FINAL REPORT

Assessment of the population of Blackbuck *Antilope cervicapra* in Bidar District, Karnataka

October 2023

FOREST DEPARTMENT BIDAR
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Recommended citation

Pawar, R.A., S.S. Narwade, Vivekanand Baburao, M.M. Vaanathi, B. Pandav, M. Pawar, S. Bole, and N. Ghag (2023). Assessment of the population of Blackbuck *Antilope cervicapra* in Bidar District, Karnataka. Jointly published by BNHS and Bidar Forest Division. Pp. 95.

Assessment of the population of Blackbuck *Antilope cervicapra* in Bidar District, Karnataka

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Contents

Acknowledgements

We express our gratitude to Shri. Sanjay Mohan, Former Principal Chief Conservator of Forests (PCCF) and Head of the Forest Force (HoFF), Karnataka; Shri. Rajeev Ranjan, IFS, Former Principal Chief Conservator of Forests (PCCF Wildlife) and Head of the Forest Force (HoFF), Karnataka; and Shri. Subhash Malkede, IFS, Present Principal Chief Conservator of Forests (PCCF Wildlife) and Chief Wildlife Warden (CWLW), Karnataka, for granting permission to conduct the studies and providing the necessary support and information.

We also want to extend our appreciation to Shri. S. Sivashankar, IFS, former DyCF Bidar Forest division, for initiating the project and providing valuable guidance, as well as to the Staff of Bidar Forest Division for their local-level logistics and administrative support.

We thank Mohan A., the former Project Fellow of BNHS, for his invaluable contribution to the project work. We also thank all the survey participants (non-BNHS staff) and the BNHS staff for participating in the landscape surveys. Their support and assistance were crucial to the successful completion of the project.

We acknowledge the project teams of Great Indian Bustard and Lesser Florican from Rajasthan, the Environmental Information Awareness Capacity Building and Livelihood Programme (EIACP) Centre, and the Resource Partner (RP) on Avian Ecology at the BNHS for developing a data collection app and participating in field surveys for a short period.

Finally, we express our gratitude to our colleagues from the administration, accounts, and HR departments at Hornbill House for their backend support, which ensured the smooth execution of the project.

Summary

Background - Bidar district is situated on the Deccan Plateau, in the northernmost region of Karnataka, and covers an area of 5,448 sq. km. It experiences a predominantly dry climate, except during the southwest monsoon and winter seasons. Blackbucks are widely distributed in Bidar, as the district provides suitable habitats like patches of grassland, forest, and agricultural land. Grasslands in Bidar are vital habitats that support a wide range of wildlife and serve as grazing areas for domestic animals. Blackbucks prefer grasslands, but due to the increasing human population, they are forced to live in agro-pastoral landscapes. However, habitat loss affects their population, and in Bidar, they are often found in agricultural fields. Therefore, in collaboration with the Bidar Forest Division, a systematic study was launched to assess the status of blackbuck and their habitat, as well as to understand the corridors used by them. Since October 2021, BNHS has been working on a lesser florican project in Bidar; some data on grassland-associated species was available, but a systematic study on blackbuck was launched in August 2022.

Landscape-level field surveys – Three surveys were conducted across the Bidar district with multiple observers: one in early winter, the second during the monsoon, and the third in winter. Initial surveys were conducted in early winter, from October 31 to November 29, 2021, and were designed to assess the status and distribution of Blackbuck and other grassland-associated species. As part of the assessment, interviews were conducted with 75 local people. 180 6km x 6km grids were laid across the district for the landscape survey. Based on data from the initial BNHS surveys, previous records, and agricultural patterns in the area, 114 grids were selected for the survey. During the survey, 99 grids were examined due to the presence of villages and other disturbance factors. In the entire district of Bidar, 816 individuals of Blackbuck were counted during the landscape survey. During the monsoon season, the first survey occurred from July 20 to August 3, 2022. The survey covered 95 grids, and each grid was covered using a 12 km transect on a vehicle. A total of 950 km of transect length was covered, and for every 2 km, a 10-minute point count was conducted. The surveyors spent a total of 30.2 working hours observing the counting points, and they recorded 1,241 Blackbucks during the survey. The second survey was conducted in December 2022, and 1007 Blackbucks were recorded. The third survey was conducted from January to April 2023, during which we found the highest count was 1024 blackbucks. The surveys aimed to determine the presence of Blackbuck, grassland-associated species, and their habitats. The survey found that roads, power lines, settlements, dogs, and quarries are the major threats to the Blackbuck population, posing the highest threat probability.

Site-wise intensive surveys - Eleven sites were selected for further detailed observation based on the initial results. These sites, namely Chondi, Chetnal, Alur-Bellur, Aliyabad, Kamthana, Shamshirnagar, Hedgapur, Karnataka Industrial Area Development Board (KIADB) plot area behind Bidar airfield, Chondi village with solar plant, Dhanur tanda, and Santhpur, were chosen based on their history of Blackbuck sightings. Three visits were conducted between January and March 2023 to record the herd and group composition of Blackbucks in the areas as mentioned earlier. During this survey, a total of 837 Blackbucks were recorded cumulatively. Most of the recorded Blackbucks were female and sub-adults. It was observed that Blackbucks spend most of their time grazing and walking during the morning hours between 07:00 and 11:00. In the afternoon, Blackbucks tend to rest in the shade of trees or bushes and walls. Between 16:00 and 20:00, they become active again. The study found that Blackbucks are most active in the morning, while their activity decreases in bright sunlight, causing them to rest more often in the afternoon. It was also observed that Blackbucks tend to rest undisturbed in the grasslands. They move towards plantations or scrublands when they sense any disturbance. The main factors that disturb Blackbucks are

people, vehicles, and noise. Overall, the survey found that Blackbucks are more likely to be found in the eleven selected areas, and understanding their daily routine and behaviour can help in their conservation efforts.

Conservation issues - The region's grasslands and corridors are essential for the Blackbucks' survival and are affected by land-use changes that cause population out-migration. The survey found that power lines, settlements, dogs, and quarries pose a threat to the Blackbuck population. The survey also noted a larger number of female Blackbucks in the population. The survey revealed that the main activity times for Blackbucks are mornings and evenings. The main threats to Blackbucks in this region are people, dogs, fences, grazing livestock, noisy settlements, and roads. All studies have highlighted the urgent need for conservation, as Blackbucks in Bidar are exposed to various threats. The decline in grassland is the biggest threat, and many factors, including agricultural expansion, private land, and other human activities cause it. The most extensive grasslands and concentrations of Blackbucks were found in the Aurad, Bhalki, and Bidar tehsils. This region, with its corridors, traditional cropping patterns, and essential grasslands, supports the diversity of avifauna and mammals. It is crucial to conserve these areas as they are significant. The KIADB area adjacent to Bidar city, Santhpur, Kamthana, Nirna, Chondi, and Chetnal grasslands in Bidar are high-potential grasslands undergoing major habitat degradation and rapid changes due to human activities. If this trend continues, the grassland area will likely be lost within a few years, posing a significant threat to the Blackbuck population and the ecosystem.

The way ahead - If the current trend continues, the grassland area in Bidar will likely be completely lost within a decade. The number of blackbucks in the area is highly variable, and their decline would devastate the ecosystem and the wildlife that relies on it. The loss of grassland is a warning sign of the total loss of this vital ecosystem. The consequences of this loss could be severe, with far-reaching effects threatening the biodiversity and ecological balance of the region. Understanding the causes of these changes is crucial to develop effective management strategies that can help conserve these valuable ecosystems. Human activities have caused habitat loss, conflicts, and a decline in the blackbuck population. Poaching and trade in blackbuck products are also threats. To protect blackbucks and their habitat, conservation efforts aim to establish protected areas, anti-poaching patrols, and awareness campaigns. **Creating community or conservation reserves** for blackbucks in the Bidar district is necessary. One conservation reserve near **Konmelkunda** village was declared on a block of reserve forest in the year 2023, which has a mix of forest, grassland, agriculture, and scrubland, with invasive species being the primary threat to grasslands. Since the area is full of exotic trees, Gliricidia sp. To address key threats like controlling the population of free-ranging dogs through an effective Animal Birth Control program and protecting grasslands so that blackbucks will not face a shortage, which in return will reduce the blackbuck-human conflict. BNHS recommends promoting habitat restoration and eco-tourism through community engagement, which is a crucial step for the long-term survival of blackbucks and biodiversity dependent on grasslands in Bidar.

1) Introduction

About grasslands

India's grasslands are vast expanses of land covered by various grasses, herbs, and shrubs. These ecosystems are of great ecological significance, as they provide habitats for many animals and serve as a natural resource for local communities. India's grasslands are divided into three main types: tropical, subtropical, and temperate. Unfortunately, India's grasslands are under threat due to factors such as overgrazing, agricultural expansion, and industrialization. Conservation efforts are being made to preserve these ecosystems and protect the biodiversity they support. Moreover, in the 1980s, the government undertook large-scale plantations of exotic trees such as *Gliricidia* spp., *Eucalyptus* spp., rendering some grassland unsustainable for birds, such as the Great Indian Bustard, Lesser Florican, and other grassland-dependent species.

Grassland habitats currently face severe anthropogenic exploitation, leading to global cascading effects on the survival of grassland-dependent biodiversity, particularly in non-protected areas. Many such biodiversity-rich grasslands in India are found outside protected areas but lack quantitative information on their status (Paul *et al.* 2021).

In the last 30 years, the overall natural grassland area decreased by 24 per cent, while the agricultural area doubled. Woodland cover increased by 28 per cent because of ecological succession. Distance from human settlements was the most crucial factor affecting the transitions, followed by topography and distance to water bodies (Banerjee *et al.* 2020).

Image 1: Territorial herd of Blackbucks in Konmelkunda area @ Rushikesh

Introduction

The Blackbuck *Antilope cervicapra* is a medium-sized ungulate antelope species native and endemic to the Indian subcontinent. The common name 'Blackbuck' refers to the dark brown to black colour of the dorsal (upper) part of the coat of a male Blackbuck. This species is the state animal of Punjab, Haryana, and Andhra Pradesh. The Blackbuck is commonly called Indian Antelope (in English); *kadiyal*, *kala hiran*, *krishnamrig* and *krishnasaar* (in Hindi); *Yelli*

(in Kannada); *Krishna jinka* (in Telugu); and *iralaimaanandvelimaan* (in Tamil) (Meena and Saran 2018). It is a diurnal ungulate listed as a Schedule I species of the Wild Life (Protection) Act 1972. There has been a growing conflict between humans and blackbucks in India recently. The primary reason for this conflict is the increasing habitat loss due to human activities such as urbanization, industrialization, and agriculture.

Taxonomy

The generic name of *Antilope cervicapra* is derived from the Latin word *antelopes*, meaning 'horned animal,' and the specific name *cervicapra* is composed of the Latin word *Cervus*, meaning 'deer,' and *capra*, meaning 'she-goat' (Meena and Saran 2018).

Image 2: Majestic Adult Male Blackbuck in Chetnal Grassland in Bidar @ Rushikesh Pawar

External features of the Blackbuck

Blackbucks largely resemble gazelles found in the Arabian Peninsula. The colouration of the dorsal side helps distinguish between two species: brown in gazelles and dark brown or black in Blackbucks. Blackbucks are slender-bodied with a head-to-body length of approximately 100–150 cm. Blackbucks exhibit pronounced sexual dimorphism. Males are more significant than females, with adult males weighing 35–55 kg and adult females weighing 30–40 kg (Prater 1971). The dorsal parts of female and subadult male Blackbucks are yellowish brown, while the ventral parts are white. These two colours are divided by a distinct lateral pale band (Meena and Saran 2018).

The dorsal and lateral sides and the front side of the neck of adult male Blackbucks are blackish-brown, which, with age, changes colouration to almost black in the insides of the legs and lower chest, along with a white ring surrounding the eye and a white chin. Males have horns that are diverging, cylindrical, spiral, and ringed throughout. The rings are closer

together near the skull. The spiral turns vary from less than 3 to 5. Horns are 45.6–68.5 cm long and can increase to 79 cm. Females rarely have horns, and the few females lack the rings and spirals that characterize the male Blackbuck horns. Blackbucks have a short, compressed tail approximately 10–18 cm long These antelopes are also renowned for their incredible speed and agility, as they can reach a top speed of 80 km/h and change direction in mid-air while running. They stand at a height of approximately 70–80 cm at the shoulder. (Prater 1971; Meena and Saran 2018).

Distribution of Blackbuck

Distribution of Blackbucks in India

Blackbucks were once distributed throughout India, extending up to the Terai zone of Nepal. However, they are now extinct in Pakistan and Bangladesh. (Prater 1971). In India, the species is common and widely distributed throughout the country. The Major Blackbuck populations are present in some Protected Areas of the states of Rajasthan, Punjab, Gujarat, Madhya Pradesh, Maharashtra, Karnataka, Odisha, Telangana, Andhra Pradesh, and Tamil Nadu. In 2000, approximately 50,000 (*c.* 35,000) mature individuals were estimated, with the most significant numbers reported in Rajasthan, Punjab, Madhya Pradesh, Maharashtra, and Gujarat (Meena and Saran, 2018). 1982 the estimated population was approximately 22,500 – 24,500 (Ranjithsinh 1989).

Although the species is categorized as a Least Concern species by the IUCN, the population of this species is dwindling because of the loss of its primary habitat, grasslands. The social organizations of Blackbucks include a mixed herd formed by males and females of different age groups, a Harem herd or territorial herd with one territorial male and females from all age groups, and a Batcheler's herd constituting all male members. They prefer open areas with sparse tree cover and are adapted to withstand their habitat's hot and dry climate. The blackbuck, an antelope species, was once widely distributed throughout India. Unfortunately, due to various factors such as habitat loss, hunting, and poaching, their population has experienced a significant decline over time, leading to a reduction in their range. The situation calls for effective measures to protect and conserve this species to prevent further decline. Today, the largest populations of blackbucks are found in protected areas such as national parks and wildlife sanctuaries. Some important protected areas for blackbucks include the Velavadar Blackbuck National Park in Gujarat, the Tal Chhapar Sanctuary in Rajasthan, and the Great Indian Bustard Sanctuary in Maharashtra. Efforts are being made to conserve the remaining blackbucks in India, including habitat restoration, anti-poaching measures, and community-based conservation programmes. These efforts have helped stabilise their people in some areas and offer hope for their continued survival. The conservation of blackbucks in India is an ongoing effort to protect this species and its habitat.

Distribution of Blackbucks in Karnataka

A) Blackbucks in protected areas

The Ranebennur Blackbuck Sanctuary had a population of around 6,000 blackbucks (Meena and Saran 2018). The Daroji Sloth Bear Sanctuary is known to have a significant population of blackbucks, with sightings of herds of over 50 individuals (Karnataka Forest Department). The Bhadra Wildlife Sanctuary has diverse wildlife, including blackbucks, elephants, tigers, and leopards (source: Karnataka Forest Department). The population of blackbucks in Karnataka has been relatively stable over the years, with occasional fluctuations due to habitat loss and poaching (The Hindu Kalaburagi edition 2021). The government of Karnataka has taken several measures to protect blackbucks and their habitat, including establishing sanctuaries, anti-poaching patrols, and community-based conservation initiatives (Karnataka Forest Department).

B) Blackbucks in non-protected areas

The blackbucks can be found in non-protected areas of Karnataka, such as agricultural fields, fallow lands, and scrub forests; the species was found in higher density in farm fields and fallow lands than scrub forests, and it was also identified that factors such as vegetation cover, human disturbance, and the availability of water sources influence the distribution of blackbucks in these areas. The study found that the species had adapted to living in human-dominated areas and had even shown changes in their behaviour and diet to survive. While the presence of blackbucks in non-protected areas is promising for conservation, it highlights the need for better management practices to minimize human-wildlife conflict and protect the species from threats such as habitat loss and poaching. (Prasad and Ahmed 2021, Ahamad *et al.* 2021, Delu and Singh 2023, Singh and Kumara 2006).

Image 3: Adult Male Blackbuck, Adult Female Blackbuck, and Faun in Aliyabad Grassland, Bidar @ Rushikesh Pawar

2) Objectives

1. To study the population structure and regional population dynamics of Blackbucks in Bidar District, Karnataka
2. To investigate the potential habitats and corridors used by Blackbucks in Bidar District
3. To understand the intensity of the Human-Blackbuck conflict across the Bidar District landscape

3) Study Area – Bidar, Karnataka

The study area comprises five talukas: Bidar, Bhalki, Aurad, Basavakalyan, and Humnabad, in the Bidar District of Karnataka. The district is located on the Deccan Plateau. It is the northernmost part of Karnataka, approximately 700 km from Bengaluru. Bidar District (17° 35' and 18° 25' N and 76° 42' and 77° 39' E) covers a land area of 5,448 sq. km and comprises two rivers and one stream flowing through the district, namely Karanja, Manjra, and Karanja, respectively. Karanja River originates from the northern part of the district and flows through the eastern part of the district. It joins Manjra near Bhalki, flowing towards the district's east side. Riverbanks and irrigated areas have changed the traditional cropping system; farmers widely plant sugarcane in this region. The habitat is unsuitable for blackbucks because only certain heights consume sugarcane. The climate is generally dry throughout the year, except during the southwest monsoon, which continues till the end of September. The months of October and November constitute the post-monsoon or retreating monsoon season. The winter season is from October to January, and the temperature drops from November. December is the coldest month, with mean daily maximum and minimum temperatures of 27.3 and 16.4 °C, respectively (Karnataka State Gazetteer 1977). From mid-February onwards, both during day and night, temperatures begin to rise rapidly. May is the hottest month, with mean daily maximum and minimum temperatures of 38.8 °C and 25.9 °C, respectively. This month, wildlife, especially Blackbucks are usually seen in areas where water is readily available. The forest area in the Bidar division consists of dry deciduous and scrub-type vegetation. Most of the existing forest in this area includes an artificial forest. The forests of the Bidar division (435.5816 sq. km), accounting for approximately 8.5% of the total geographical location of the district, are classified as reserved, protected, and unclassified. (District Gazetteer) (Karnataka Forest Department).

Bidar is a city situated in Karnataka, India. The surrounding region of Bidar is mainly a part of the Deccan Plateau, which boasts diverse landscapes, including grasslands. The grasslands of this area refer to regions covered with natural grasses, typical of the Deccan Plateau ecosystem. These grasslands are crucial habitats that support a wide range of wildlife and serve as grazing areas for domestic animals. Bidar comprises several grassland areas. Every grassland has a unique ecosystem. In Chondi, grass covers the *Andropogon* spp. In Aliyabad, Chondi, Nirna, Alur-Bellur, and Kamthana areas, *Chrysopogon* spp. and *Heteropogon* spp. cover the same area.

Grasslands in Bidar

Grasslands are unique ecosystems that support a variety of plant and animal species specifically adapted to thrive in this habitat. These species are often referred to as "grassland-oriented species." They have evolved to take advantage of the open grassy landscapes and have specialized characteristics that help them survive in this environment. The land of Bidar district is predominated by agricultural fields, with a few patches of scrubby forest and grassland. It is considered the ideal habitat for Blackbuck (Rahmani 1991). The Blackbuck is known to prefer open habitats (Ranjitsinh 1989). The distribution of Blackbuck in the Bidar district needs to be more balanced. They are widely distributed in Bidar taluka compared to the other four talukas of the district. They freely roam near the village and in grassland. The habitat in Bidar taluka is suitable for the Blackbuck as it contains patches of grassland surrounded by forest and agricultural land. This habitat supports the Blackbuck with food in grassland; the forest patch protects from enemies, and agricultural fields provide water and food. The Blackbuck, though an animal of dry open country, requires water regularly. (Ranjitsinh 1989).

