



RESEARCH ARTICLE

Impacts of anthropogenic activities on the behavior of Indian fox (*Vulpes bengalensis*) in the Thar desert

Neeru Garg, B.R. Jaipal*, Harshvardhan Singh

Abstract

The Indian fox is a species that has evolved into the desert and lives in rocky and dry environments. It primarily eats insects, rodents and birds. Anthropogenic activities alter the structural properties of the habitat. Through modifications to land use, human habitation has a direct impact on desert ecosystems. Many effects of human actions on animal behavior have been recorded during the study period. Mining, hunting, overgrazing, chemical use in agricultural crops, vehicles and construction activities affects the habitat, activities and behavior of the Indian fox. Although it is well known that variations in animal behavior in the absence of human can have a cascading impact on community structure, species interactions and ecosystem function, little is known about whether the type of behavioral changes caused by humans are consistent with perceptible ecological change. *Vulpes bengalensis* travel between ideal foraging places may be restricted by human activities, which may also result in direct mortality, habitat loss and habitat degradation. Our findings imply that the persistence of Indian fox populations is highly dependent on current protected and uninhabited areas. We advise restricting vehicle traffic inside the existing areas and continuously watching the population trends for this studied fox species.

Keywords: Anthropogenic activities, Indian fox, Behaviour, Thar desert.

Introduction

Indian fox prefers low-precipitation semi-arid regions with short grassland or scrub, thorny deciduous forests and arid climates (Johnsingh and Jhala, 2004; Macdonald and Sillero-Zubiri, 2004; Prater, 1980). They also reported that Indian foxes avoid the dense forest, true desert and tall grassland. Indian fox found in the Thar desert patches is decreasing continuously (Jaipal *et al.* 2010). Indian foxes bury extra food in the ground and in their dens so they can consume it later. They often cover them with grass and foliage and mark them with urine spray (Garg *et al.* 2020).

Animal behavior can be affected by anthropogenic activities that alter habitat structure or produce chemical

or sensory pollution by altering habitat suitability and environmental conditions. Technology advancements allow us to access and alter previously remote environments in addition to our expanding population and increasing urban and agricultural development (Ramirez-Llodra *et al.* 2011; Perterra *et al.* 2017) as well, as increased outdoor recreation participation increases our anthropogenic footprint in previously protected and pristine natural areas (Gonson *et al.* 2016; Watson *et al.* 2016). In many ecological systems, humans act as super predators, with the ability to influence the behavior of even the highest trophic level animals. (Darimont *et al.* 2015).

Rising human activity levels impact the spatial behavior of animal populations worldwide (Tucker *et al.* 2018). Carnivores are found in low numbers and often have vast home ranges that include a variety of human-made obstacles. Thus the combination of roads, trails and other human developments may harm them (Crooks, 2002). The availability of resources can be affected by land use changes, hunting, fishing, climate change and pollution (Estes *et al.* 1998; Gutierrez *et al.* 2008; Tinker *et al.* 2008), which can also lead to changes in consumer foraging behaviors. Foxes are known to feed on human resources (Doncaster *et al.*, 1990; Serafini and Lovari, 1993) and are frequently seen in large numbers close to agricultural areas (Panek and Bresinski, 2002).

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Material and Methods

Study Area

The research was carried out from January 2015 to December 2019 at various sites in Balotra, Rajasthan. The northwest region of Rajasthan covers 3,42,239 km² and is located between longitudes 23° 3' and 30° 12' and latitudes 69° 30' and 78° 17'. In this area an average of 277 mm of precipitation per year with temperatures that can reach 47°C in the summer (May and June) and an average range of 15 to 25°C in the winter. Block Balotra and the surrounding areas include primarily agricultural land, rocky terrain, and desert areas. The research, which was conducted at three different locations to examine various Indian fox behaviors, is divided into three categories: (1) Flat land with hills (hilly topography) close to Nakoda, Mewa Nagar, and Asada (2) Irrigated lands near Tapra, Jagsa, and Budiwada (3) Sandy area Manchhanio ki Dhani (Kaludi) and Bhukhan.

