation and disappearance of these water resources significantly impacts the survival of desert animals, especially during hot and sunny days in the summer. Effects of these local anthropogenic activities are exacerbated by global trends impacting faunal and floral diversity composition in the Thar Desert. Furthermore, changes in vegetation composition due to IGNP and invasion of exotic species, such as *Prosopis juliflora*, degrade arid region vegetation and landscape characteristics of western Thar Desert of Rajasthan. Combination of anthropogenic pressures, destruction, fragmentation and loss of habitat and alteration in desert ecosystems represents a significant challenge for conservation efforts in the Thar Desert of Rajasthan. These conditions underscore an urgent need for sustainable habitat management and conservation of desert wildlife owing to the rapid decline of their population in this region.

Figure 1: Cattle grazing in forest area

Figure 2: Free-ranging dog roaming in forest habitat

Figure 3: Habitat fragmentation due to road network

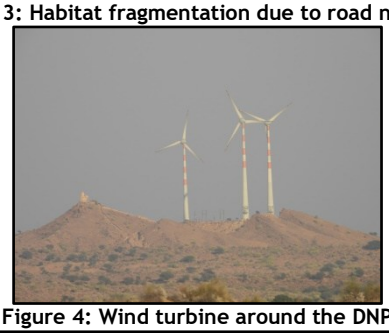

Figure 4: Wind turbine around the DNP

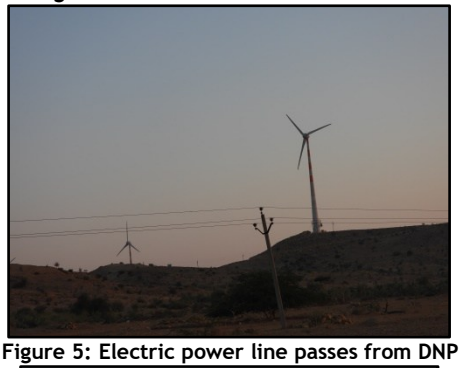

Figure 5: Electric power line passes from DNP

Figure 6: Invasion of Exotic species (*Prosopis juliflora*) in grassland habitat

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