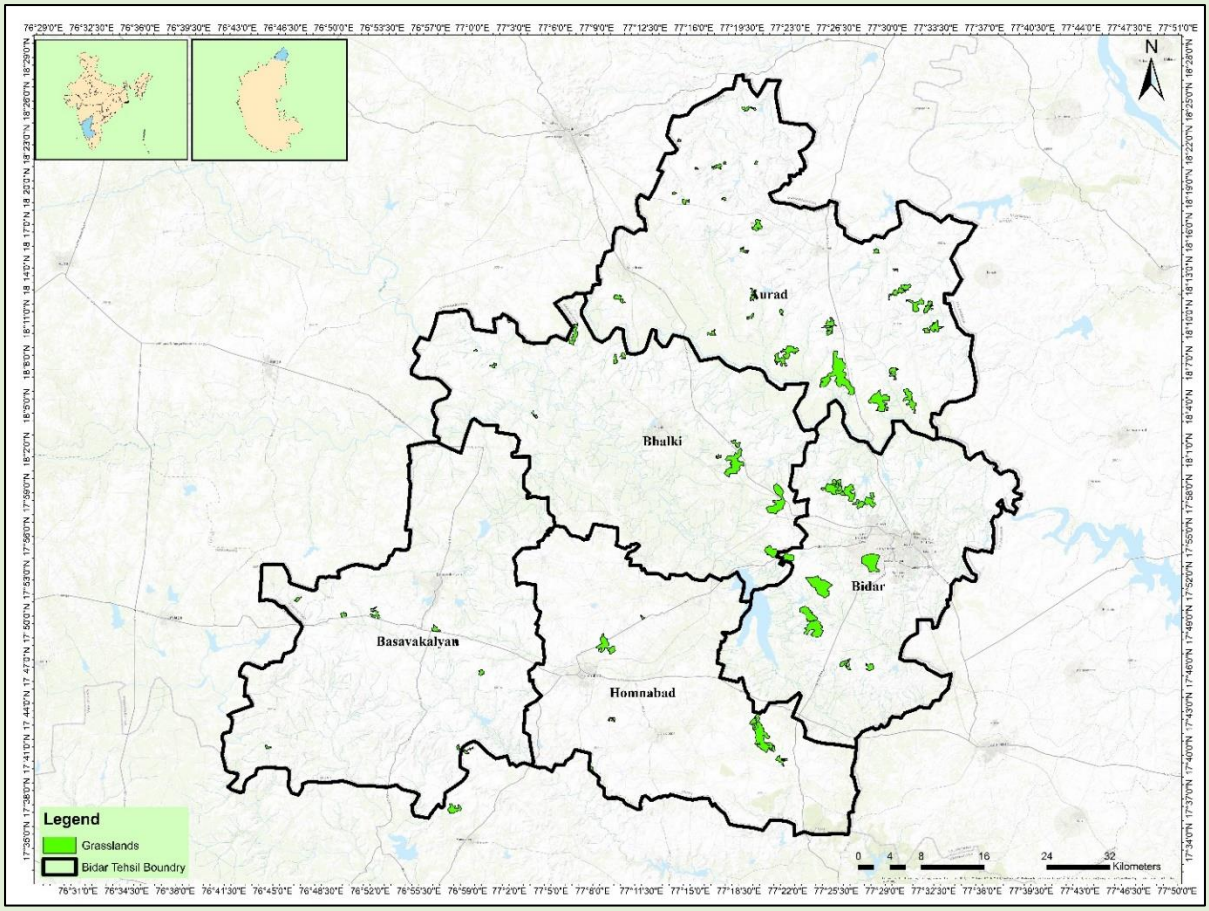


Figure 1 Study area showing important grassland site available at present in Bidar district

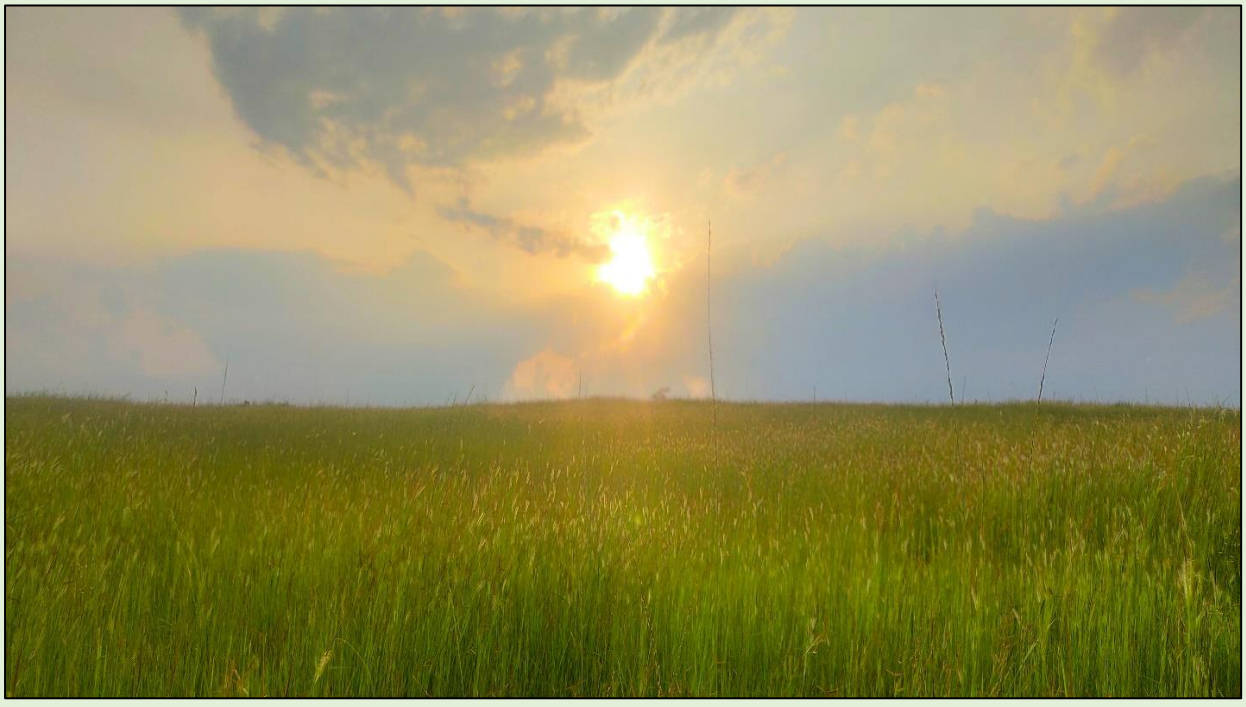


Image 4: Beautiful view of Aliyabad Grassland in Bidar during sunset @ Rushikesh Pawar

Blackbucks in the study area

A periodic census of Blackbuck conducted in 1997, 2002, and 2009 reported 408, 610, and 454 individuals, respectively (Kumar & Zutshi 2013). The Bidar District hosted many Blackbucks, as surveyed and registered by Rahmani (1991). Blackbuck's distribution pattern and population were studied in Bidar District from June 2012 to 2014. In all, 886 individuals were found, with the highest number in Bidar Taluka, followed by Aurad, Bhalki, Basavakalyan, and Humnabad. Based on the report, it was concluded that the Blackbuck prefers habitats with patches of grasslands and farmlands. Moreover, although the forest patch in the blackbuck habitat is not essential for the species' survival, it protects it from predators (Mohammed & Modse 2016a).

Blackbucks utilize a range of habitats, including tropical and subtropical weed land, dry deciduous forests, grasslands, river banks, and semi-desert habitats. Additionally, they forage in croplands and pasturelands. They are generally sedentary but may travel long distances for water and food in the summer (Rahmani 1991). Their average lifespan in captivity is 12 years (Crandall 1964). Approximately 80,000 Blackbucks were reported in the Indian Environment Portal Report in 1947. In 1982, the estimated population was 22,500–24,500 individuals (Ranjithsinh 1989). The Ranebennur Blackbuck Sanctuary, located in the Haveri District of Karnataka, had a population of 2,000 individuals in 1980 (Karanth & Singh, 1981; Rahmani, 1991).

Although an animal of dry, open countries, the Blackbuck requires water regularly (Ranjithsinh, 1989). Its population is shrinking due to the loss and degradation of habitats, consequently blocking wildlife corridors. Blackbuck prefers short grasslands (<50 cm of grass length) and avoids wooded habitats and tall grasslands (Jhala 1991). According to the data presented by the Union Government in the United Nations Convention to Combat Desertification during the 14th Conference of Parties, from 2005 to 2015, India lost approximately 31% of its grasslands because of land conversion for different anthropogenic activities, such as urbanization, industrialization, and agriculture. Grasslands have been severely destroyed in several states, including Maharashtra, Karnataka, Gujarat, and Uttar Pradesh (Pandey et al. To Earth, Published on September 10, 2019). Moreover, in the 1980s, the government undertook large-scale plantations of exotic trees, rendering some grasslands unsustainable for birds, such as the Great Indian Bustard, Lesser Florican, and other grassland-dependent species. A periodical census of Blackbuck conducted in 1997, 2002, and 2009 reported 408, 610, and 454 individuals, respectively (Kumar and Zutshi 2013).

In Bidar Taluka, Blackbucks frequently invade agricultural fields at night. They also damage crops by feeding on tender saplings. Blackbuck raiding of crops creates a conflict between farmers and Blackbucks. Farmers chase blackbucks away from their farms using various methods and materials. Therefore, a systematic study should be conducted on the Blackbuck population based on grid-based surveys and proper demographic data.

Image 5: "Nature's playground: vast grassland of Nirna site, Bidar under tremendous pressure of new renewable energy infrastructure @ Rushikesh Pawar

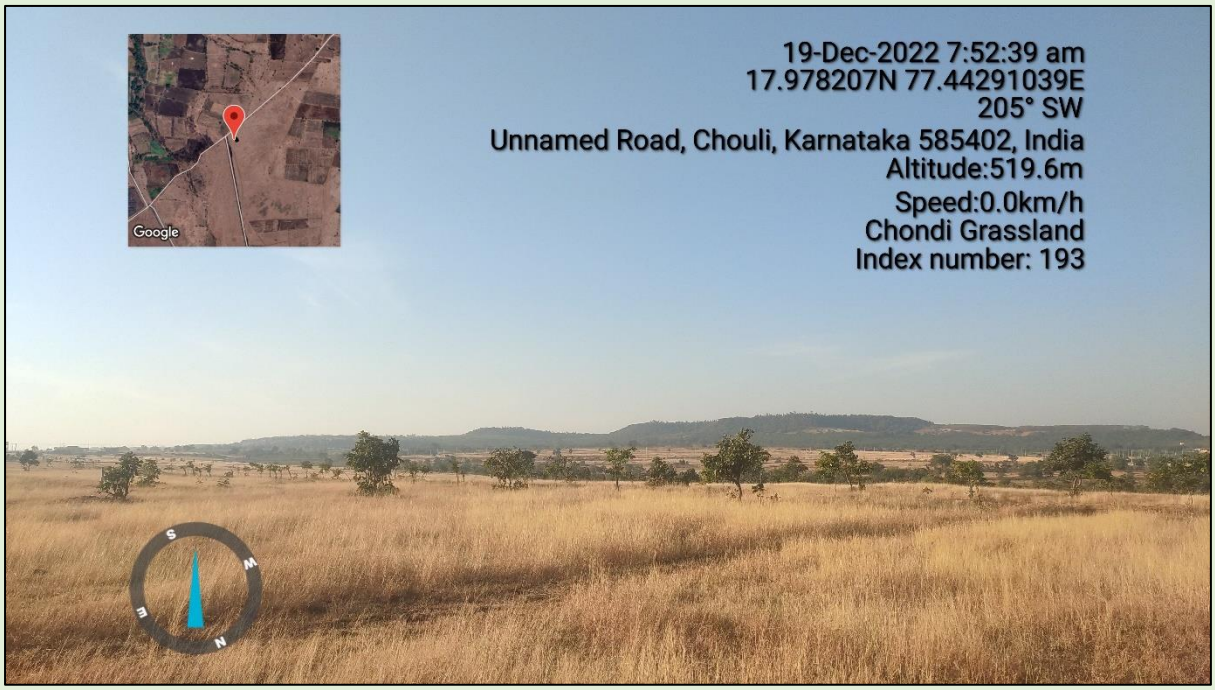


Image 6: View of grassland in winter, Chondi, Bidar @ Rushikesh Pawar

4) Methods

4. Surveys

4.1. Regular Surveys

The field surveys were conducted from August 2022 to July 2023. Secondary information was collected based on interviews with local respondents (herders and farmers) on the occurrence of Blackbuck and associated species and perceived threats. The report gives general observations.

4.1.1. Early Winter Survey: November 2021

In November 2021, a landscape survey was carried out in the entire Bidar district to evaluate the status and distribution of Blackbucks and other species associated with grasslands. As part of the assessment, interviews were conducted with 75 locals. To conduct the landscape survey, 180 grids measuring 6 km x 6 km were laid over the district. Based on data from BNHS initial surveys, previous records, and agricultural patterns in the area, 114 grids were chosen for the survey. During the survey, 99 grids (87%) were surveyed due to the presence of villages and other disturbances. The grids were surveyed to determine the presence of Blackbuck, grassland-associated species, and their habitats.

4.1.2. Monsoon Survey: July-August 2022

The landscape level survey was conducted during monsoon from July 20 to August 3, 2022. Based on the Early winter survey of 2021, 180 grids measuring 6 km x 6 km were laid over the district. Based on data from BNHS initial surveys, previous records, and agricultural patterns in the area, 114 grids were chosen for the survey. During the survey, 99 grids (87%) were surveyed due to the presence of villages and other disturbances. Among them, 95 grids were selected for the study in the Monsoon Survey from July to August 2022. total of 95 grids were surveyed during the landscape survey to determine the presence of Blackbuck, grassland-associated species, and their habitats.

4.1.3. Post Monsoon Survey: October-December 2022

From October to December 2022, routine field surveys were carried out. The grasslands, farmlands, and potential areas in Bidar were visited during the survey. Local respondents (herders and farmers) were surveyed to gather secondary data about Blackbuck and related species occurrences and perceived threats.

4.1.4. Winter Survey: January 2023

Based on the Landscape survey done in 2022, 35 priority grasslands were identified in the Bidar district (Narwade *et al.* 2022). Of the 35 grassland sites, 11 were selected to conduct this study based on records of the Blackbuck congregation and the size of the area. The selected 11 sites are referred to by names based on the village or area they belong to. Their names are as follows: Chondi, Chetnal, Alur-Bellur, Aliyabad, Kamthana, Shamshirnagar, Hedgapur, Chondi Solar, Dhanur tanda, and Santhpur.

4.1.5. Regular Survey: April-October 2023

The regular field surveys were conducted from April 2023 to October 2023. The grasslands, farmlands, and potential areas in Bidar were visited during the survey.

4.2. Survey Planning

Five to six teams were involved during the survey, each with at least four members. These included a biologist, scientist, or birdwatcher who could identify species on the

spot, a photographer, a data collector, and a volunteer. The teams conducted ground surveys in designated grids following vehicle transects and point counts. The surveys were conducted in the early morning hours, from 6:00 am to 10:00 am, and Afternoon to evening hours, from 3:30 pm to 6:30 pm, depending on the light and ground situation. Each team was assigned to survey one grid in the morning and one grid in the evening, covering nearly 105 grids in the selected study area over 12 days from July 20, 2022, to August 03, 2022.

4.3. Survey protocol

A mix of point count and line transect data was collected during data collection. In each grid, a length of 10-12 km of vehicle transects were laid. The vehicle speed was maintained between 10-30 km/hr. From the start point to the endpoint, at an interval of 2 km, 10 minutes of point count was conducted. Animal/bird sightings were recorded between the point count locations as part of the line transect. The survey was targeted to document the information regarding the presence of grassland obligatory species like Lesser Florican *Sypheotides indicus*, Indian Grey Wolf *Canis lupus pallipes*, Blackbuck *Antilope cervicapra*, Chinkara *Gazella bennettii*, Great Indian Bustard *Ardeotis nigriceps*, Montagu's Harrier *Circus pygargus*, Pallid Harrier *Circus macrourus*, Marsh Harrier *Circus aeruginosus*, Hen Harrier *Circus cyaneus*, Chestnut-bellied Sandgrouse *Pterocles exustus*, Nilgai *Boselaphus tragocamelus*, Wild Boar *Sus scrofa cristatus*, Indian Small Fox *Vulpes bengalensis*, Jungle Cat *Felis chaus*, and free-ranging dogs.

4.4. Equipment used

Each team was equipped with a GPS device to record the tracks, a binocular to observe and identify the species, a range finder to measure the animal's distance from the observer, and a camera to record the species sightings through photographs.

4.5. Important habitat characteristics noted

Land cover, topography, and human disturbances were recorded at intervals of 2 km. To assess habitat quality, dominant land cover type, terrain type, and vegetation composition within a 100 m radius from the point were recorded systematically.

4.6. Data Collection

1. All the observations were entered in the Data Collection App explicitly designed for landscape surveys by BNHS and The Bustard Programme. All the parameters such as GPS location, date and time, weather, terrain, vegetation cover, insect count, animal name, and vegetation details like name and specification of grasses, trees, shrubs, and invasive species fed into the app.
2. The sighting of an animal or a group of individuals among any of the species mentioned above has been considered one sighting. For each sighting, the number of individuals, sex if possible, with Latitude and Longitude coordinates during the vehicle line transect.
3. The dominant land cover type within a 100 m radius of the point shall be recorded as fallow, agriculture, grassland, scrubland, and plantation.

4.7. Grassland mapping for identification of corridors

Data from multiple sources was collected and mapped to determine the distribution of various grassland-associated species. This included gathering information on the ground, such as observing the vegetation, animals and threats present in the area. Based on this data, polygons were drawn around the identified grassland patches throughout

the district. These grassland areas were then categorized into three different classes - Moderate Potential, High Potential, and Very High Potential Areas. This classification will be determined by considering the area's size and the presence of key grassland obligatory species.

The identified areas were closely monitored before any conservation interventions were carried out. This monitoring aimed to ensure that the areas were accurately classified and identify any potential changes that could impact the grassland areas. The collective data will be useful in preparing digital maps and identifying the area. The maps were prepared using ArcGIS 10.8 software. Using maps to conserve valuable grassland areas is critical for the Forest Department's efforts to preserve and protect these natural resources. The department has chosen to utilise these maps to facilitate its conservation efforts effectively. By mapping the grassland areas, the department can quickly identify the areas that require conservation and take necessary steps to ensure their protection. Therefore, using these maps is pivotal for the Forest Department to carry out its conservation efforts effectively.

4.7.1 Tracks saved

The tracks have been saved using GPS. The habitat data and anthropogenic disturbances have been recorded at each 2 km interval. If two or more trails are laid in one grid, they will be recorded separately with separate track IDs. The tracks were useful for creating distribution maps and covering the necessary areas. The distribution data of grassland indicator species such as Lesser Florican *Sypheotides indicus*, Indian Grey Wolf *Canis lupus pallipus*, Chinkara *Gazella bennettii*, Blackbuck *Antilope cervicapra*, Montagu's Harrier *Circus pygargus* and Pallid Harrier *Circus macrourus*, was considered for identifying potential grassland habitats. The data generated through field surveys, landscape surveys, interviews, and species presence data of the recent past 2018 onwards was overlaid on a grid-based map to assess the potential areas that need to be conserved. The grasslands were likely demarcated using Google Earth. Other fauna like Striped Hyena *Hyaena hyaena*, Small Indian Fox *Vulpes bengalensis*, Golden Jackal *Canis aureus*, Jungle Cat *Felis chaus*, Egyptian Vulture *Neophron percnopterus*, Amur Falcon *Falco amurensis*, Bonelli's Eagle *Aquila fasciata*, and Short-toed Snake Eagle *Circaetus gallicus* were also documented.

4.8 Blackbuck-human conflict

To better understand the complex issue of human-wildlife conflict, it is important to collect data on the tactics used by farmers to drive away the blackbucks and finding out problem animals other blackbucks. The data wase gathered through questionnaire surveys and provide detailed insights into the causes of human-wildlife conflicts. The pattern of crop raiding was assessed using regular field visits and interviews with locals. Data was collected to understand the response of animals to sound devices used by farmers to drive away the blackbuck. Overall, questionnaire surveys are a powerful tool for collecting detailed data on human-wildlife conflict. By using this data to inform evidence-based management strategies, we can work towards reducing the negative impacts of human-wildlife conflict and promoting coexistence between humans and wildlife. Secondary information based on interviews regarding Blackbuck and associated species occurrence and perceived threats was collected from local respondents' herders and farmers, with age 50< preferred. Secondary information based on interviews regarding the occurrence of Blackbuck and associated species and perceived threats was collected from local respondents (herders and farmers).

5) Results

5.1 Early Winter Survey November 2021

The study of sampled grids (N=99) found that roads posed the highest threat probability, followed by powerlines, settlements, dogs, and quarries. The field survey was conducted from October 31, 2021, to November 29, 2021. In this survey, 99 grids were surveyed during the landscape survey and **816** Blackbucks were sighted. The structure groups in Table 1.

Sr. No.	No. of individuals in a group	No. of Groups	Total Count
1	0–10	103	368
2	11–50	19	378
3	51–350	1	70
	Total	**123**	**816**

Table 1: Total count of Blackbucks sighted during the early winter landscape survey in Bidar District in winter 2021

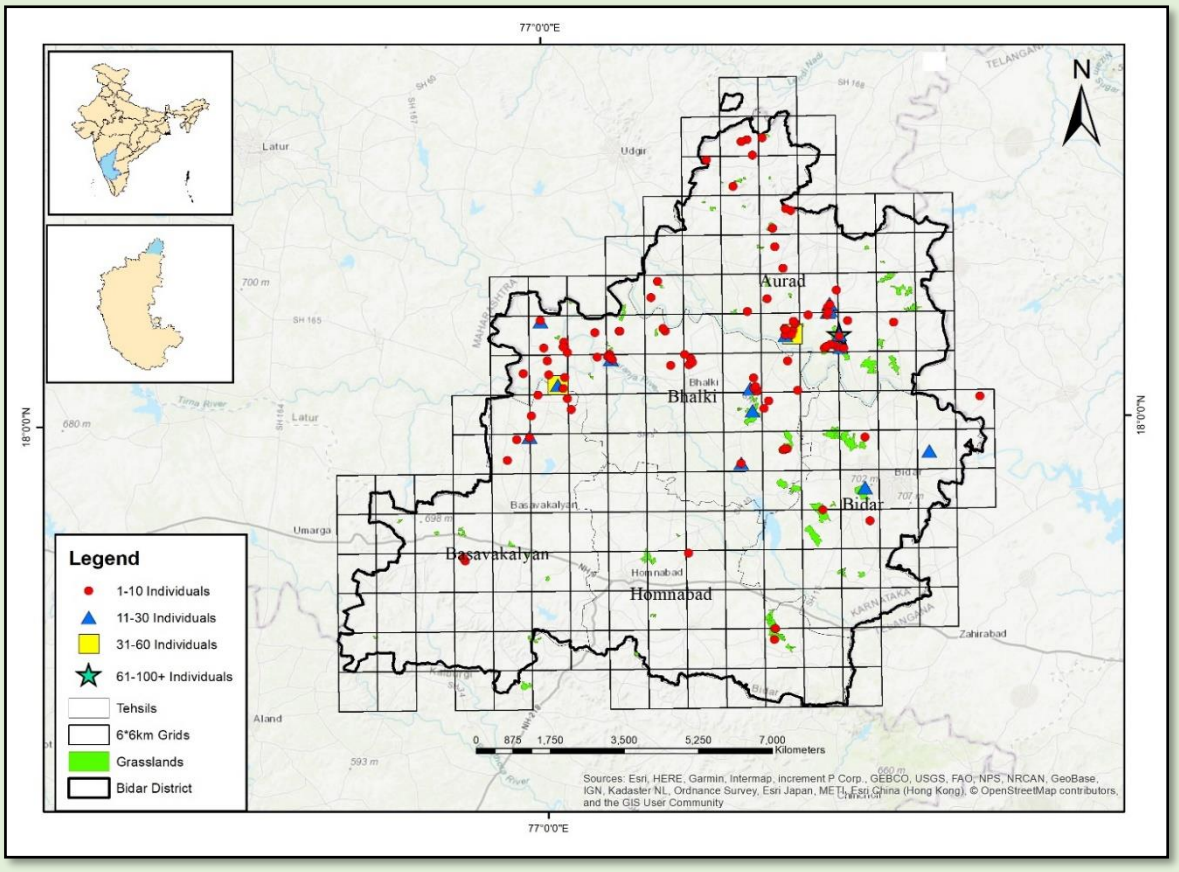


Figure 2: Blackbucks observed during the landscape survey in Bidar from October 2021 to November 2021

5.2. Monsoon Survey July-August 2022

Surveys were also conducted from July 20 to August 3, 2022. In the monsoon, 95 grids were surveyed, which compose more than 83% of grids and an area of 2,375 sq. km. During the survey, an average length of 12 km a transect was conducted in each grid on the vehicle; around 950 km length of the transect was covered along with a 10-minute point count at an

interval of 2 km each. Overall, 454-end counts 454 x 10 min = 4,540 minutes were conducted for the data. In each team, four observers were deployed. Therefore 454 x 4 = 1,816 minutes or 30.2 human hours were spent for the point count observation. In this survey, **1241** blackbucks were recorded. The groups are mentioned in Table 2.