Data related to the behavior and activities of the Indian foxes were gathered from sunrise to dusk in each season. The direct observation method was used for study. The information was obtained from farmers, herders and native Dhani families living near croplands by interviews and questionnaires. Dull-colored clothing was used during data collection on fox-related activities. A prismatic field binocular (20 x 50) was employed for close-up views of the animals throughout the investigation. The animal was captured with a Nikon Coolpix B700 camera equipped with 60X wide optical zoom lenses.

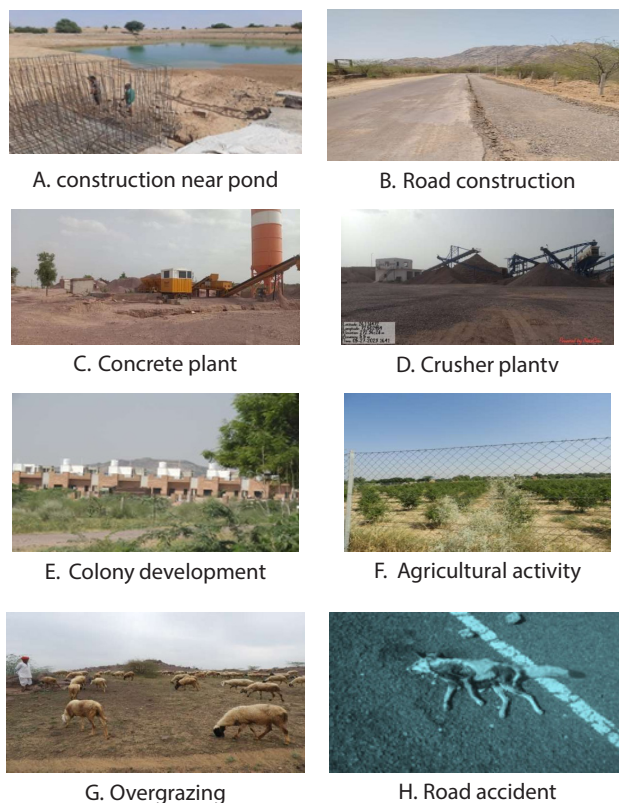
Result and Discussion

Animals and people who share the same habitat compete for comparable resources. Species are forced to struggle for scarce resources as a result of human disruptions that simultaneously affect the availability of food and habitat (Table 1). Conflict over their habitat occurs due to overlapping competition between people and wild animals. While farming, grazing their cattle and moving through the fields, the locals come into contact with foxes. Due to their shy character, Indian foxes hide in their natural habitat and ran away from the area when people are present. (Figure 1: A to H)

Overpopulation of Humans

At the national level, Rajasthan's human population is continuing to grow, while the state's cattle population has been heavily utilizing grasslands. The population's involvement in various activities also rises, encouraging agriculture and animal husbandry. All of these factors had an impact on the fox's natural environment as well. Lack of habitat protection posed the biggest threat to the fox. Garg and Jaipal (2020) depicted the changes in feeding behavior due to anthropogenic activities that the feeding behavior of the Indian fox does not resemble natural feeding. They

Figure 1: Anthropogenic activities which affects habitat of Indian fox



observed artificial food like cotton, lamp of wicks, polythene, coconut pieces and bread etc. in the scat analysis of Indian foxes, which were collected from small temples and near houses.

Agricultural Activities

Because of cattle grazing, agriculture, and other local people's development projects, the habitat of the *Vulpes bengalensis* is rapidly declining. The loss of Indian fox habitat areas was caused by urbanization and land cultivation. Human activity was found to be more prevalent in irrigated areas, which contributed to a lower fox population density.

Most of the residents of Balotra depend on animal husbandry, agriculture and the textile industry. Rainfall in this area comes in erratic patterns. However, certain regions in Balotra have expanded the scope of agriculture, leading to increased human activity and reduced wildlife habitat. Pomegranate cultivation has been practiced extensively in irrigated areas, which affected the grazing habitat and population density of the Indian fox. It was noticed that some of the dens were destroyed during ploughing activities for farming. As a result, they moved to another site.

Human activity was found to be more prevalent in irrigated areas, so fox density was also low there. According to Punjabi *et al.* (2013), the Indian fox species, which depends on dens, will benefit from agricultural extension preservation and effective management in human-dominated areas.

Jaipal (2020) reported that the desert foxes damage the crop in the agriculture field and it highly preferred the fruits of Matira (*Citrullus lanatus*).