Sr. No.	No. of individuals in a group	No. of Groups	Total Count
1	0–10	16	53
2	11–50	27	532
3	51–350	4	656
	Total	**47**	**1241**

Table 2: Distribution of Blackbucks during monsoon survey in Bidar District

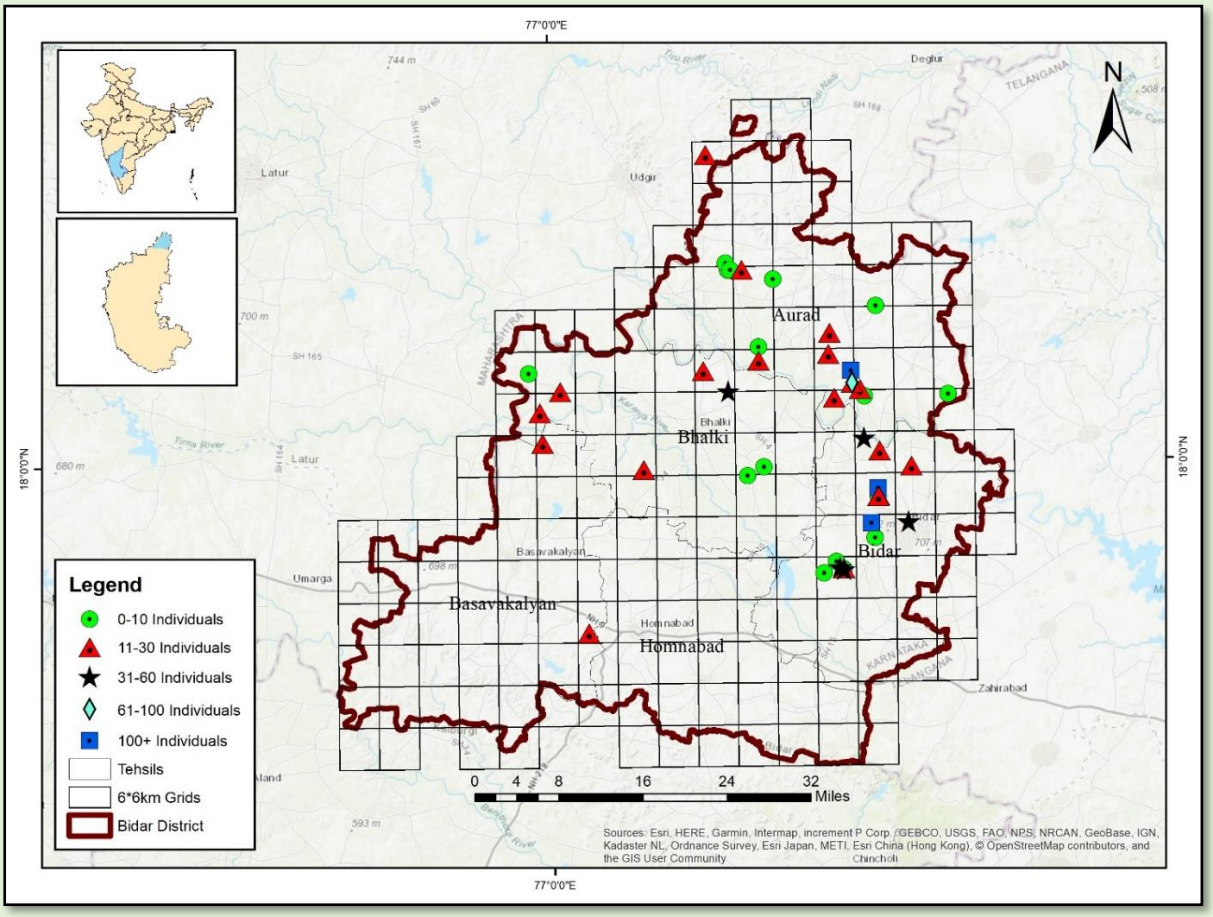


Figure 3: Blackbucks observed during the landscape survey in Bidar during July 2022- August 2022

5.3. Post Monsoon Survey October-December 2022

Surveys were also conducted from October 1 to December 20, 2022. The high-potential grasslands identified in Bidar districts were surveyed post-monsoon, and data was collected by point count observation. In this survey, **1007** blackbucks were recorded. Group-wise numbe, ther of individuals is mentioned in Table 3.

Sr. No.	No. of individuals in a group	No. of Groups	Total Count
1	0–10	78	283
2	11–50	28	554
3	51–350	2	170
	Total	**108**	**1007**

Table 3: Distribution of Blackbucks during post-monsoon survey in Bidar District

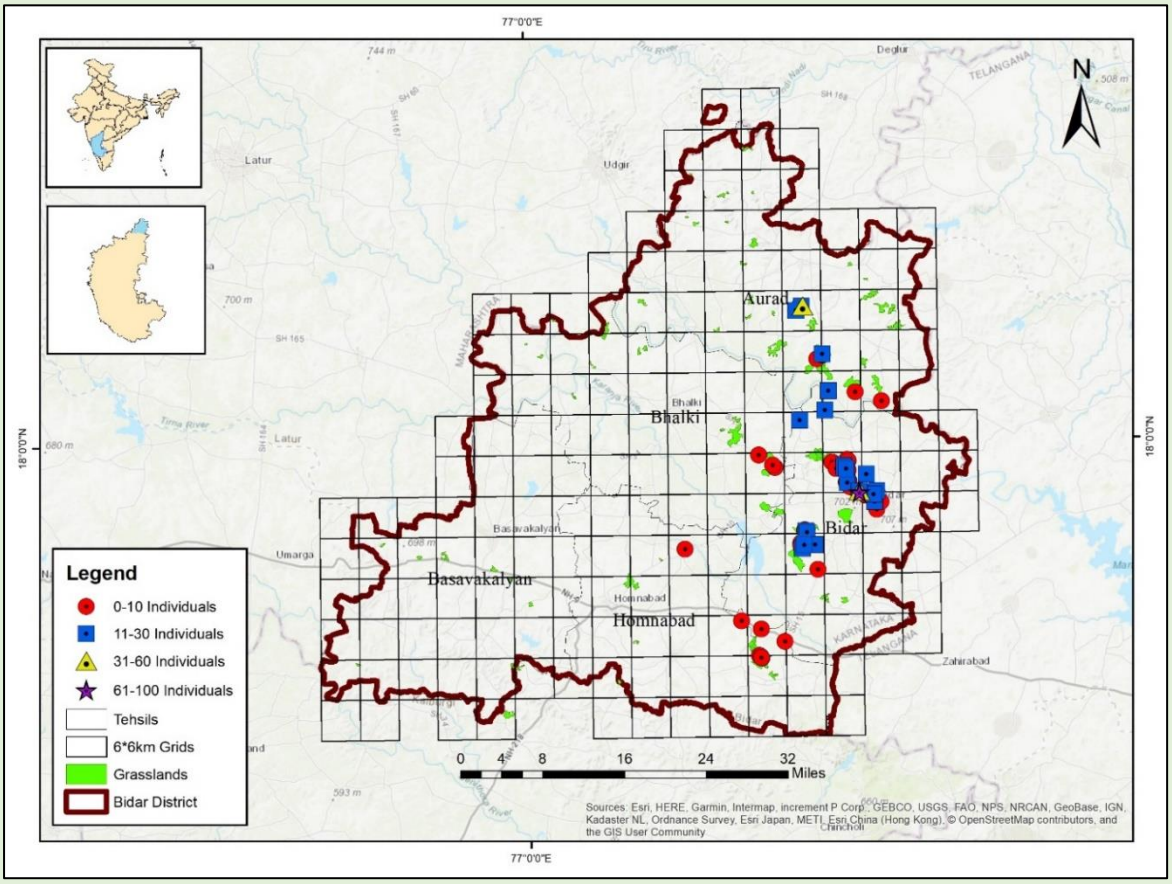


Figure 4: Blackbucks observed during the regular landscape survey in Bidar during October 2022-December 2022

5.4. Site-specific surveys across selected grasslands (January to March 2023)

Eleven sites were selected based on records of the congregation of Blackbuck and the size of the area, and three visits were conducted during the study period from which the herd and group composition were recorded. In this survey, **837** blackbucks were recorded. The groups are mentioned in Table 4.

Sr. No.	No. of individuals in a group	No. of Groups	Count across 11 sites
1	0–10	64	231
2	11–50	20	423
3	51–350	4	183
	Total	**88**	**837**

Table 4: Distribution of Blackbucks during site surveys in selected grasslands in Bidar District

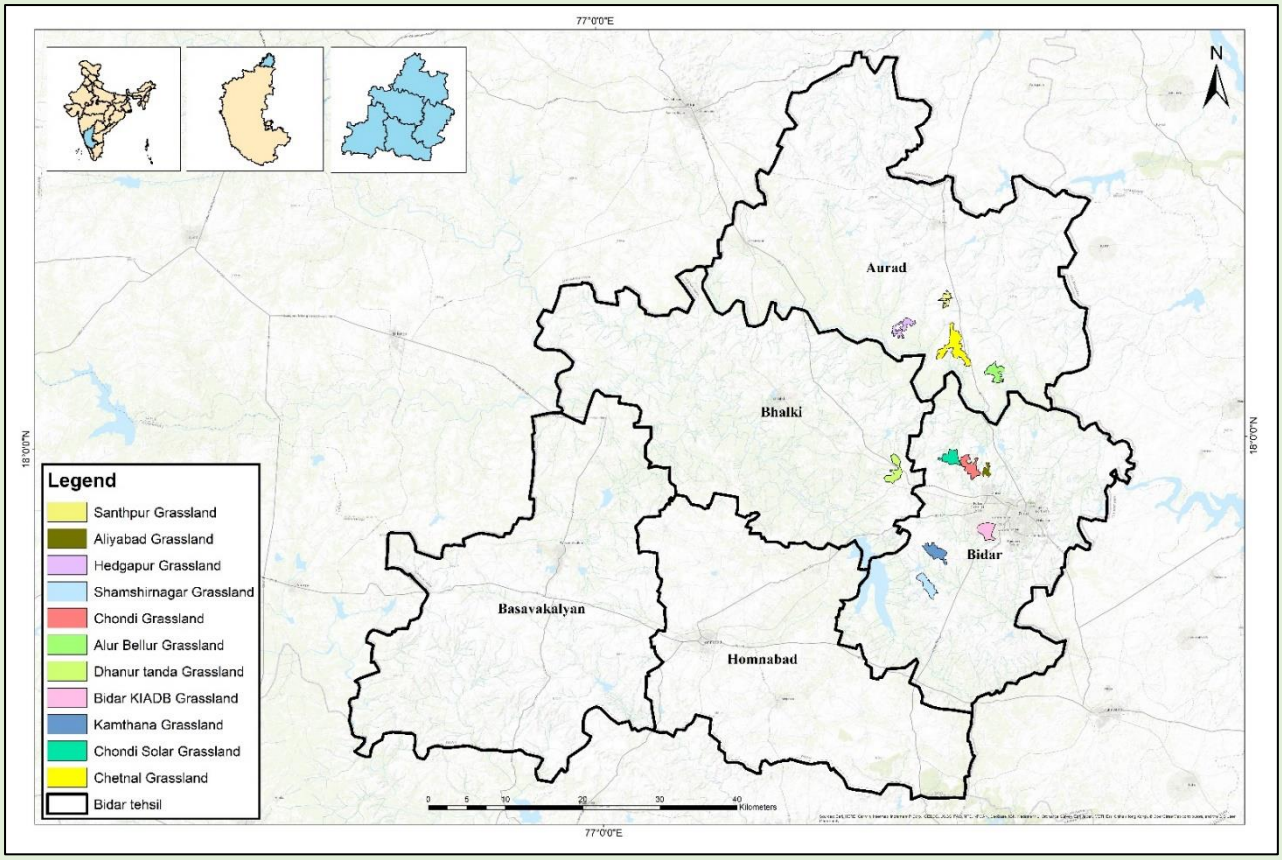


Figure 5: Eleven major grasslands were chosen for detailed study

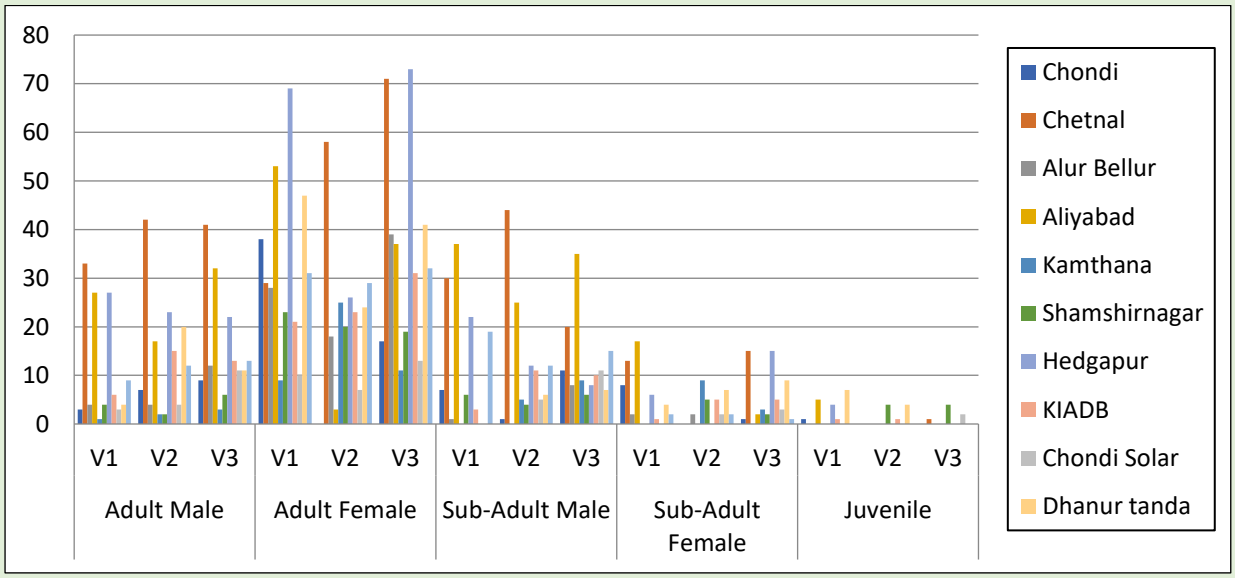


Figure 7: No. of Blackbucks sighted visit-wise during the survey (V=visit. KIADB plot= Karnataka Industrial Areas Development Board)

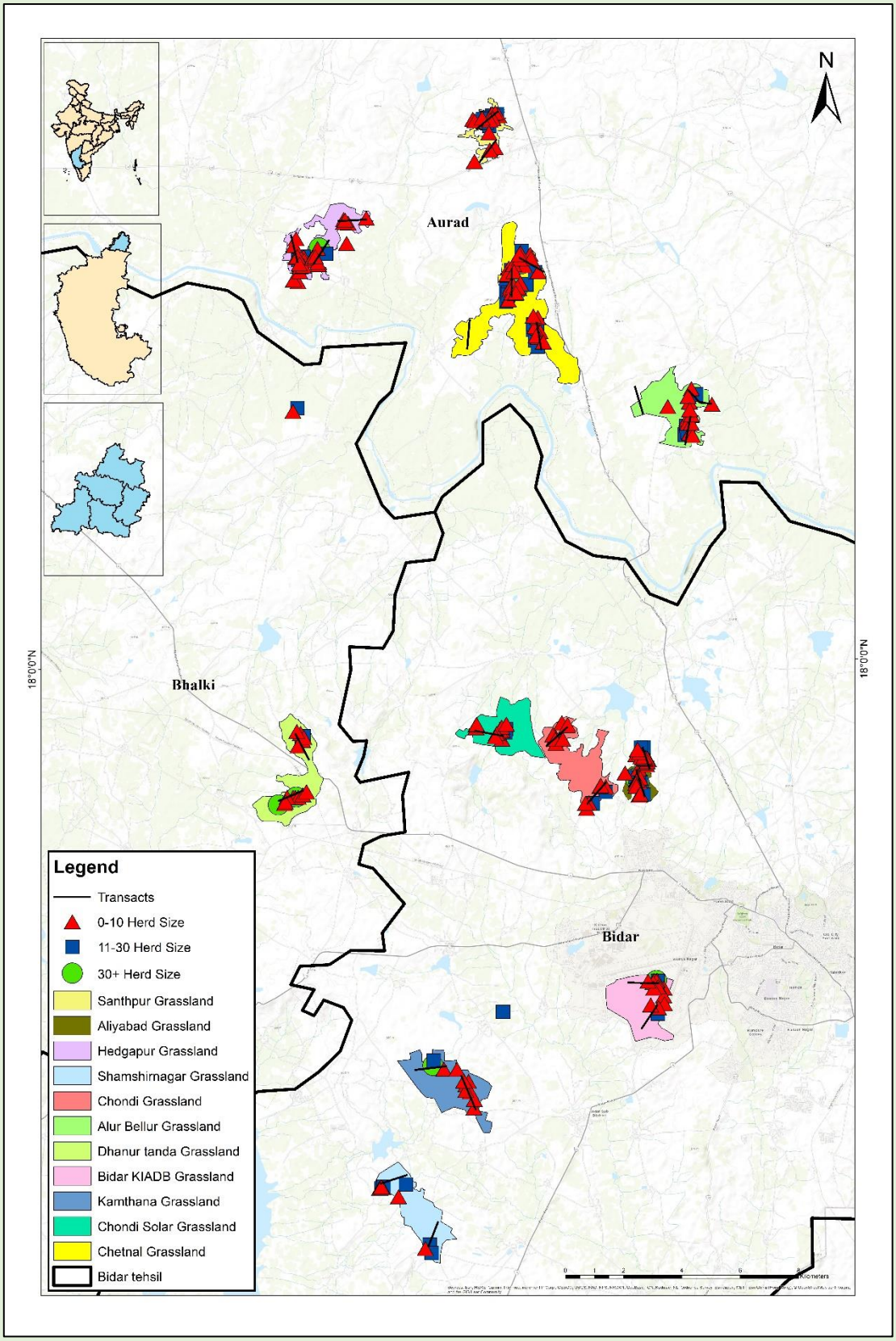


Figure 6: Distribution of Blackbucks according to herd size observed during the survey in January-March 2023 in Bidar

5.4.1 Demographic data of Blackbuck observed during the survey of each visit

Demographic data found during the count survey at each monthly visit made from December 2022 to March 2023 gives insight into Blackbuck's age structure at different sites.

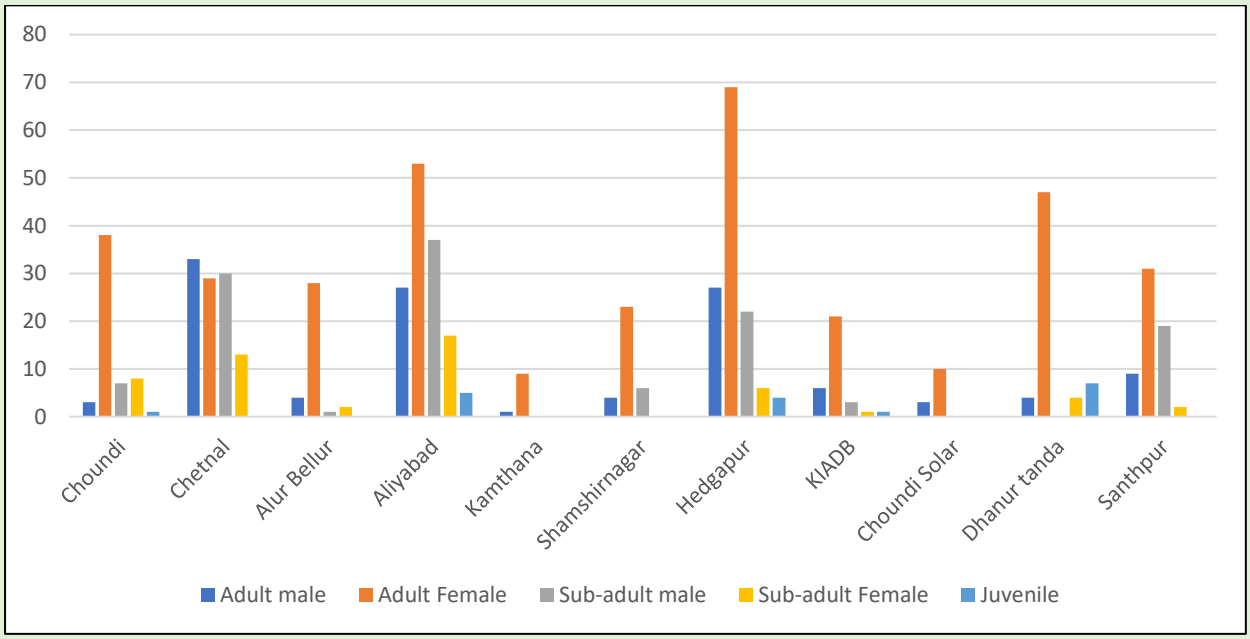


Figure 8: Demographic Data of Blackbucks during first visit

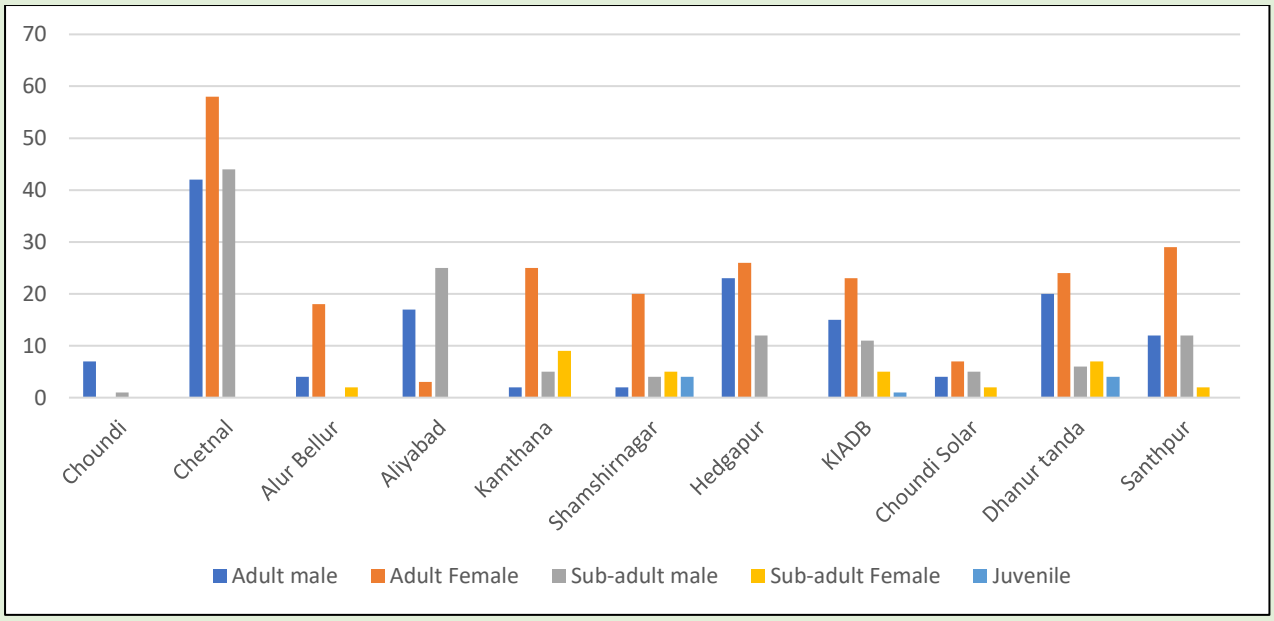


Figure 9: Demographic Data of Blackbucks during 2nd visit

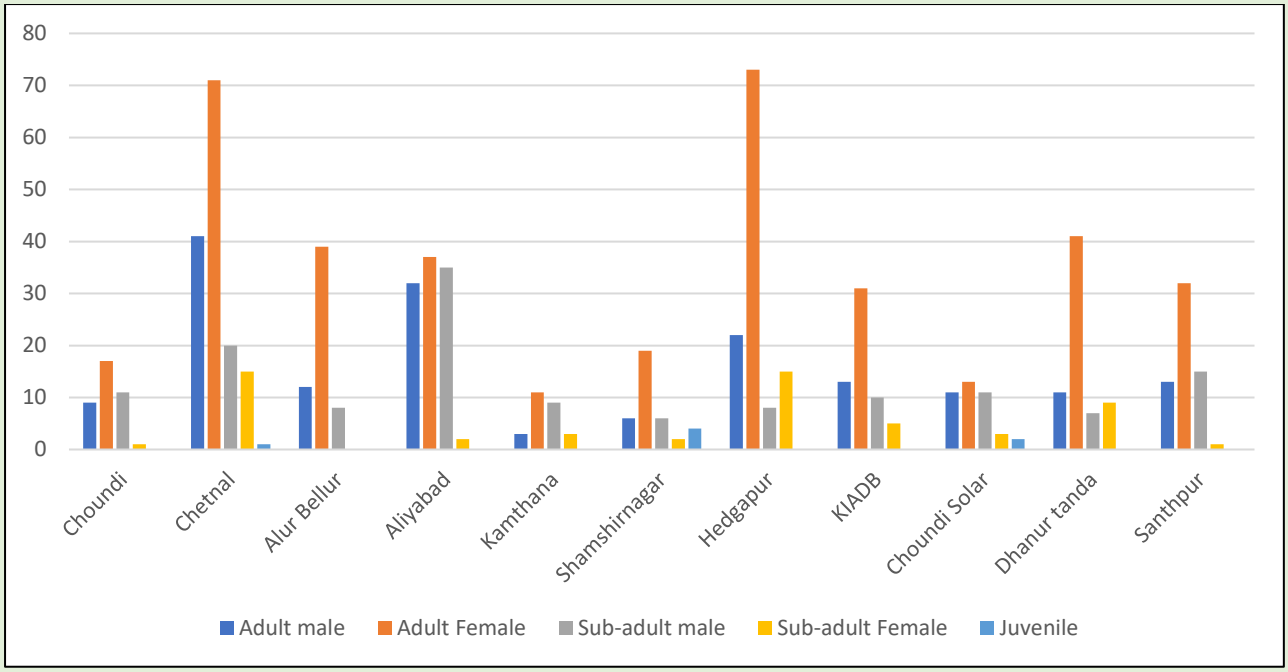


Figure 10: Demographic Data of Blackbucks during 3rd visit

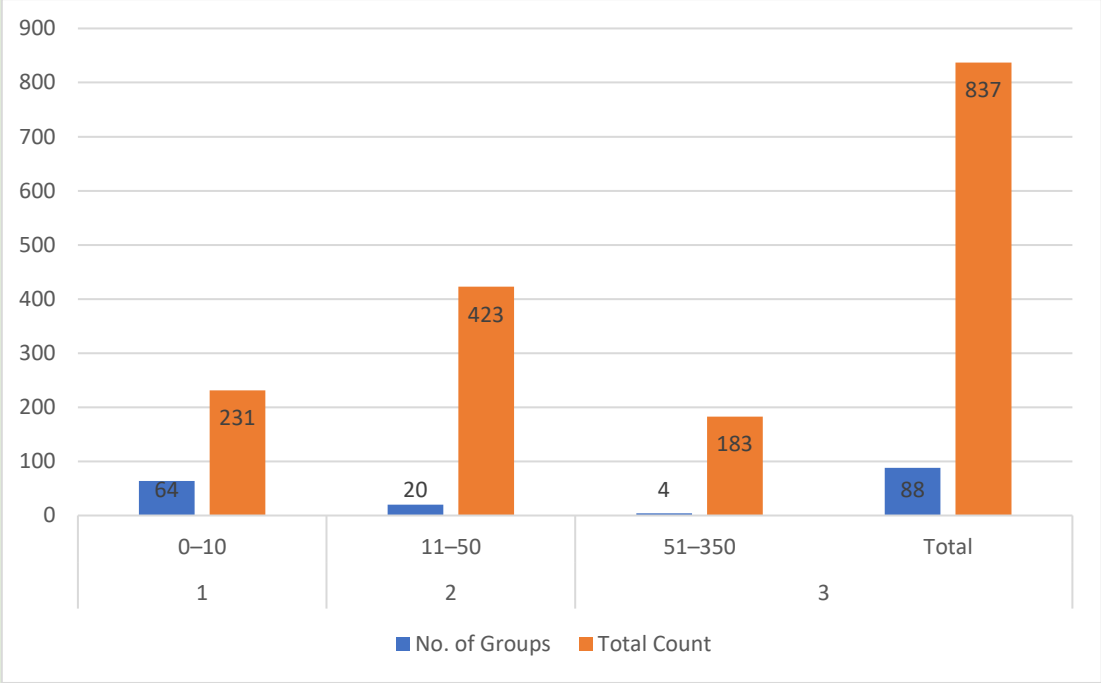


Figure 11: Size of herds and their average count in 3 visits

5.4.2. Daylong observations at selected sites

Two of the 11 selected sites, Aliyabad and Chetnal were selected based on the high blackbuck count observed in 3 counts. One site, the KIADB area, was chosen because the blackbuck population is isolated in the area, as the grasslands are covered from all directions by the city and development.

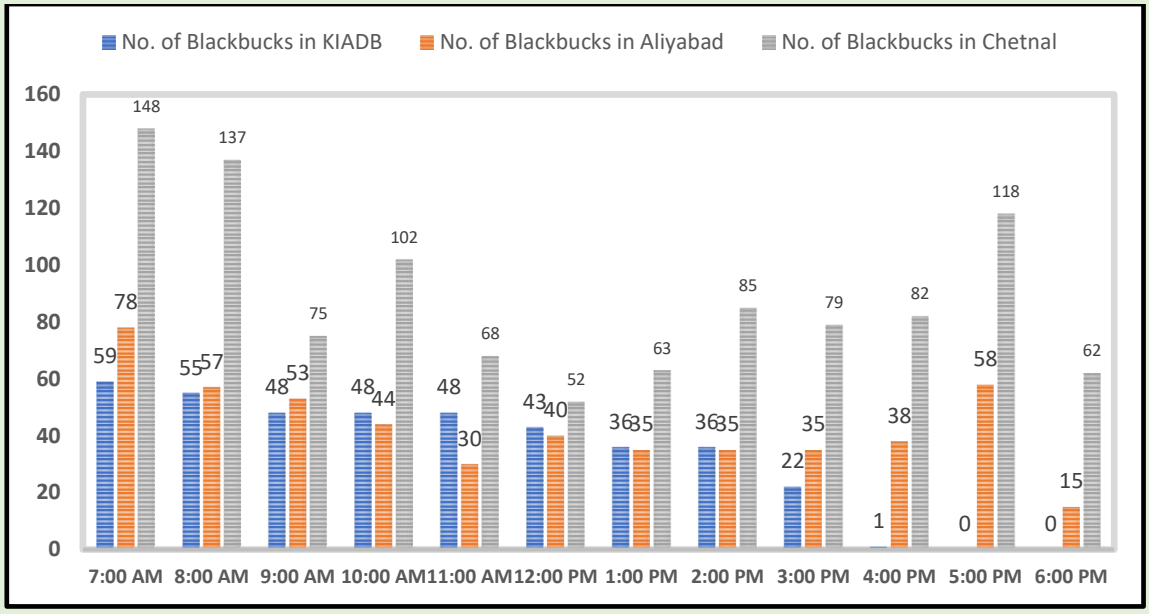


Figure 12: Count of Blackbucks observed Daylong at KIADB, Aliyabad, and Chetnal

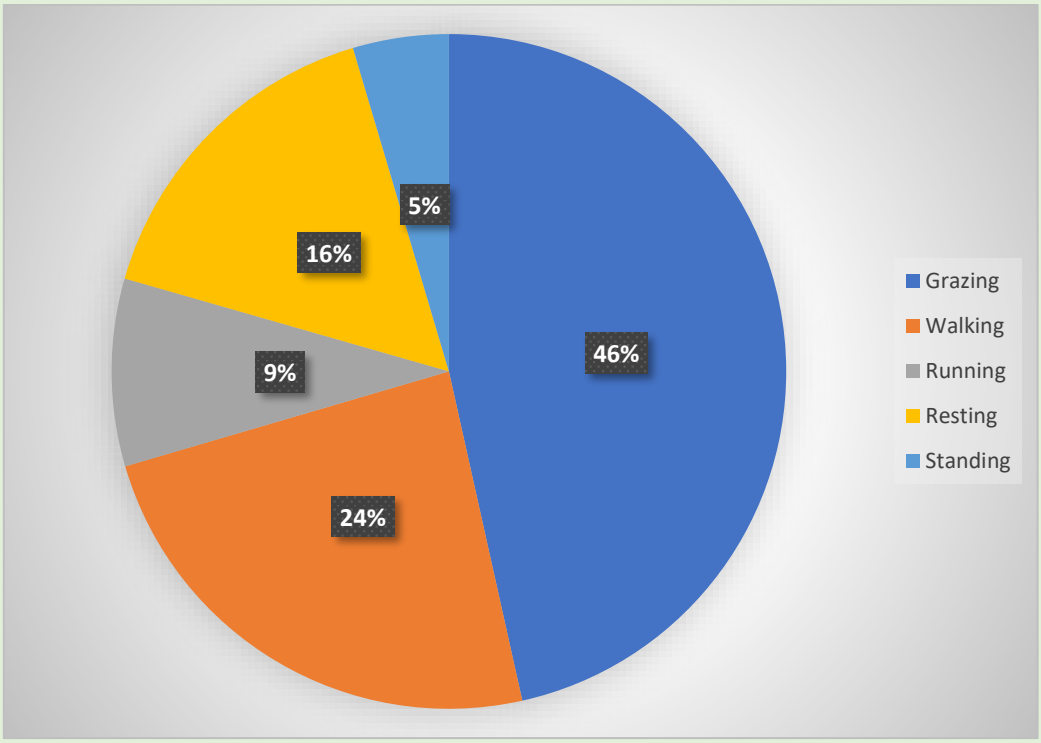


Figure 13: Daylong overall activity observed altogether

1) Chetnal

At 7:00 am, the survey observed the highest count of 148 Blackbucks for the day. The count decreased gradually over the next few hours, with 137 observed at 8:00 am, 75 at 9:00 am, and 102 at 10:00 am. The count decreased sharply, with only 68 followed at 11:00 am and 52 at noon. However, the count increased slightly in the afternoon, with 63 observed at 1:00 pm, 85 at 2:00 pm, and 79 at 3:00 pm. The count remained relatively steady from 4:00 pm to 6:00 pm, with 82, 118, and 62 Blackbucks observed, respectively. Overall, the table shows the variation in the number of Blackbucks observed during different hours of the day. It provides

valuable information for conservation efforts, indicating the time duration the blackbucks are most active and the location where they are concentrated.

2) Aliyabad

At 7:00 am, 78 Blackbucks were observed, the highest count of the day. The count gradually decreased over the next few hours, reaching its lowest point at 6:00 pm when only 15 Blackbucks were observed. There are a few notable changes in the count during the day. The count dropped significantly between 10:00 am and 11:00 am, with only 30 Blackbucks observed at 11:00 am compared to 44 at 10:00 am. There was also a slight increase in count between 4:00 pm and 5:00 pm, with the count increasing from 38 to 58 blackbuck observed.

Figure 12 shows a gradual increase and decrease in the count compared to the other 2 locations. Maximum count was seen at 7 am, which was also when the maximum movement of blackbucks was observed. The count kept fluctuating till noon, after which, for 3 hours, only a single herd was observed from 1 pm to 3 pm from the vantage point. The pack was observed mainly resting and very casually grazing during the afternoon. Another peak in the count could be seen at 5 pm when multiple herds were observed entering and exiting the grassland. Active grazing was observed during this time. A sudden decrease in the count was because of 3 dogs that entered the tables and started chasing all the blackbucks, which resulted in many blackbucks leaving the site.

3) KIADB plot

During the daylong survey, it was observed that a herd of 35 individuals was constant throughout the survey; all the blackbucks started to move away from sight at around 1:30 pm. It was observed that the herd moved in batches and not all simultaneously. By 4 pm, only one male individual was seen from the vantage point, who eventually also walked out of sight at around 4:40 pm. The closest waterbody to the congregation site for KIADB is Bellura Lake, which is the exact direction in which all these individuals were seen heading. All the blackbucks were likely moving through the site to quench their thirst. While interviewing local farmers, they informed us about how all the blackbuck could be seen drinking water near the lake in the afternoon. farmers have shared their observation that after quenching their thirst, the blackbucks do not return to the same place they came from but congregate in different locations. This was further confirmed by personal observation after ending the survey at 6 p.m. and leaving the grasslands, the same herd was seen grazing at a different location within the grassland, and the location was exactly where the farmers presumed. During the set 1 blackbuck count survey, a visit was made to the KIADB area in the evening. A herd was observed with roughly the exact count and ratio. This indicates that Blackbucks follow a routine schedule.

5.4.3 Common Plants Observed during the Survey

1. **Common Trees and Shrubs:** In Bidar, Tamarind *Tamarindus indica*, Neem *Azadirachta indica*, Mango *Mangifera indica*, Babul *Acacia nilotica*, Peepal *Ficus religiosa* Shrubs include Indian mallow *Abutila indicum*, White prickly poppy *Argemone albiflora*, Matura tea tree *Senna auriculata*, Ashwagandha *Withania somnifera*, tiny periwinkle *Catharanthus pusillus*, Rubber vine *Cryptostegia grandiflora*, Coatbuttons *Tridax procumbens* were observed.
2. **Grasses:** Bidar is an area where grasses of the family Poaceae dominate the vegetation. Grass include Marvel grass *Dichanthium annulatum*, Gingergrass *Cymbopogon martini*, Gamba grass *Andropogon* spp., Feather finger grass *Chloris virgata*, *Setaria pumila*, *Chrysopogon fulvus*, Crowfoot grass *Dactyloctenium aegyptium*, Aleppo grass *Sorghum*

halepense, Desert black-millet *Melanocenchris jacquemontii*, Kangaroo grass *Themeda triandra*, White grass *Sehima nervosum*, Gold-beard grass *Chrysopogon gryllus*, Black speargrass, *Heteropogon contortus*, Foxtail *Setaria italica*.

3. **Invasive Plants:** Invasive plants in Bidar during landscape survey Crown flower *Calotropis gigantea*, Giant Milkwood *Calotropis procera*, Angel's trumpet *Datura innoxia*, Mesquit *Prosopis juliflora*, Sickla senna *Senna tora*. Invasive herb species Burkill *Cassia hirsuta*, Sliver Cock comb *Celosia argentea*, Pignut *Hyptis suaveolens*, Rose balsam *Impatiens balsamina*, *Mimosa pudica*, *Parthenium hysterophorus* were observed.
4. **Crops:** Agriculture is the main occupation in rural parts of the Bidar district. Agriculture in Bidar had its specific form. Drawing on the specification of the local ecology, agriculture is dry primarily cultivation or rain-dependent cultivation in which a wide variety of local Jowar *Shorgum bicolor* is grown in combination with pulses, oil seeds, wheat, and other cereals. Cultivation is restricted to two seasons, Rabi or "winter cultivation" August–January, and Kharif or "summer cultivation" June–September. In the Rabi season, wheat *Triticum*, mustard *Brassica nigra*, Grams, and Kharif season crop paddy, maize *Zea mays*, jowar *Sorghum bicolor*, bajra *Pennisetum glaucum*, moong *Vigna radiata*, urad *Vigna mungo*, cotton *Gossypium*, and soybean *Glycine max*. Major crops are green gram *Vigna radiata*, Bengal gram *Cicer arietinum*, Rice *Oryza sativa*, Wheat *Triticum* spp., Red gram *Cajanus cajan*, Cotton *Gossypium* spp., Sugarcane *Saccharum officinarum*, and Chilly *Capsicum frutescens*.

5.5 Understanding the distribution, threats, and behaviour of the blackbuck across Bidar (April-October 2023)

It was found that the blackbucks were widely and commonly distributed in Bidar, Aurad, and Bhalki tehsils (Figure 14). This area has potential grasslands and corridors, which are essential for the blackbuck population (see details in section 5.7)—the grasslands in the areas face land use change, resulting in population migration. The threats in the region are powerlines, settlements, dogs, and quarries. The field survey was conducted from April 2023 to October 2023. In this survey, 99 grids selected from previous surveys were surveyed during the landscape survey. (Table 5).

Sr. No.	No. of individuals in a group	No. of Groups	Total Count
1	0–10	85	338
2	11–50	28	625
3	51–350	1	61
	Total	**114**	**1024**

Table 5: Herd structure of Blackbucks in Bidar District

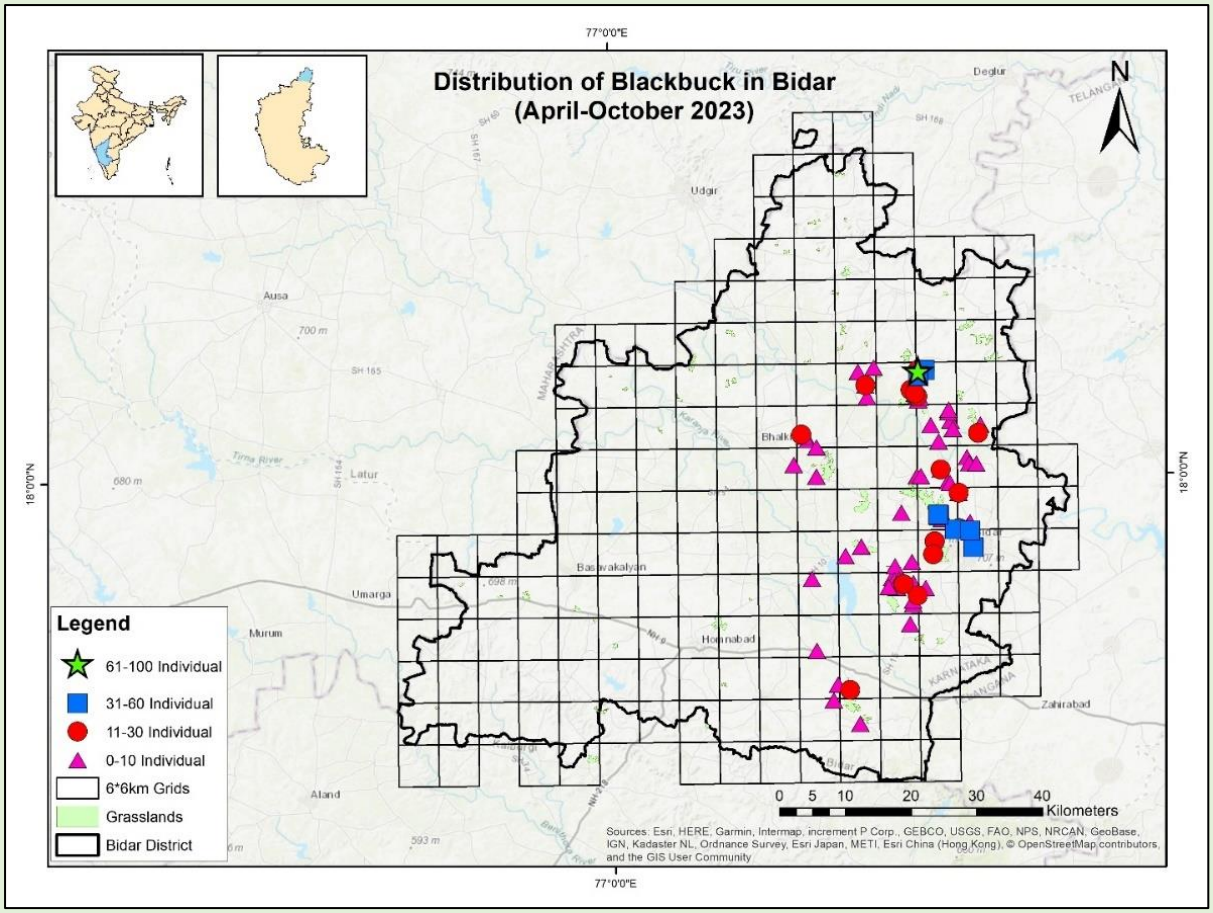


Figure 14: Distribution of Blackbucks in Bidar District during April–October 2023