The increasing number of people and animals encourages agriculture and animal husbandry. The population of animals is also placing pressure on the grasslands. Each of these has an impact on animal habitat. Johnsingh and Jhala (2004) reported that the reduction of short grassland habitat is a major factor in the decline of Indian fox numbers. Farmers used harmful chemicals in their agricultural fields. They are bad for animals. The use of plastic bags needs to be completely banned. Pandit *et al.* (2010) noted that the widespread agricultural practices, such as the conversion of devastated lands and uncultivated land into cultivated lands and the usage of pesticides, have had a detrimental impact on the population of Indian foxes.

Industrialization, urbanization and construction of buildings

Industrialization, colony, building, hotels, colleges, temples, road construction and growing cloth manufacturing in Balotra's neighboring districts had an impact on fox density (0.494 Km²). The textile sector is also the main source of employment for the residents of Balotra.

Industrial expansion and the destruction of the Indian fox's natural habitat were the results of growing factory needs.

The increase in the number of devotees in the Nakoda area due to the building and development of the Nakoda temple has impacted the wildlife's habitat. Dharmshalas and resorts were also constructed, which had an impact on the foxes' range. Several portions of the Balotra region, which were being degraded by natural ecosystems, were found to be developing colonies and buildings. Establishing schools, colleges, and factories harmed the animal's native environment.

According to Niraula *et al.* (2020), the fox avoids human annoyance and altered landscapes despite being able to tolerate a lot of it. There is a weak negative correlation between the fox's presence and human population density, a moderately negative correlation with household density, a strong positive correlation with distance to settlement, and a very strong correlation with distance to trails/roads. According to Vanak *et al.* (2008), the protection of dry-land biomes would benefit both the *Vulpes bengalensis* and other obligatory dry grassland species.

Poaching and Hunting

A typical reason for hunting an animal was to gather valuable commodities like meat, fur, skin, etc. Rural residents who hunt animals for their flesh, skin, and hair have witnessed poachers in several tribal societies, such as the Jogies. According to the study, their wild dogs are also skillful in killing foxes.

Table 1: Effect of anthropogenic activities on animal life

S.No.	Activities of human	Effect on animal life
1.	Mining	Drilling, Blasting, Crushing Underground mining etc. were affecting the habitat of the fox
2.	Construction	During the studies, it was found that Fox's home range has been affected by the construction of new colonies and buildings in some area
3.	Hunting and poaching	The Indian foxes were hunted by some tribe castes, which were harmful to the foxes
4.	Grazing	Grazing also affects the habitat of the foxes
5.	Chemical use in agricultural fields	It's harmful to the health of animal
6.	Plastic bags	It was noticed during scat analysis and it was also harmful
7.	Vehicles	These were main cause of road killing of animal

Jaipal *et al.* (2010) and Jaipal (2013) reported that the desert foxes were hunted by the Jogi tribes with the help of their dogs in the desert national park, Jaisalmer. According to Niraula *et al.* (2020), the main risks to the Indian fox species include habitat destruction spurred on by growing human populations and urbanization as well as butchery for meat and retaliatory measures.

Road and motor vehicle disturbances

Vehicles on the road frequently struck animals. The coverage area of foxes is reduced due to the construction of roads (PMGSY road) near Dhanies and villages. It was observed during the study period that foxes perished in a traffic collision. Fox's pugmarks have often been detected on human-made paths that foxes used. They crossed the road from one field to another while looking for food and occasionally, they were killed in car accidents. During the study period we observed road-killed dead bodies of one juvenile and one adult Indian fox. Baker *et al.* (2004), Vanak and Gompper (2009) reported that the rising traffic is major hazards in the habitat of Indian fox.

Illegal Mining

Mining stones and coarse sand (bajri) without adequate supervision has also resulted in the loss of biodiversity in some locations. The habitat and dens of the foxes were being destroyed in sandy areas due to bajri mining. They moved their dens to a different location. Soil erosion and exploitation are undesirable outcomes of mining processes. These activities destroyed total 20 dens. Pandit *et al.* (2010) observed similar findings. They suggest that the Indian

human activities including intensive agricultural practices, habitat degradation, and hunting primarily cause fox's low population density.

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