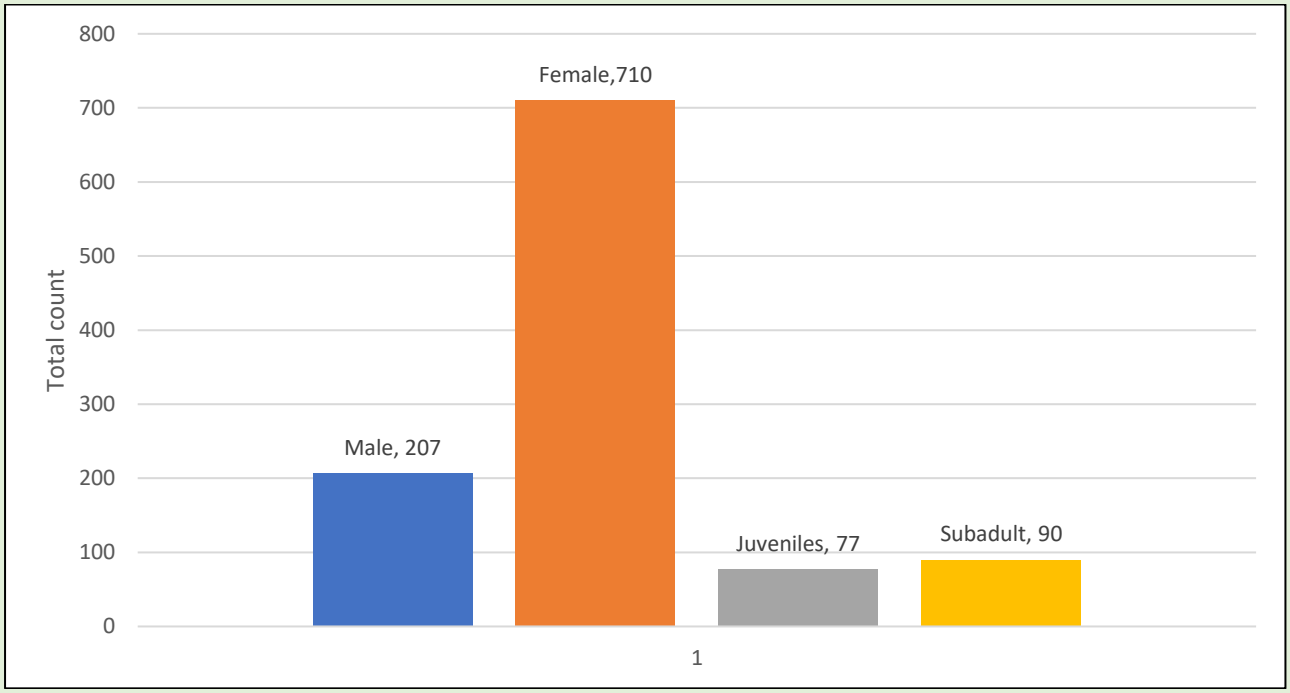


Figure 15 Demographic data of Blackbucks observed during the regular landscape survey in Bidar during April- October 2023

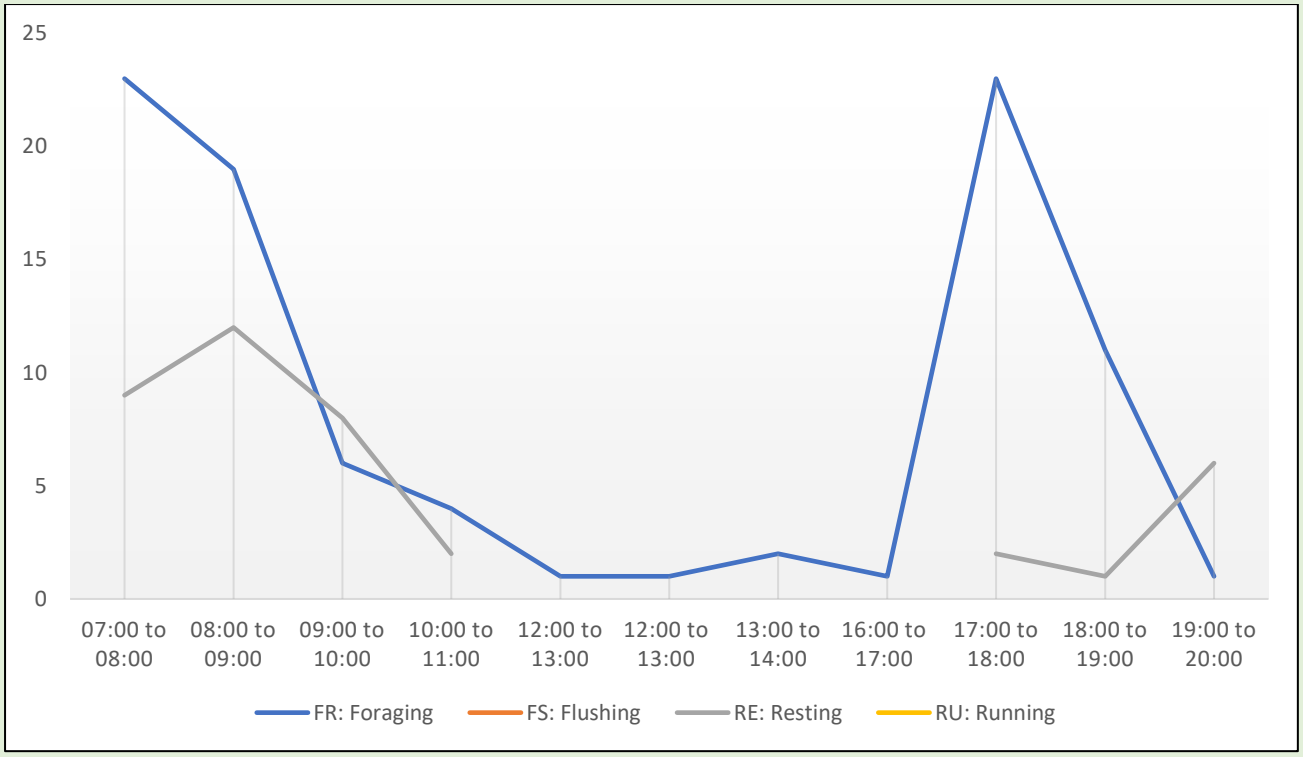


Figure 16: Activity patterns of blackbucks observed in Bidar during April- October 2023

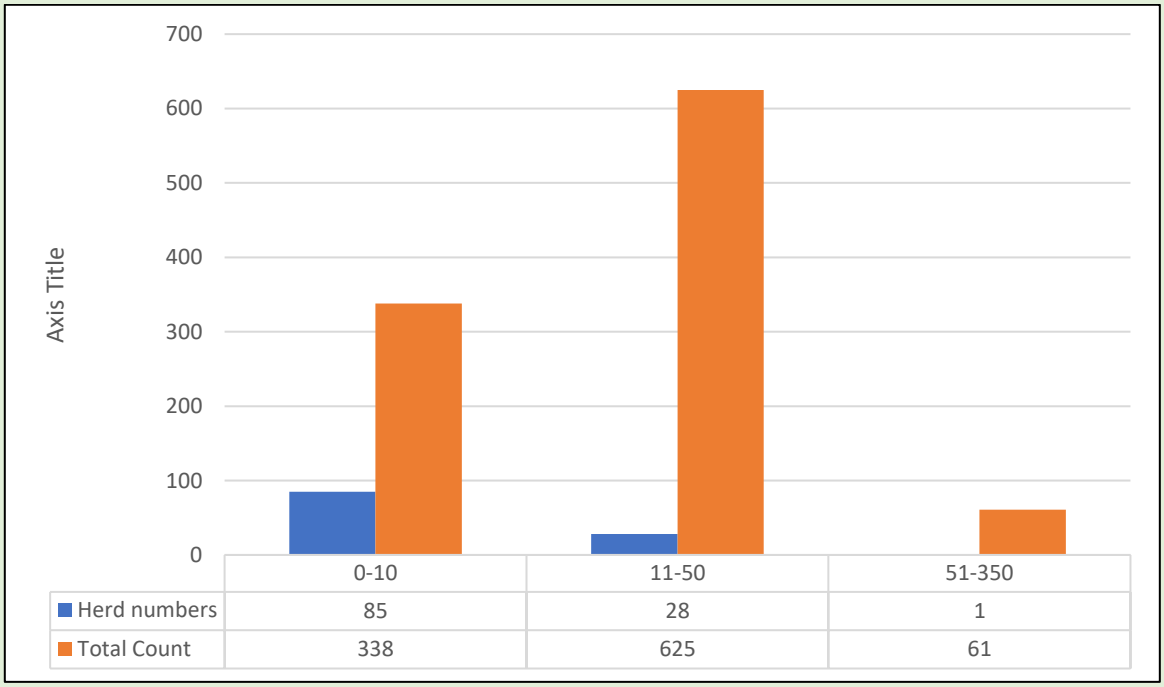


Figure 17: Herd structure of blackbucks observed in Bidar during April- October 2023

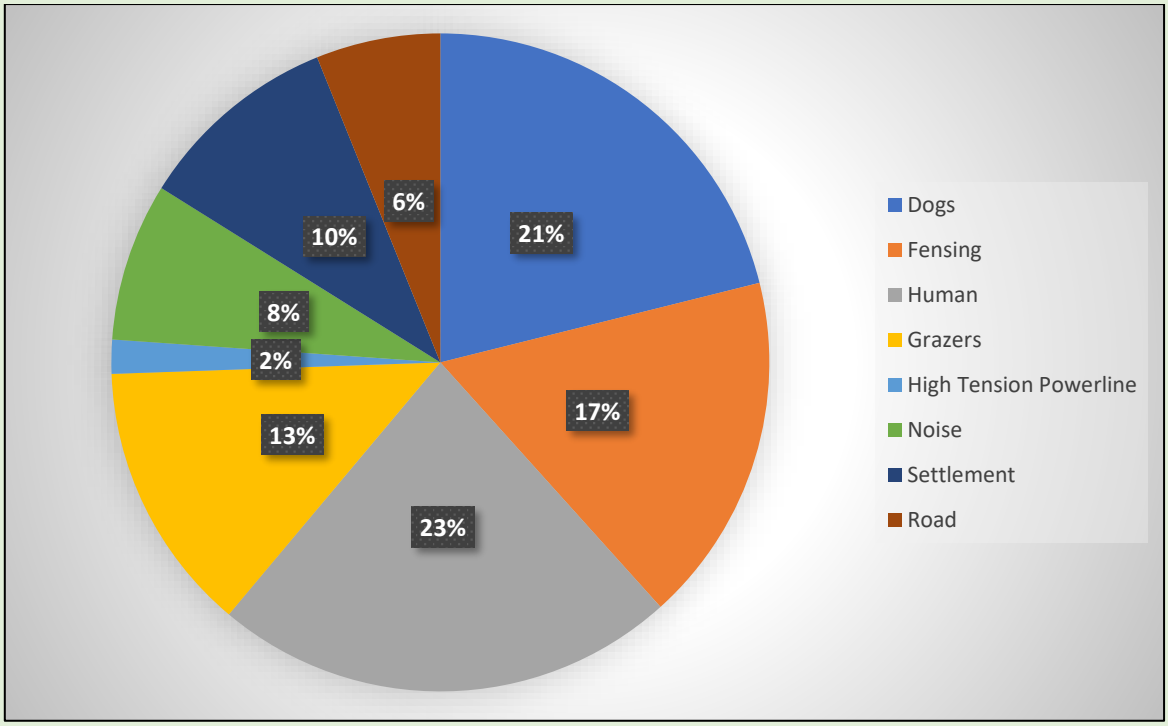


Figure 18: Threats observed in Bidar during April- October 2023

5.6 Distribution of Blackbuck in Bidar (August 2021-October 2023)

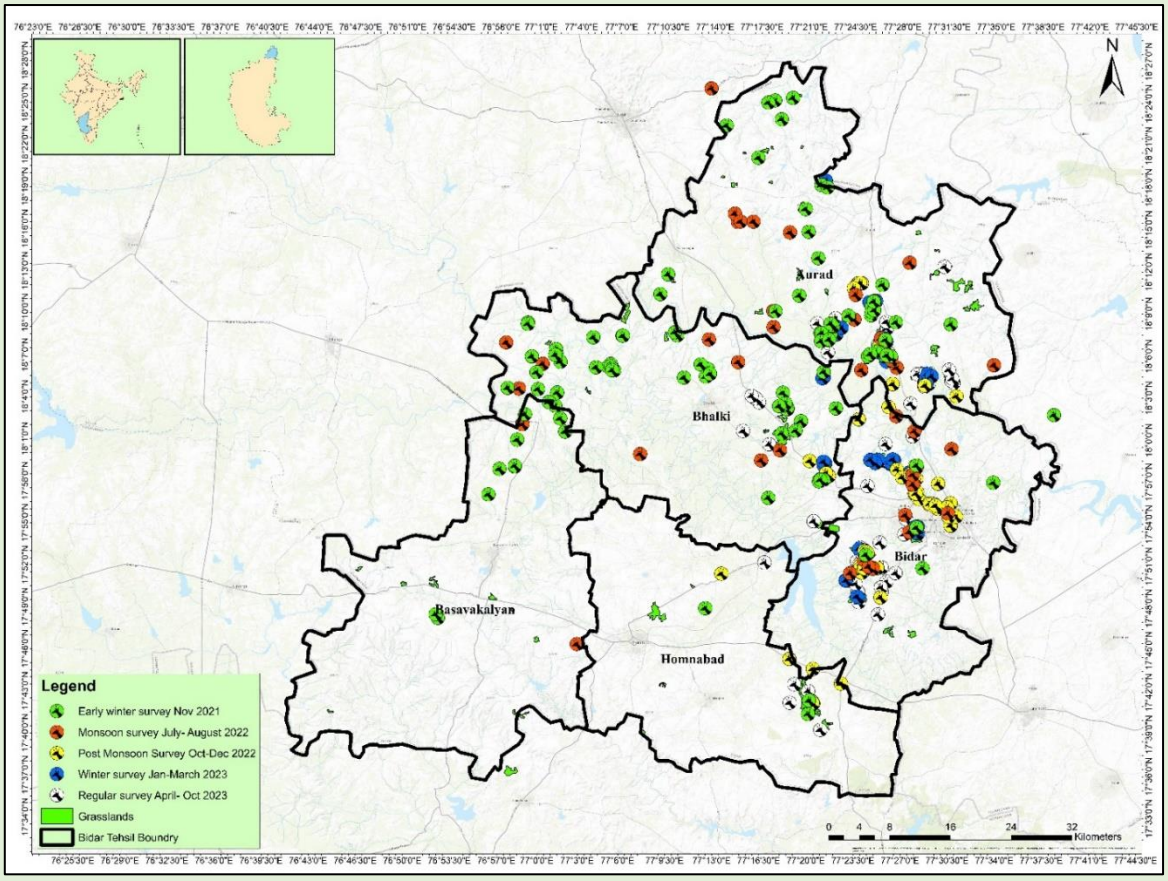


Figure 19: The presence of Blackbucks in all survey data indicates the diversity of Blackbuck in Bidar from August 2021-October 2023

5.7 Identification of essential wildlife areas and corridors in Bidar

BNHS identified the following sites under long-term conservation planning.

1. **Block/Cluster I:** Among significant clusters, the first cluster (Cluster-I) is a mosaic of plantations, grasslands, and traditional agricultural areas from Kamthana, Shamshirnagar, Dhanura, Konmelkunda, Tegampur, Mamdapur-Chondi, Chouli-Aliyabad areas. The prominent fauna represented from this area is Lesser Florican *Sypheotides indicus*, Indian Grey Wolf *Canis lupus*, Blackbuck *Antilope cervicapra*, Small Indian Fox *Vulpes bengalensis*, Golden Jackal *Canis aureus*, Jungle Cat *Felis chaus*, Amur Falcon *Falco amurensis*, Bonelli's Eagle *Aquila fasciata*, Montagu's Harrier *Circus pygargus*, Marsh harrier *Circus aeruginosus* and Pallid Harrier *Circus macrourus*. Konmelkunda, Dhanura, Honnekere, Kamthana, Chitta Forest, and Shamshirnagar are the nearest forest patches in this cluster.

2. **Block/Cluster II**: The second cluster is a mosaic of traditional agriculture, fallow lands, grasslands, and plantations from Alur-Belur, Khanapur, Ujani, Ladha, Chetnal, Mahagaon, Santhpur, and Hedgapur areas. The prominent fauna represented from this area is Indian Grey Wolf *Canis lupus*, Lesser Florican *Sypheotides indicus*, Egyptian Vulture *Neophron percnopterus*, Blackbuck *Antilope cervicapra*, Small Indian Fox *Vulpes bengalensis*, Jungle Cat *Felis chaus*, Bonelli's Eagle *Aquila fasciata*, Short-toed Snake-Eagle *Circaetus gallicus*, Montagu's Harrier *Circus pygargus* and Pallid Harrier *Circus macrourus*. Alur-Belur, Khanapur, Chetnal, Mahagaon, Ladha, and Hedgapur are the nearest forest patches in this cluster.

3. **Block/Cluster III**: Among minor clusters, cluster III is a mosaic of traditional agriculture, fallow lands, and grasslands with undulating terrain at Chikhali, Mudkhed, Hokrana, Dapka, Kherda and Lingi areas. The prominent fauna represented from this area are Chinkara *Gazella bennettii*, Indian Grey Wolf *Canis lupus*, Small Indian Fox *Vulpes bengalensis*, Blackbuck *Antilope cervicapra*, Montagu's Harrier *Circus pygargus*, and Pallid Harrier *Circus macrourus*.

4. **Block/Cluster IV**: It is a mosaic of grasslands, traditional agriculture, and fallow lands near Nirna village. The prominent fauna from this area are Blackbuck *Antilope cervicapra*, Indian Grey Wolf *Canis lupus*, Pallid Harrier *Circus macrourus*, and Montagu's Harrier *Circus pygargus*.

5. **Block/Cluster V**: It is a mosaic of plantations and grasslands on the outskirts of Humnabad, near "Chota Falls." The major fauna from this area is Blackbuck *Antilope cervicapra*, Lesser Florican *Sypheotides indicus*, Indian Jackal *Canis aureus indicus*, Jungle Cat *Felis chaus*, and Montagu's Harrier *Circus pygargus*.

6. **Block/Cluster VI**: It is dominated by traditional agriculture and fallow lands with undulating terrain from Ladwanti, Siruri, Bhosga, Batgera, and Attur. The prominent fauna represented in this area are Indian Grey Wolf *Canis lupus*, Blackbuck *Antilope cervicapra*, Indian Jackal *Canis aureus indicus*, and Montagu's Harrier *Circus pygargus*.

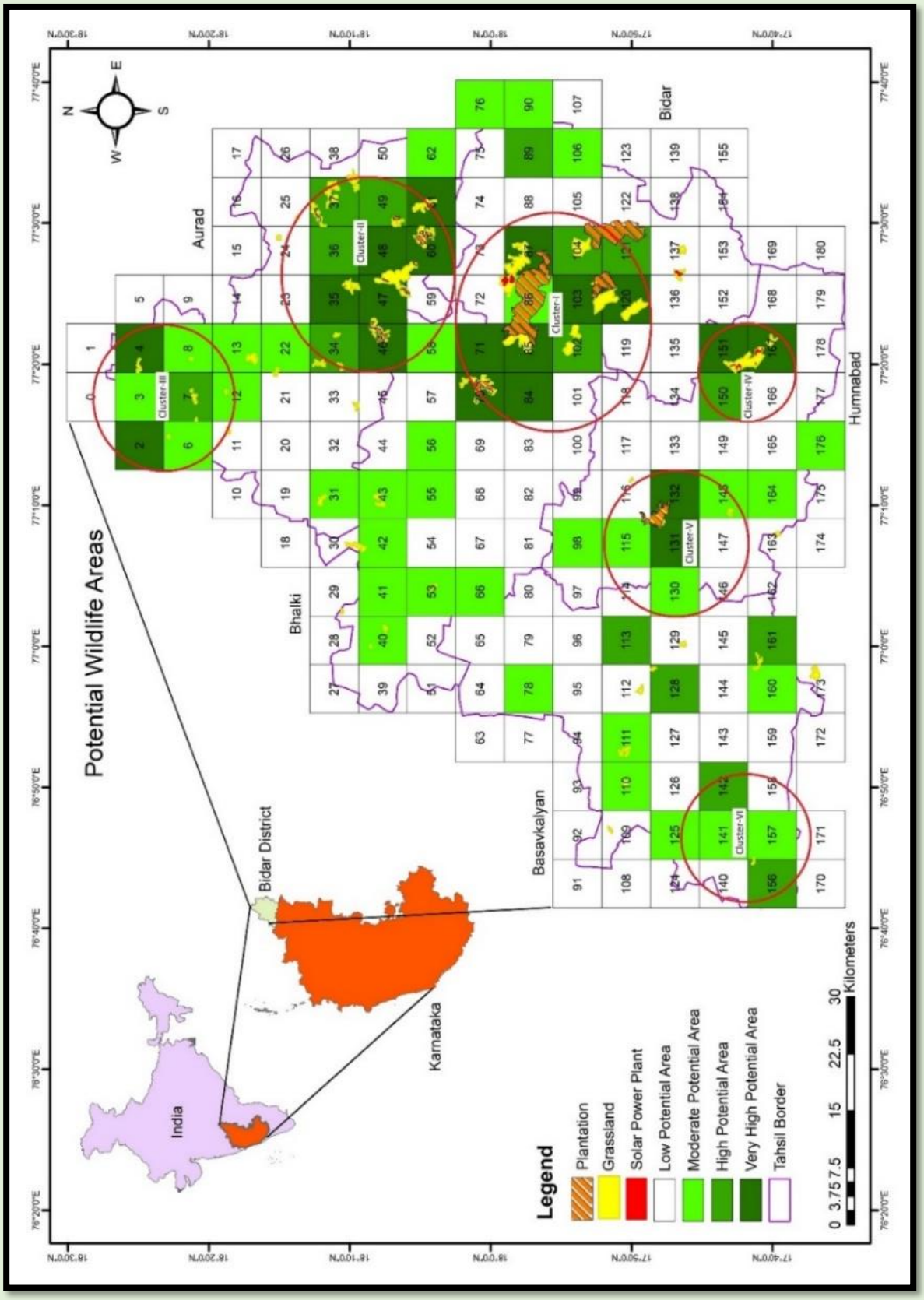


Figure 20 Six clusters were identified with two major and four minor clusters as potential wildlife areas, labelled as Clusters-I, II, III, IV, V, and VI

6) Important Grassland sites for Blackbuck conservation in Bidar

Bidar is known for its rich grassland ecosystems that play a crucial role in supporting biodiversity in the northern part of Karnataka. Presently, these grasslands are facing degradation due to multiple factors including overgrazing, agricultural expansion, urbanization, and invasive species. The grasslands in Bidar are home to a variety of plant and animal species, including grasses, wildflowers, insects, birds, and mammals. The grasslands in Bidar are a vital component of the region's ecology, supporting a diverse range of plant and animal species, and providing traditional livelihoods to many local communities. These ecosystems play a crucial role in regulating the wildlife in Bidar.

To address this issue, it is essential to implement sustainable land management practices, conservation efforts, and policies that promote the protection and restoration of these valuable grassland ecosystems. This can be done by involving the local communities in conservation efforts, raising awareness about the importance of these ecosystems, and fostering collaboration between stakeholders. Additionally, policymakers should prioritize the protection of these grasslands, encouraging sustainable land use practices, and supporting the restoration of degraded areas.

To prepare a conservation reserve, there are several important factors that need to be taken into consideration. The primary criteria that are typically considered include the biodiversity value of the area, the integrity of its habitat, the function of the ecosystem, how well-connected the area is, the various threats and pressures it faces, the engagement of stakeholders, the legal and policy framework surrounding the area, its sustainability, adaptability and flexibility, and public awareness and education. By examining these criteria carefully, conservation practitioners can determine which areas are suitable for reserve designation and implement effective management strategies to help preserve biodiversity and promote ecosystem health.

The BNHS conducted a various survey in the Bidar district of Karnataka, India, spanning from November 2021 to October 2023. The primary objective of these surveys was to assess the presence and distribution of blackbucks and other grassland species in the region. From several grasslands, BNHS chose to prioritize grasslands such as Aliyabad, Nirna, Dhanur Tanda, Santhpur, Khanapur, Alur-Bellur, Chetnal, Chondi, Chondi solar area, Kamthana, Sirsi-Aurad, Shamshirnagar, and KIADB with the intention of creating a conservation reserve for these grasslands.

The surveys were conducted in a systematic and comprehensive manner, with each site being surveyed multiple times over a study period. The data collected included information on the vegetation, habitat, and the presence of various grassland species, including blackbucks. In below site-wise description of the data collected provided valuable insights into the status and abundance of these species in the region.

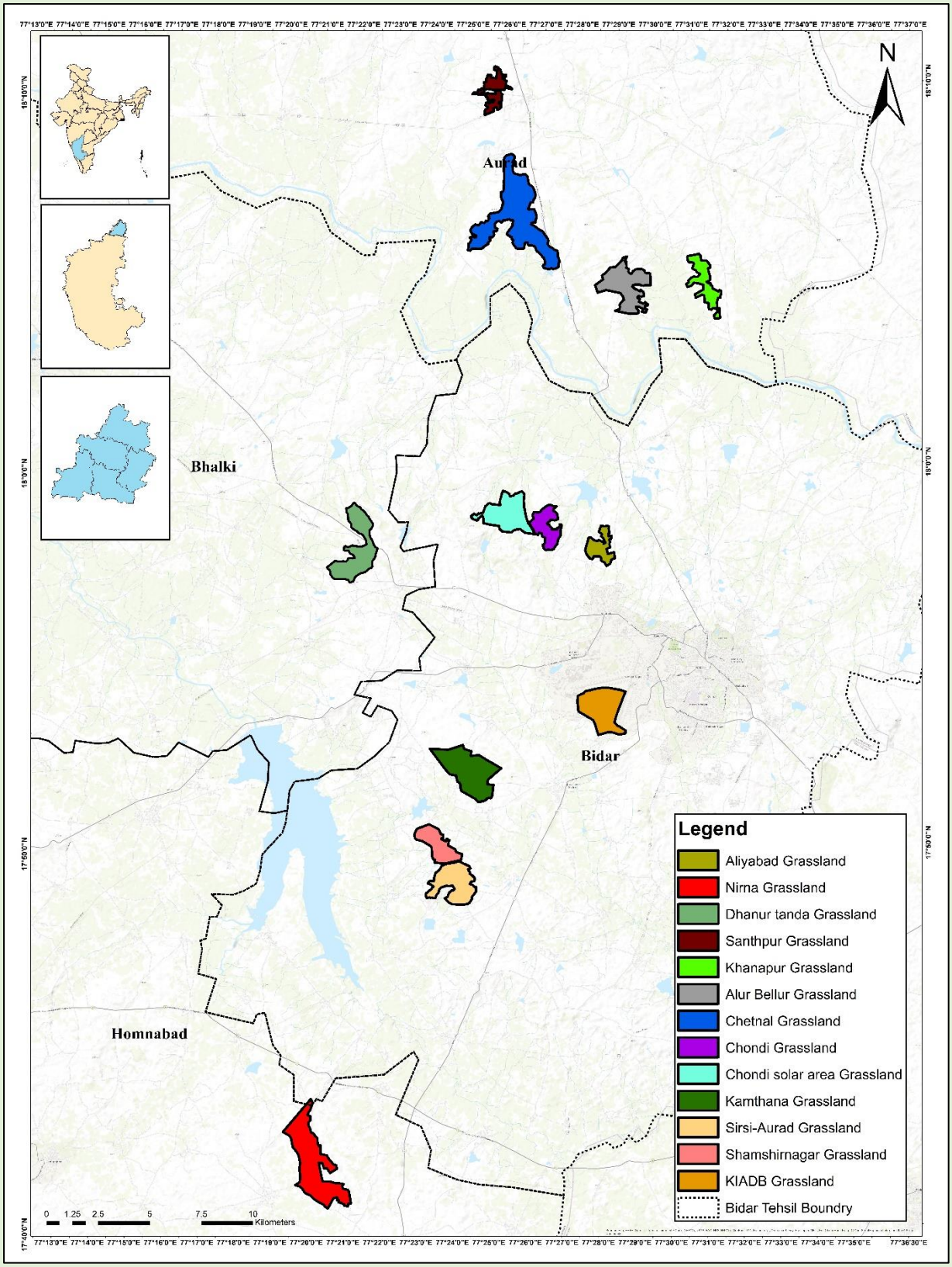
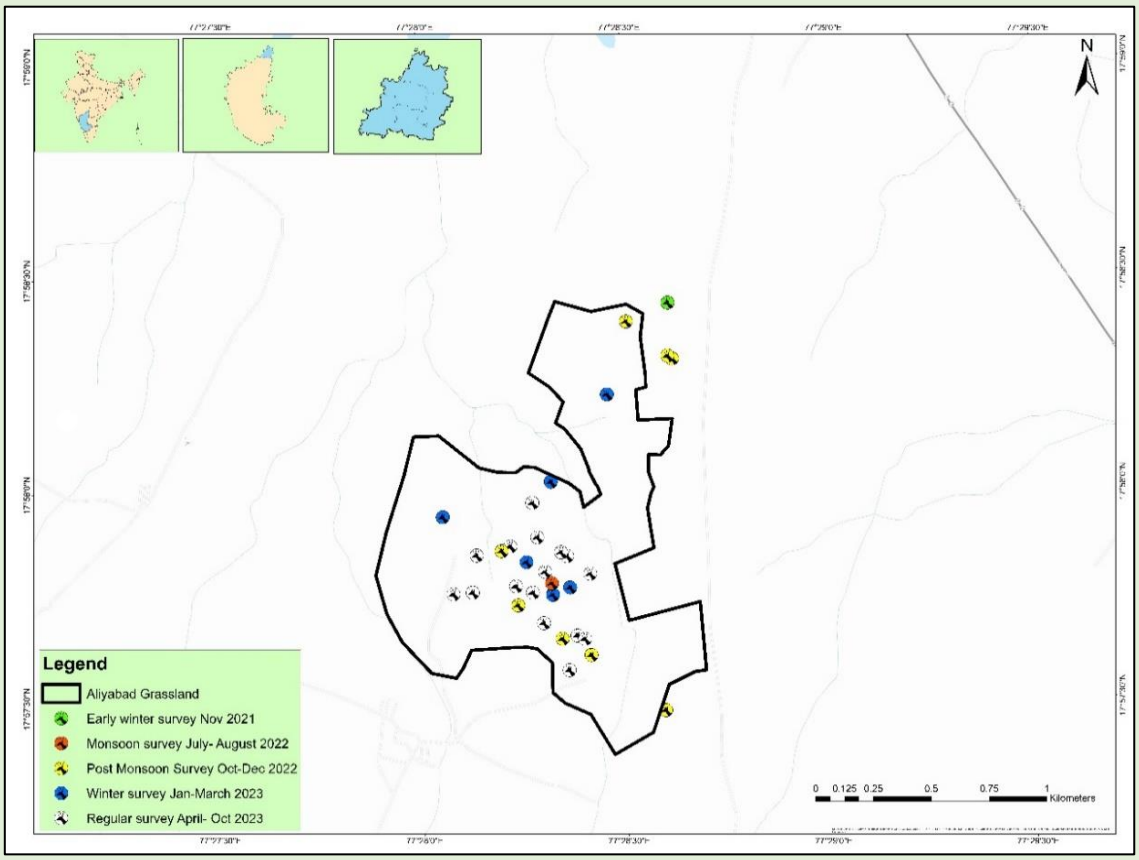
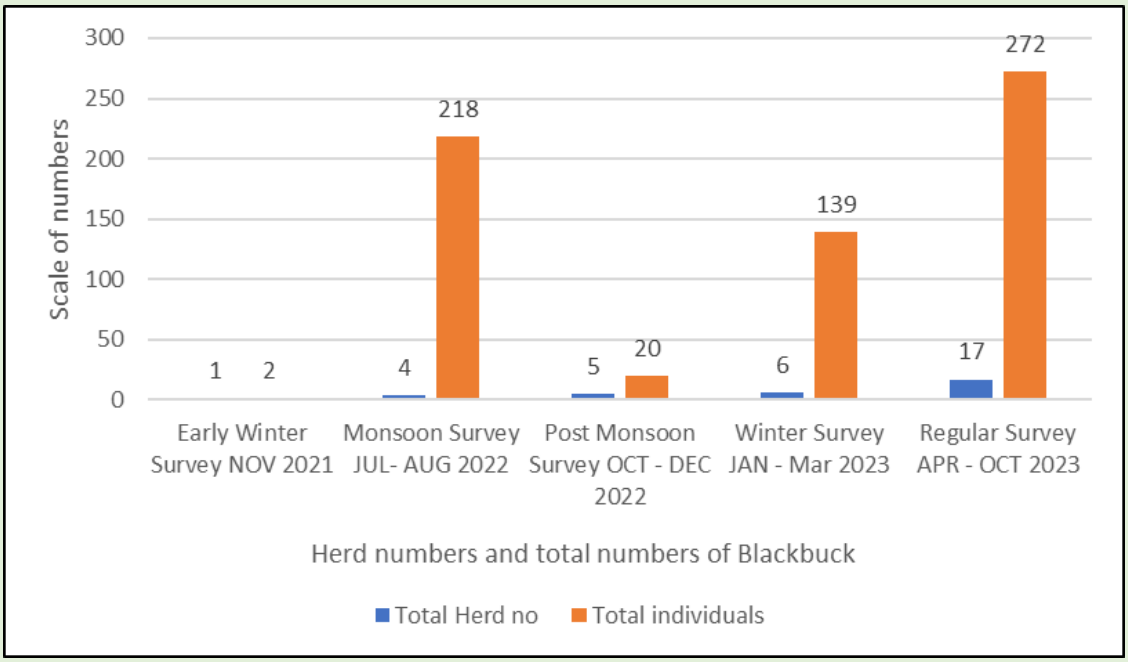


Figure 21 Important Grasslands suggested by BNHS to prepare conservation reserve in Bidar

6.1 Aliyabad





Figures 22 & 23 Seasonal variation of blackbuck in Aliyabad grassland

Aliyabad Grassland (17.962430 N and 77.471812E), situated under grid 87, is selected for observing Blackbuck, movements, and other grassland-dependent species. The Aliyabad grassland area is located near Naubad Bidar Road. On the west side of the grassland, there is Chauli village. Aliyabad villages are situated on the south side of the grassland.

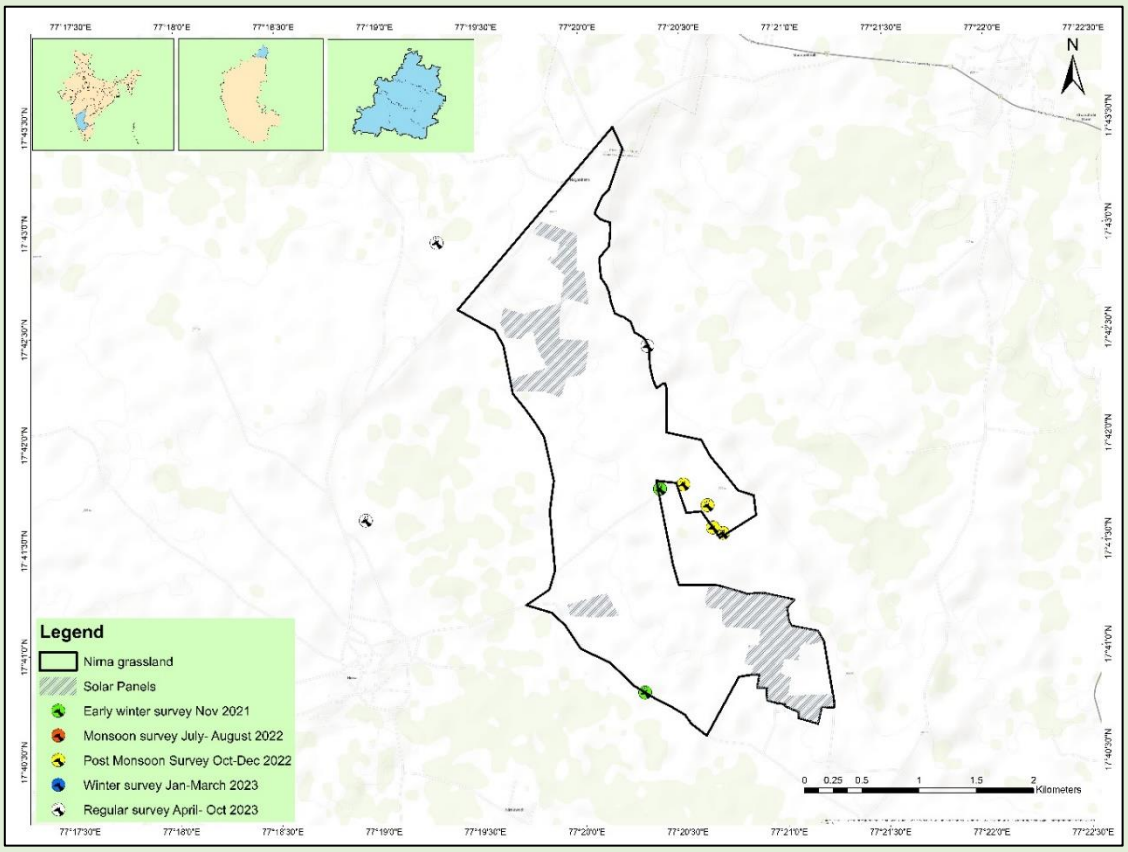
The terrain is undulating and stony; a red soil type is present. The area is covered with semi-arid grassland, agricultural land, fallow land, and scrubland. *Heteropogon*, *Dicanthium*, *Themeda*, *Apluda*, *Cymbopogon*, and *Crysopogon* spp. are the dominant grasses present in grasslands. Soybean *Glycine max*, Toor *Cajanus cajan*, Cotton *Gossypium*, and Safflower *Carthamus tinctorium* crops have been cultivated in agricultural fields. The region and the surrounding area hosts Bauhinia *Bauhinia purpurea* and *Pongamia pinnata*, Neem *Azadirachta indica*, and *Ziziphus* trees. *Acacia nilotica* and *Butea mononsperma* shrubs a present in the area. The invasive species *Hyptis*, *Prosopis juliflora*, *Senna tora*, *and Parthenium* are found all over fallow land and grassland.

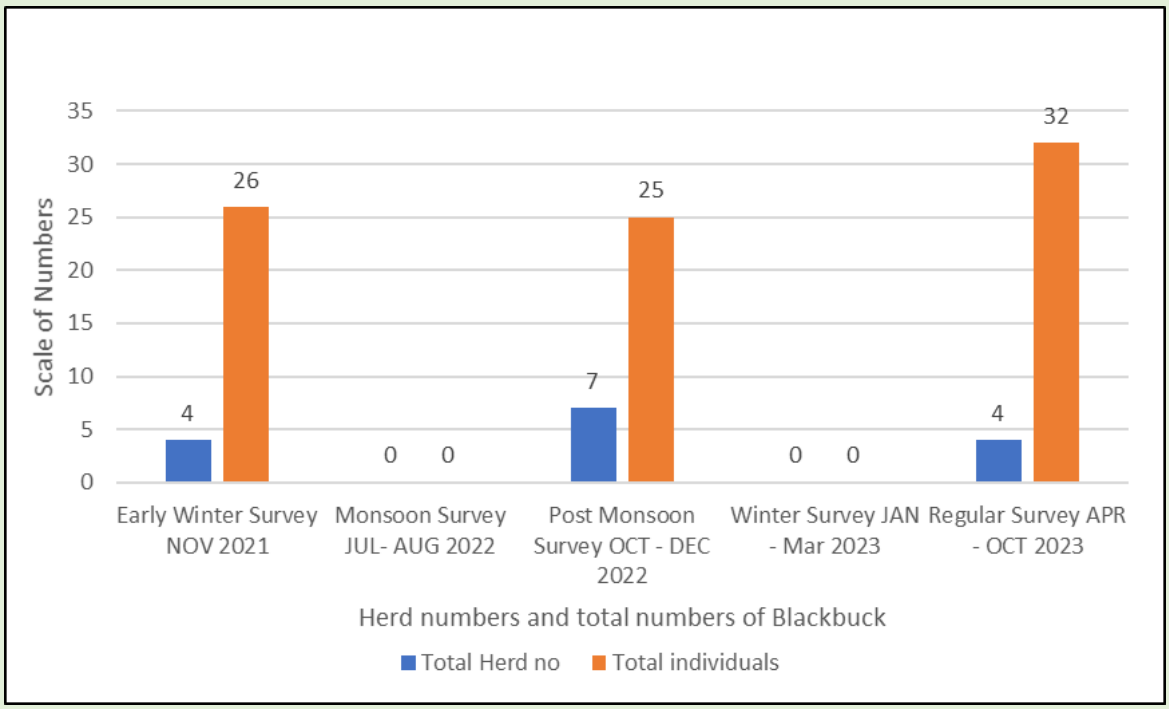
The birds in this area are Indian Courser *Cursorius coromandelicus*, Europian Roller *Coracias garrulus*, Pallid Harrier *Circus macrourus*, Ashy-crowned Sparrow Lark *Eremopterix griseus*, Paddyfield Pipit *Anthus rufulus*, Siberian Stonechat *Saxicola maurus*, Yellow-wattled lapwing *Venellus malabaricus*, Grey Francolin *Francolinus pondicerianus*, Rock Bush Quail, *Perdicula argoondoh*, Chestnut-bellied Sandgrouse *Pterocles exustus*, and Eurasian Collared-dove *Streptopelia decaocto*.

Blackbuck, *Antilope cervicapra*, and Black-naped Hare *Lepus nigricollis* are mammals found in grassland. Fencing, grazers, dogs, settlements, humans, noise, and roads are the threats wildlife faces in this grassland.

Image 7: Aliyabad grassland @Rushikesh Pawar

6.2 Nirna





Figures 24& 25: Seasonal variation of blackbuck in Nirna grassland

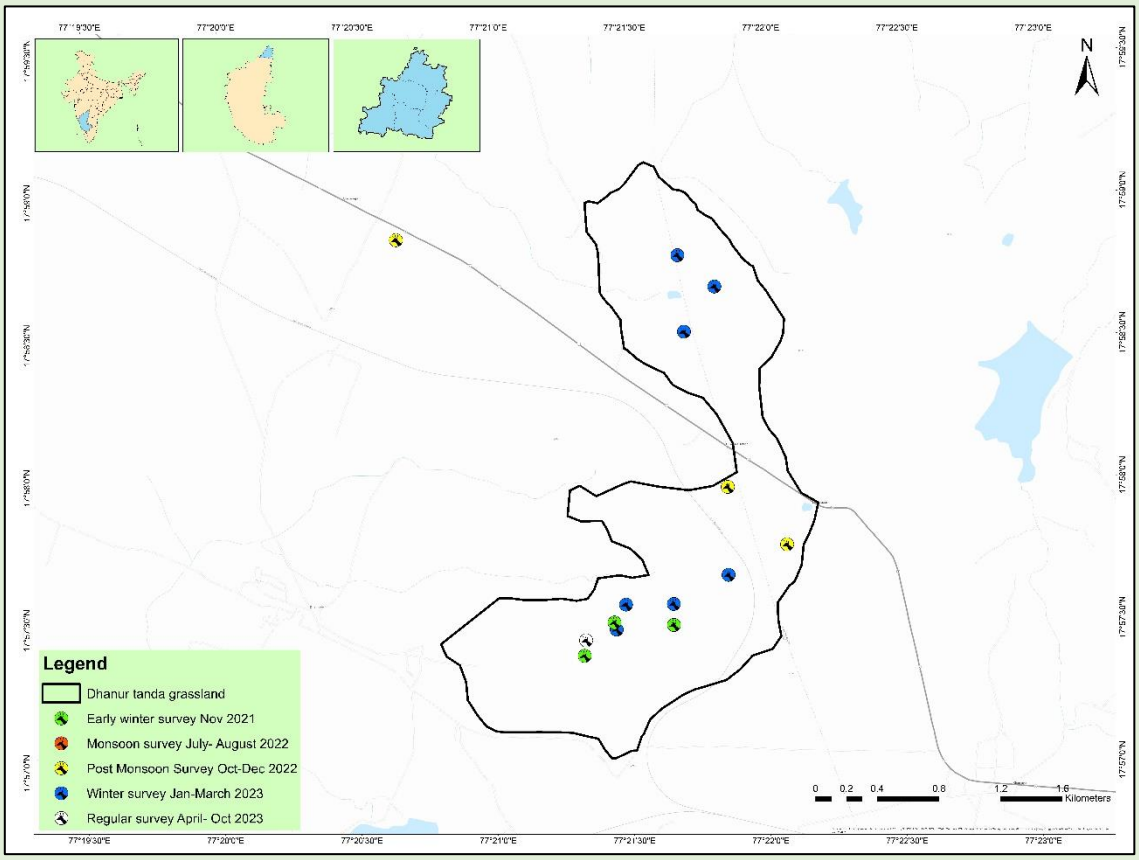
The Nirna Grassland (17.691528 N and 77.33768717 E) under grid 167, was selected for the observe Blackbuck movements and other grassland-dependent species. The Nirna grassland area is situated near Nirna village on the west side of the grassland. On the north side of the grassland, there is Nagankhera village, and on the south side Muthangi and South-east side Bashirapur villages, respectively.

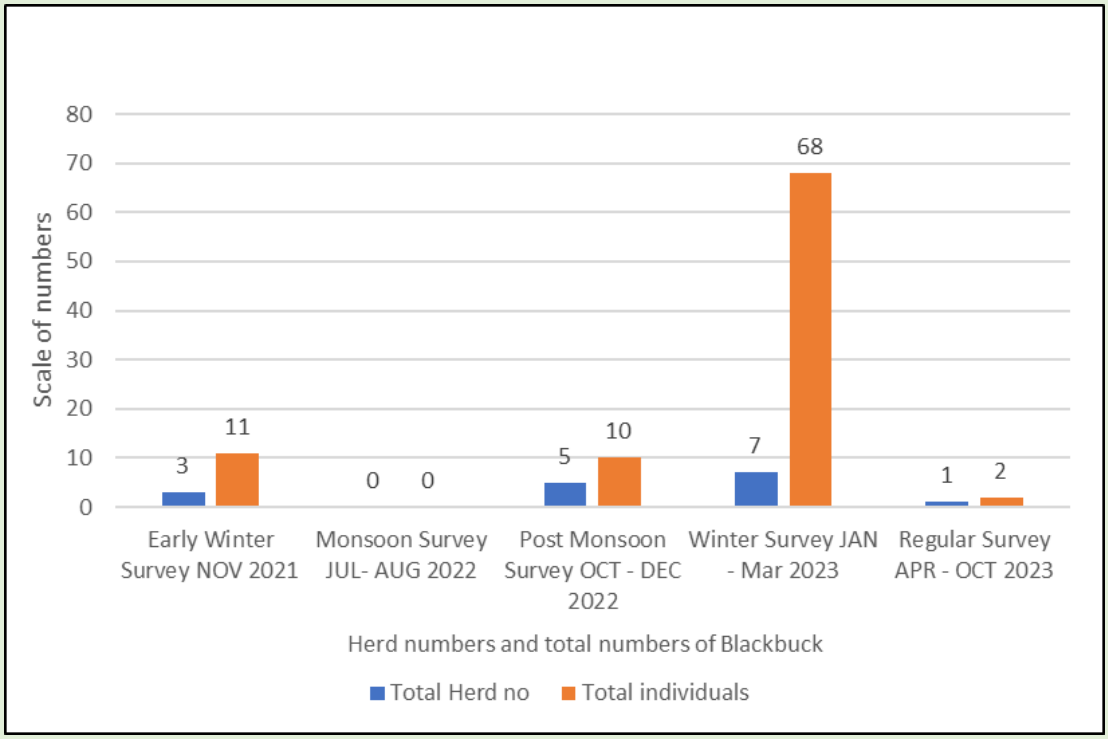
The terrain of the area is flat with a black soil type most of the time, and in a small area, red soil is present. The area is covered with a mixture of semi-arid grassland, agricultural land, fallow land, and scrubland. *Crysopogon* spp., *Heteropogon*, *Dicanthium*, *Themeda*, *Apluda*, and *Cymbopogon* are the dominant grasses present in the grassland. Toor *Cajanus cajan*, Cotton *Gossypium*, Soybean *Glycin max*, and Safflower *Carthamus tinctorium* crops have been cultivated in agricultural fields. The region and the surrounding area consist of *Eucalyptus*, Tamarind *Tamarindus indica*, *Pongamia pinnata*, Neem *Azadirachta indica*, and *Ziziphus* trees. *Acacia nilotica* and *Butea mononsperma* shrubs are present in the area. The invasive species *Lantana camara*, *Hyptis*, *Prosopis juliflora*, *Senna tora*, *and Parthenium* are found all over fallow land and grassland.

The grassland consists of residential as well as migratory birds such as Eurasian Sparrow Hawk *Accipiter nisus*, Common Hawk-cuckoo *Hierococcyx varius*, Booted Eagle *Hieraaetus pennatus*, Indian Courser *Cursorius coromandelicus*, European Roller *Coracias garrulus*, Montagu's Harrier *Circus pygargus*, Pallid Harrier *Circus macrourus*, Ashy-crowned Sparrow Lark *Eremopterix griseus*, Paddyfield Pipit *Anthus rufulus*, Siberian Stonechat *Saxicola maurus*, Yellow-wattled Lapwing *Venellus malabaricus*, Grey Francolin *Francolinus pondicerianus*, Rock Bush Quail, *Perdicula argoondoh*, Chestnut-bellied Sandgrouse *Pterocles exustus*, Painted Francolin *Francolinus pictus* and Eurasian Collared-dove *Streptopelia decaocto*. Blackbuck *Antilope cervicapra*, Indian Fox *Vulpes bengalensis*, Jungle Cat *Felis chaus*, and Black-naped Hare *Lepus nigricollis*, are mammals commonly found in this grassland. The grassland is under threat from various sources including solar panels, high-tension power lines, fencing, grazers, dogs, settlements, humans, noise, and roads.

Image 8: Nirna grassland @Rushikesh Pawar

6.3 Dhaur tanda





Figures 26 & 27: Seasonal variation of blackbuck in Dhanur Tanda grassland

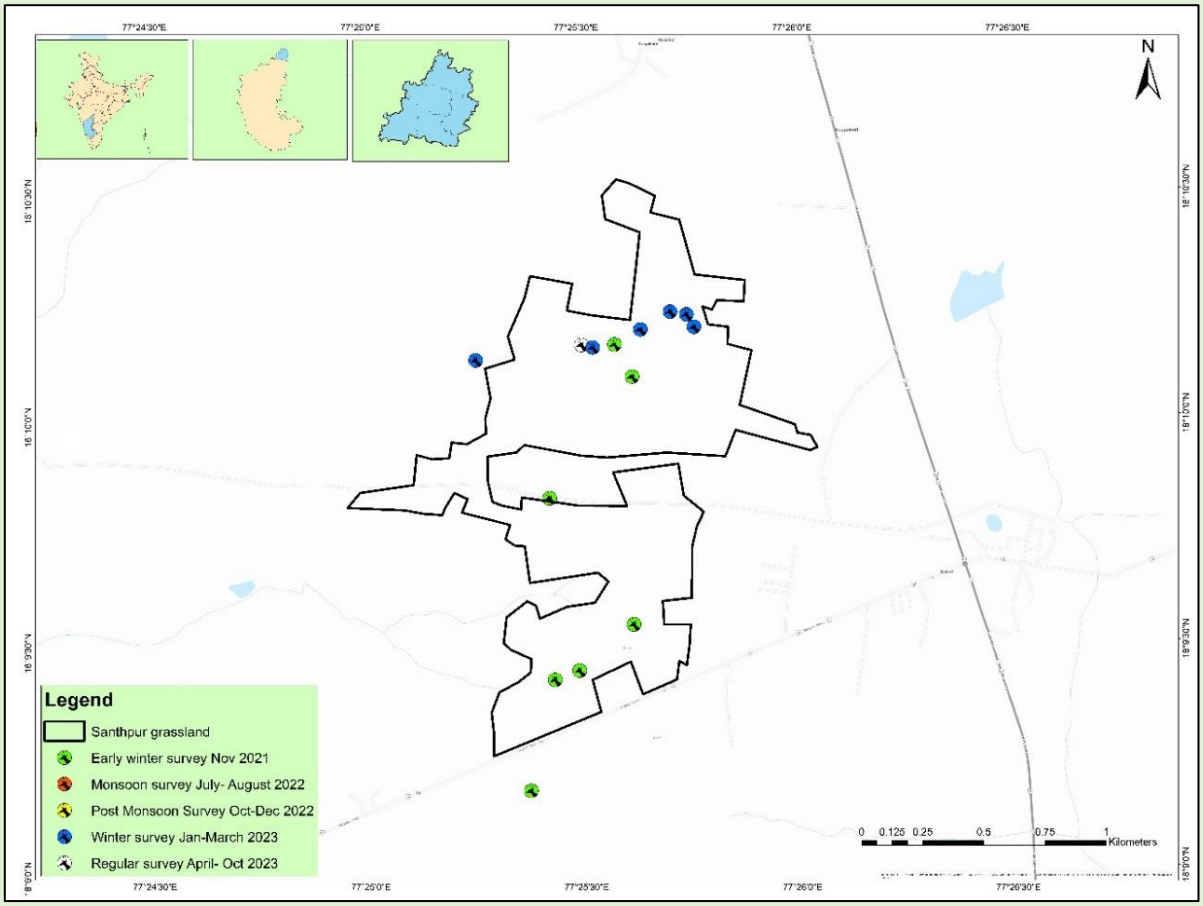
Dhanur tanda Grassland (17.962218 N and 77.36356 E) located under grid 85, has been chosen to observe the movements of Blackbucks and other species dependent on grasslands. The Dhanur tanda grassland area is positioned near Dhanura village on the western side of the grassland. Halahiparga village is situated on the northern side, while Dadoddi Tanda and Khanapur villages are located on the southern side of the grassland.

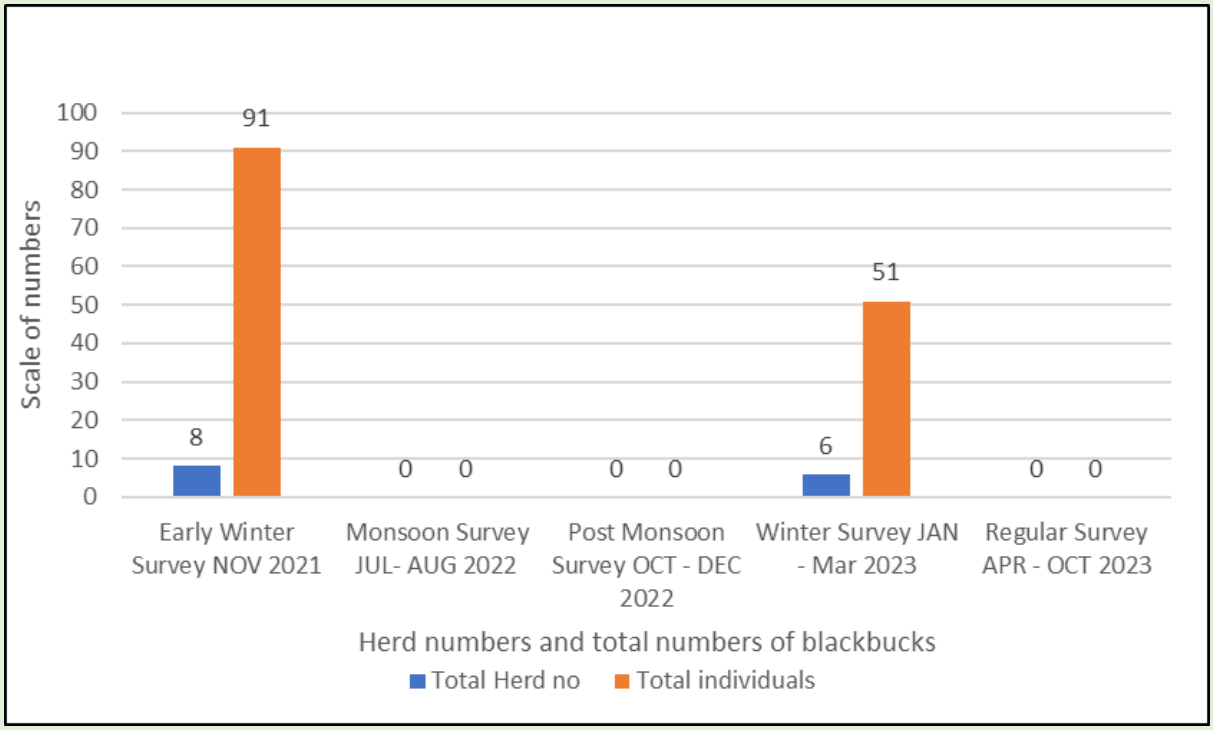
The terrain of the area is undulating; a black soil type is present most of the time, and in a small area, red soil is present. The area is covered with a mixture of semi-arid grassland, agricultural land, fallow land, Plantation, and scrubland. *Crysopogon* Spp *Heteropogon*, *Dicanthium*, and *Cymbopogon* are the dominant grasses present in the grasslands. Maize *Zea mays* Soybean *Glycin max*, Toor *Cajanus cajan*, and Safflower *Carthamus tinctorium* crops have been cultivated in agricultural fields. The region and the surrounding area consist of Tamarind *Tamarindus indica*, *Pongamia pinnata*, Neem *Azadirachta indica*, and *Ziziphus* trees, and plantation of *Eucalyptus* and *Gliricidia*. *Acacia nilotica* and *Butea mononsperma* shrubs are present in the area. The invasive species *Lantana camara Hyptis*, *Prosopis juliflora*, *Senna tora*, and *Parthenium* are found all over fallow land and grassland.

The birds in this area are residential and migratory. Short-toed Snake-Eagle *Circaetus gallicus*, Common Hawk-Cuckoo *Hierococcyx varius*, Indian Courser *Cursorius coromandelicus*, Montagu's Harrier *Circus pygargus*, Pallid Harrier *Circus macrourus*, Tawny Lark *Galerida deva*, Ashy-crowned Sparrow Lark *Eremopterix griseus*, Paddyfield Pipit *Anthus rufulus*, Siberian Stonechat *Saxicola maurus*, Yellow-wattled lapwing *Venellus malabaricus*, Grey Francolin *Francolinus pondicerianus*, Rock Bush Quail, *Perdicula argoondoh*, Chestnut-bellied Sandgrouse *Pterocles exustus*, Painted Francolin *Francolinus pictus* and Eurasian Collared-dove *Streptopelia decaocto* are the birds found in the grassland. In the Dhanor tanda grassland, it is common to find mammals such as Blackbuck *Antilope cervicapra*, Indian Fox *Vulpes bengalensis*, Jungle Cat *Felis chaus*, and Black-naped Hare *Lepus nigricollis*. This grassland is confronted with various threats including fencing, grazers, dogs, settlements, humans, noise, and roads.

Image 9: Dhanur tanda grassland @Rushikesh Pawar

6.4 Santhpur





Figures 28 & 29: Seasonal variation of blackbuck in Santhpur grassland

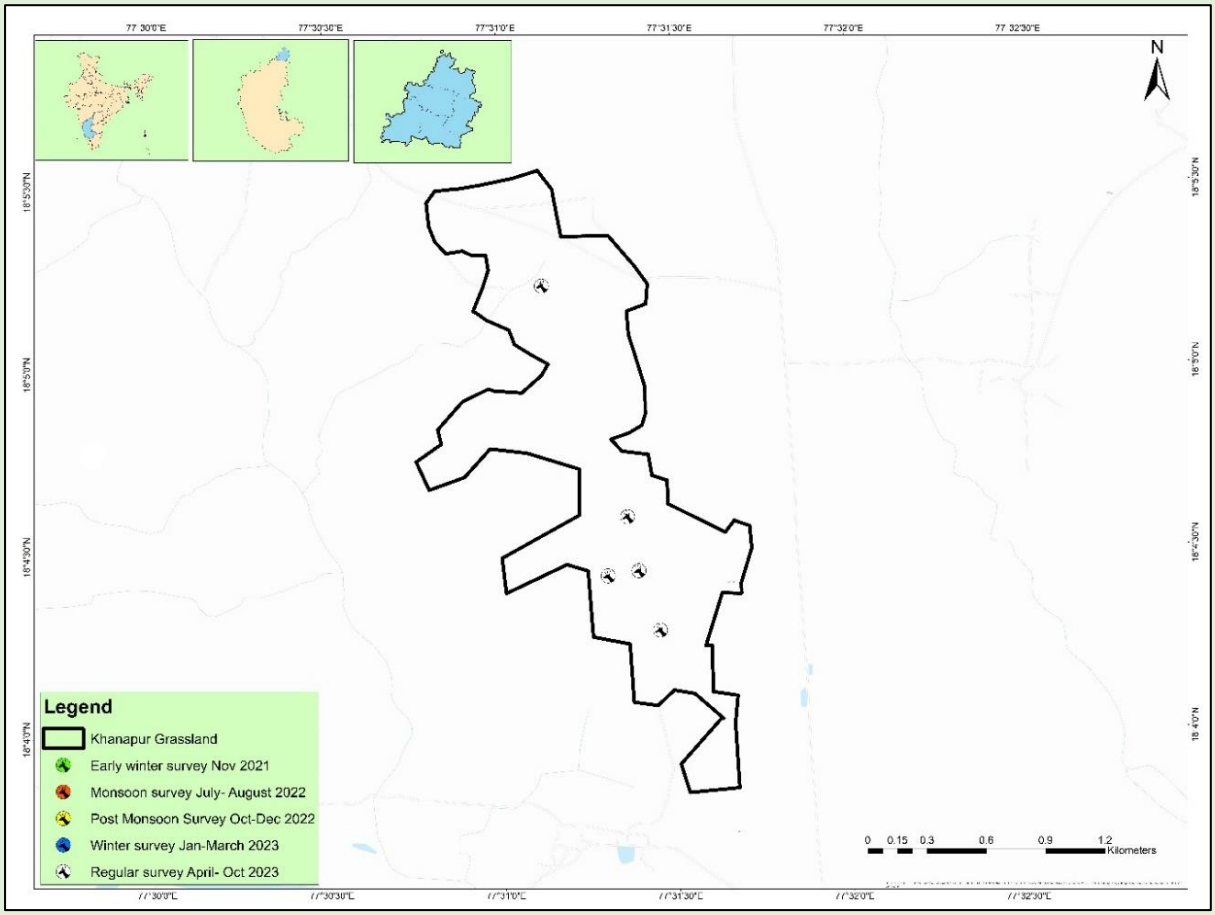
Santhpur Grassland (18.169950 N and 77.425969 E), situated between grids 35 and 47, has been chosen for observing Blackbuck movements and other species dependent on grasslands. The Santhpur grassland area is located near Santhpur village on the eastern side of the grassland. Kappekeri village is situated on the northern side, while Maskal Tanda village is found on the southern side of the grassland.

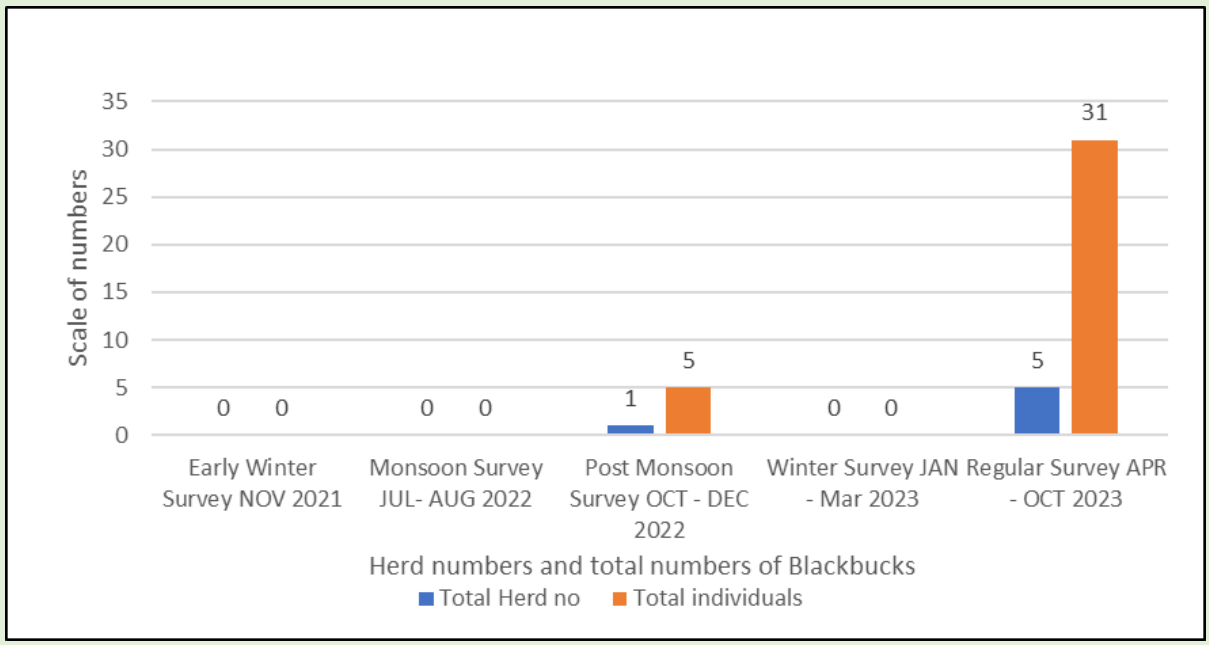
The terrain of the area is undulating, with predominantly black soil and a small area of red soil. The grassland is a mix of semi-arid grassland, agricultural land, fallow land, and scrubland. Dominant grass species in the grasslands include *Crysopogon* spp., *Heteropogon*, *Dicanthium*, and *Cymbopogon*. Agricultural fields in the area cultivate crops such as maize *Zea mays*, soybean *Glycin max*, Toor *Cajanus cajan*, and safflower *Carthamus tinctorium*. The region and its surroundings are populated with trees such as Tamarind *Tamarindus indica*, Neem *Azadirachta indica*, and *Ziziphus* spp. Shrubs like *Acacia nilotica* and *Butea monosperma* are also present in the area. Invasive species such as *Lantana camara*, *Hyptis*, *Prosopis juliflora*, *Senna tora*, and *Parthenium* are found in fallow land and grassland.

The area is home to various residential and migratory bird species including the Short-toed Snake Eagle *Circaetus gallicus*, Changeable Hawk Eagle *Nisaetus cirrhatus*, Greater Spotted Eagle *Clanga clanga*, Common Hawk-Cuckoo *Hierococcyx varius*, Indian Courser *Cursorius coromandelicus*, Montagu's Harrier *Circus pygargus*, Pallid Harrier *Circus macrourus*, Tawny Lark *Galerida deva*, Ashy-crowned Sparrow Lark *Eremopterix griseus*, Paddyfield Pipit *Anthus rufulus*, Siberian Stonechat *Saxicola maurus*, Yellow-wattled Lapwing *Venellus malabaricus*, Grey Francolin *Francolinus pondicerianus*, Rock Bush Quail *Perdicula argoondoh*, Chestnut-bellied Sandgrouse *Pterocles exustus*, Painted Francolin *Francolinus pictus*, and Eurasian Collared-Dove *Streptopelia decaocto*. Mammals commonly found in the grassland include Blackbuck *Antilope cervicapra*, Indian Fox *Vulpes bengalensis*, Jungle Cat *Felis chaus*, and Black-naped Hare *Lepus nigricollis*. Threats to this grassland include solar panels, high-tension power lines, fencing, grazers, dogs, settlements, humans, noise, and roads.

Image 10: Santhpur grassland @Rushikesh Pawar

6.5 Khanapur





Figures 30 & 31: Seasonal variation of blackbuck in Khanapur grassland

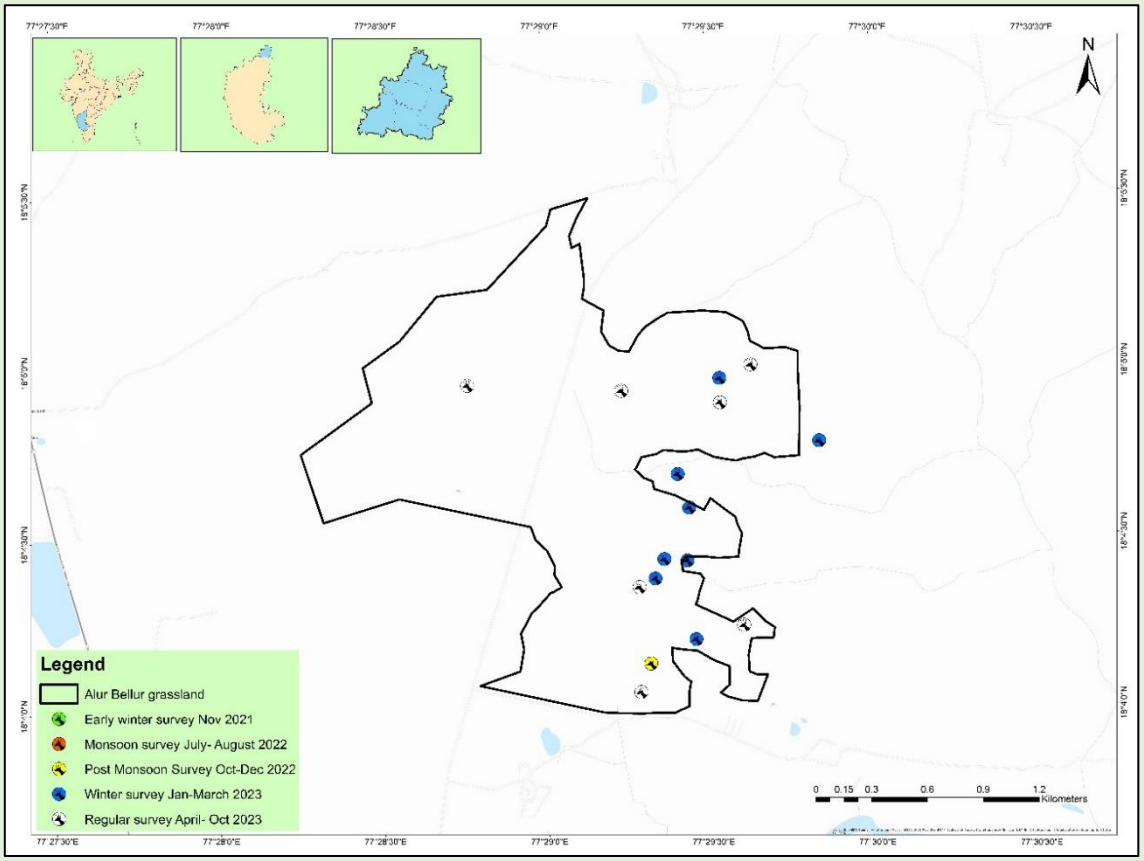
Khanapur is a village in the Bidar district of Karnataka. In November and December 2022, the Wildlife Institute of India (WII) recorded two locations where Lesser Florican visited the Khanapur Grassland area. The first location is at 18.06896 N, 77.52700 E, and the second at 18.07171 N, 77.5250 E. These locations are close to Bidar-Wadgaon Road. It is a flat terrain. The major area is covered in black cotton soil with some patches of stony land. The agricultural patch stretches around 400 m from the Bidar-Wadgaon road, which surrounds the grassland area.

The region surveyed consists of agricultural patches that also include invasive species like *Celosia* sp. The grasses seen were *Cymbopogon* spp., *Chrysopogon* spp., *Andropogon* spp., *Diacanthium* spp., and *Themeda* spp. with small patches of *Digitaria* spp. It also consisted of plantations of *Gliricidia* Spp. The cultivated crops included Soybean *Glycine max*, Toor *Cajanus cajan*, and *Roselle* spp. The mammal species observed in the grassland area include Blackbuck *Antilope cervicapra*, and Black-naped Hare *Lepus nigricollis*. Bird species observed were Black-winged Kite *Elanus caeruleus*, Chestnut-bellied Sandgrouse *Pterocules exuxtus*), Rufous-tailed Lark *Ammomanes phoenicura*, Indian Courser *Cursorius coromandelicus*, Green Bee-eater *Merops orientalis*, Plum-headed Parakeet *Psittacula cyanocephalus*, Bay-backed Shrike *Lanius vittatus*, Great Grey Shrike *Lanius excubitor*, Painted Francolin *Francolinus pictus*, and Grey Francolin *Ortygornis pondicerianus*.

Wildlife here faces threats from agriculture, fencing, free-ranging dogs, livestock grazing, roads, and humans.

Image 11: Khanapur grassland @Rushikesh Pawar

6.6 Alur-Bellur



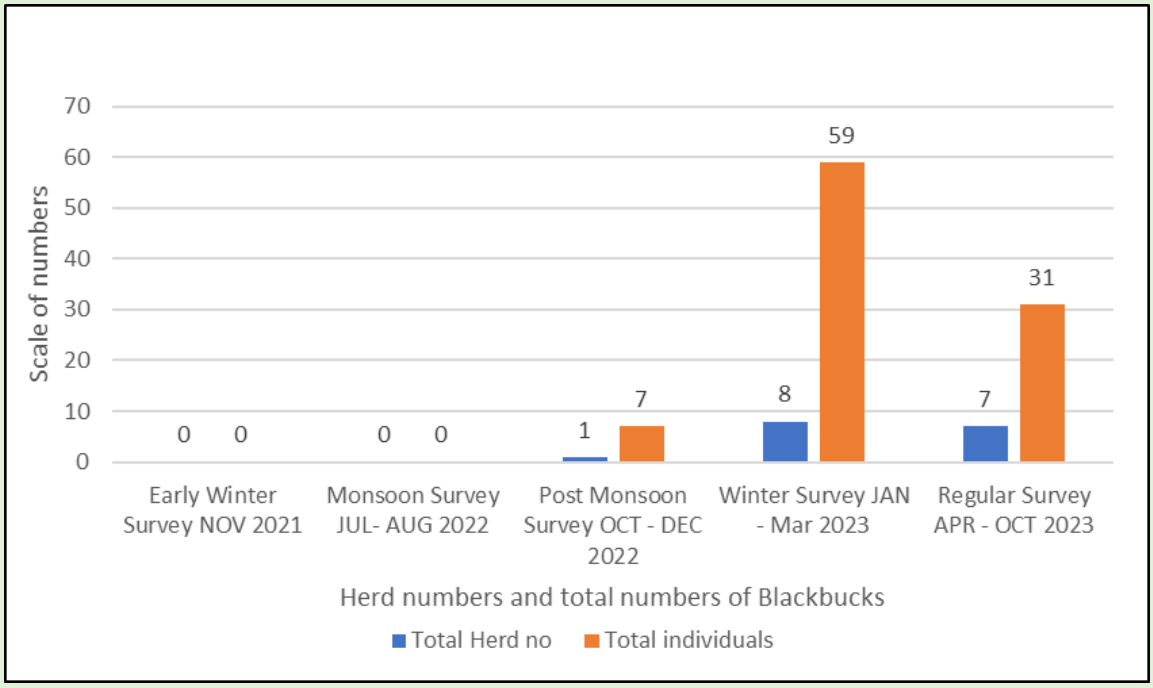


Figure 32 & 33 Seasonal variations of blackbuck in Alur-Bellur grassland

Alur-Bellur is a village in Bidar district of Karnataka state. The surrounding villages include Gadi Kushnoor and Pashapur. The terrain is flat and undulating. The major area is covered in red soil with some patches of stony land. The region surveyed consists of small patches of agricultural land. The cultivated crops include Soybean *Glycine max* and Toor *Cajanus cajan.*

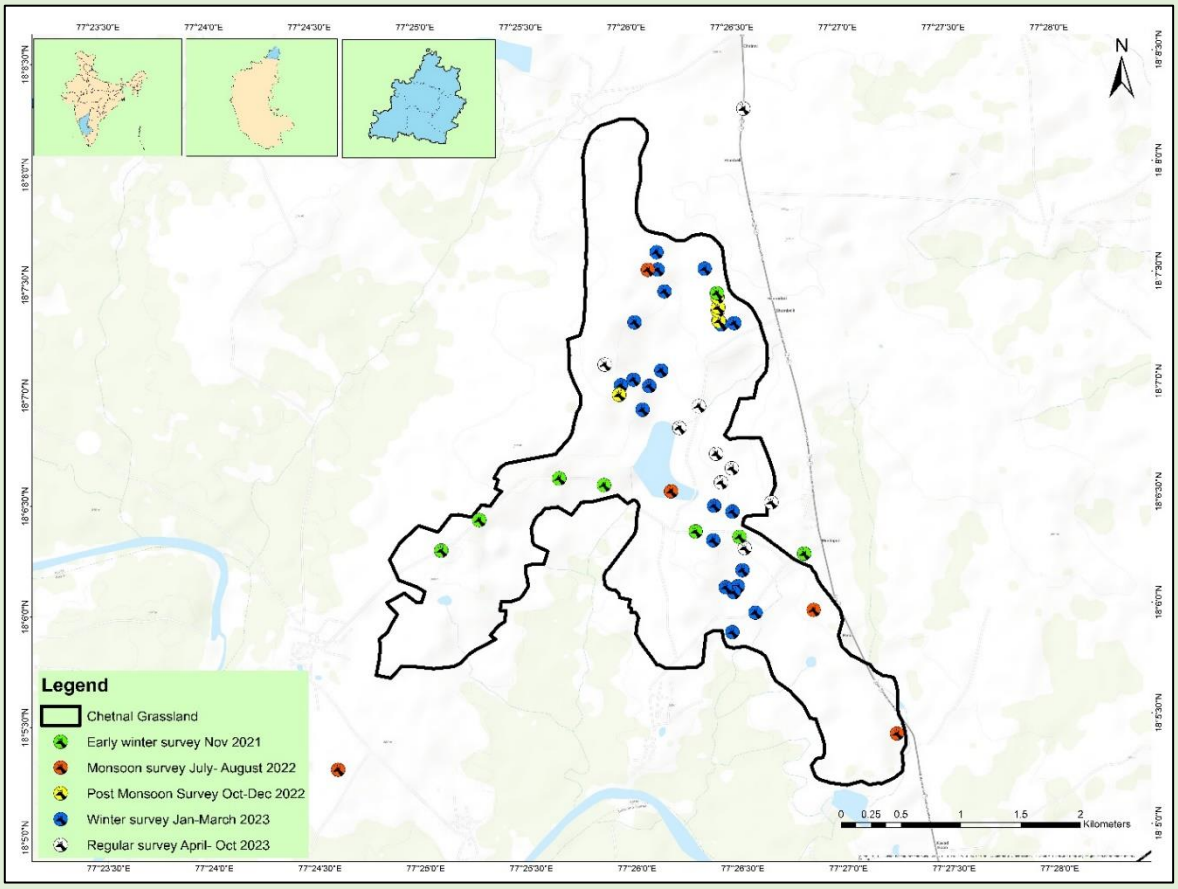
The grasses observed here are *Cymbopogon* spp., *Chrysopogon* spp., *Dicanthium* spp., *Themeda* spp., and *Heteropogon* spp.

The mammal species observed in the grassland area includes 3 individuals of Blackbucks *Antilope cervicapra.* Bird species observed were Ashy-crowned sparrow-lark *Eremopterix griseus*, Paddyfield Pipit *Anthus rufulus*, Scaly-breasted Munia *Lonchus punctulata*, Tricoloured Munia *Lonchura malacca*, Brown Rock Chat *Oenanthe fusca*, Siberian Stonechat *Saxicola maurus*, Pied Bushchat *Saxicola caprata*, Black Redstart *Phoenicurus ochrurus*, Indian Bushlark *Mirafra erythroptera*, Woolly-necked Stork *Ciconia episcopus*, Green Bee-eater *Merops orientalis.*

The threats faced by wildlife here include agriculture, fencing, free-ranging dogs, invasive plantations, livestock grazing, and humans.

Image 12: Alur-Bellur grassland @Rushikesh Pawar

6.7 Chetnal



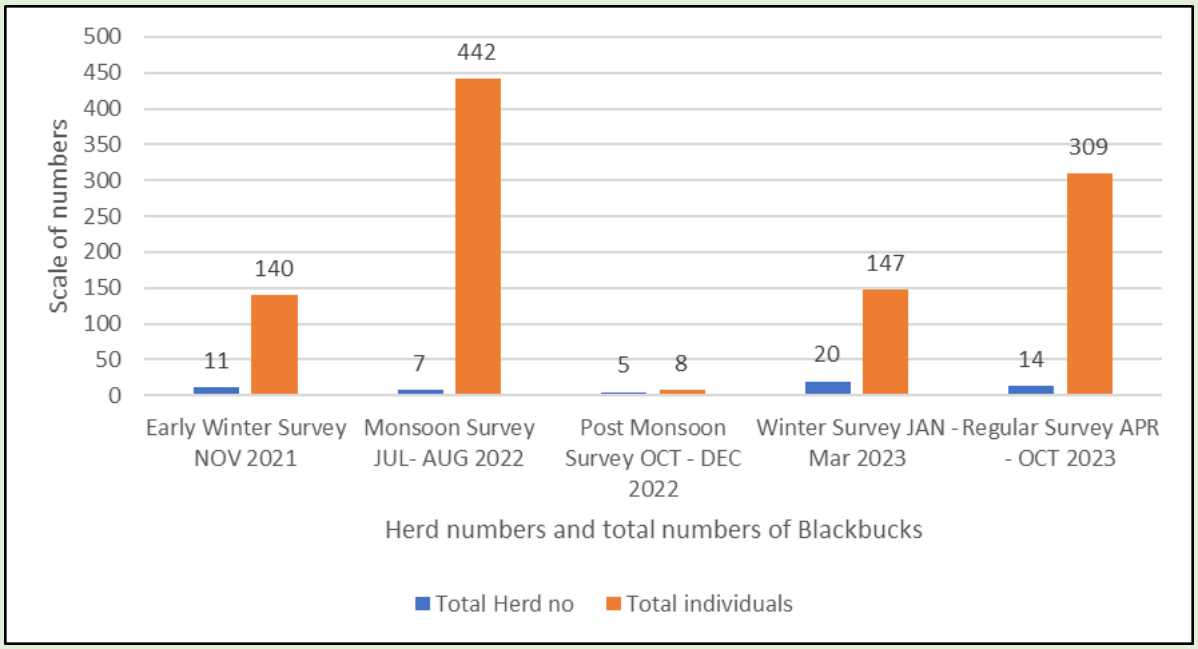


Figure 34 & 35: Seasonal variation of blackbuck in Chetnal grassland

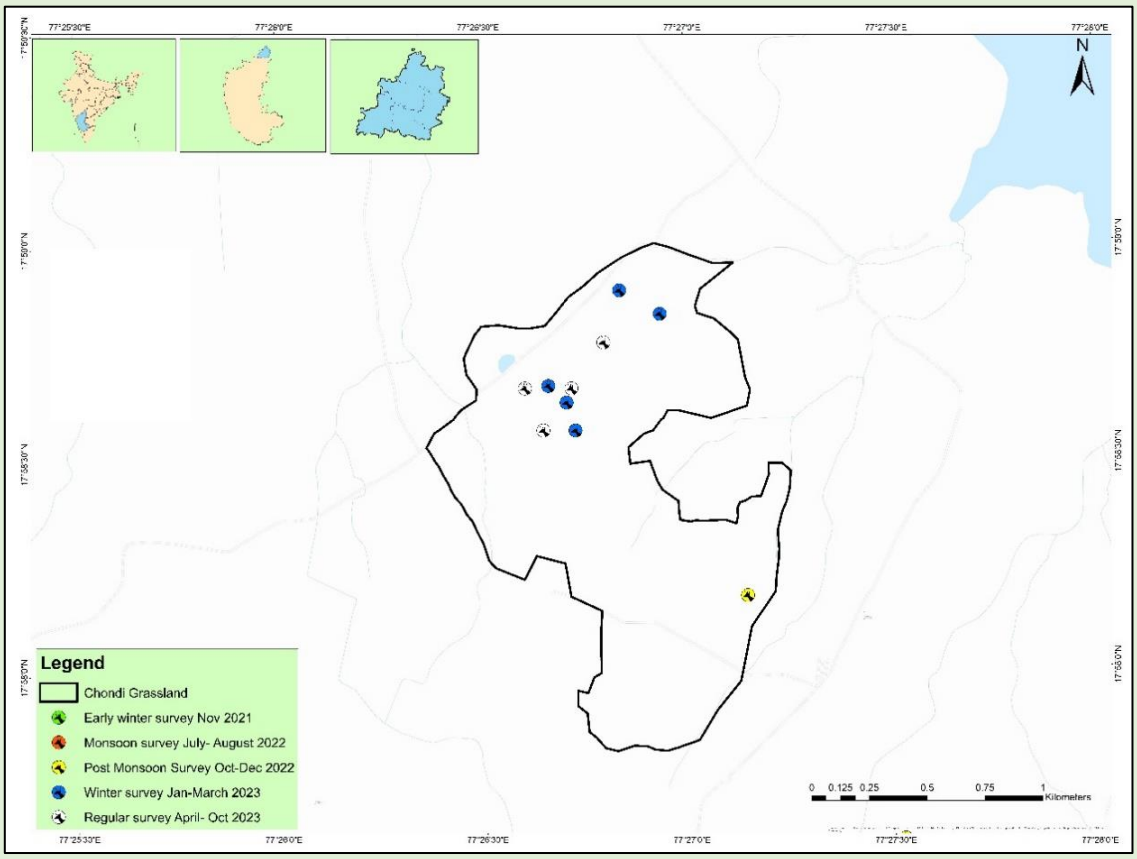
Chetnal village is in Aurad taluka of Bidar district in Karnataka, India. The grassland lies under grids 47 and 48 which are situated at the Lat 18.11469 and Long 77.43273. the grassland consists of the highest numbers of blackbuck in the entire district. The major area is covered in black cotton soil and the terrain is undulating.

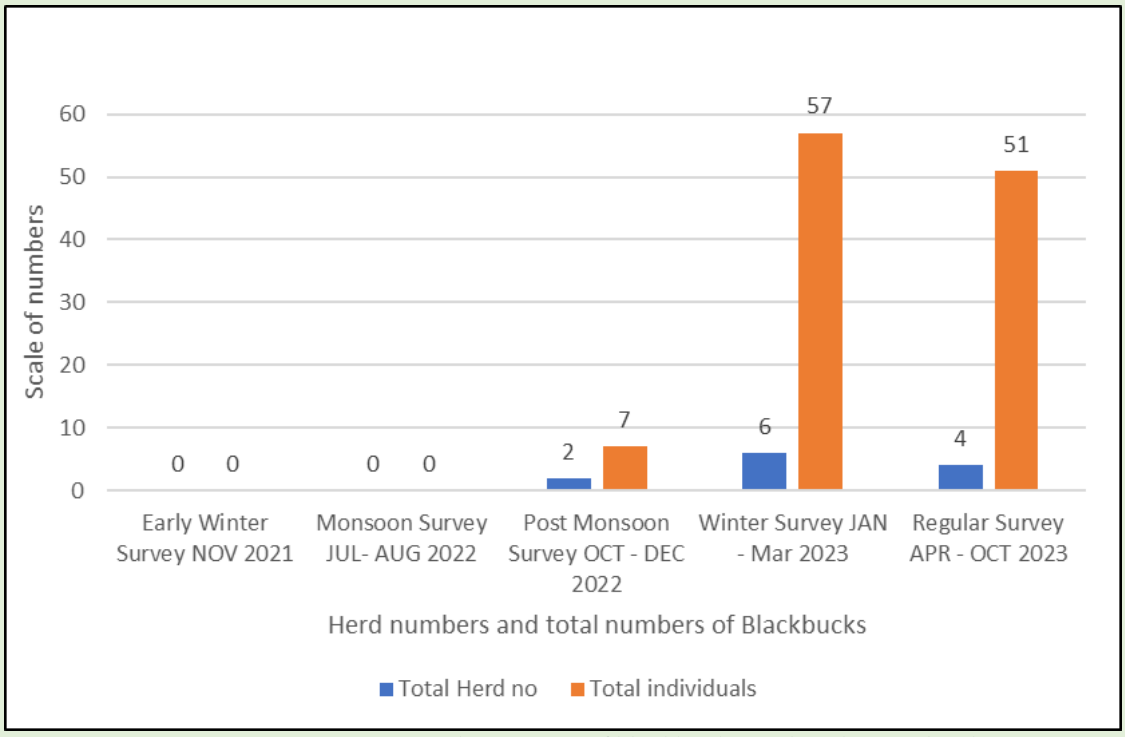
The grasses observed are *Chrysopogon* spp., *Andropogon* spp., *Dicanthium* spp., *Cymbopogon* spp. *Themeda* spp. and *Heteropogon* spp. It also consists of plantations of *Gliricidia* spp.
The mammal species observed here are Blackbuck *Antilope cervicapra*, Black-naped Hare *Lepus nigricollis*, Indian Wolf *Canis lupus pallipes*, Bengal Fox *Vulpes bengalensis*, Indian Boar *Sus scrofa cristatus*. Bird species observed here are Great Grey Shrike *Lanius excubitor*, Bay-backed Shrike *Lanius vittatus*, Pallid Harrier *Circus macrourus*, Black-winged Kite *Elanus caeruleus*, Paddyfield Pipit *Anthus rufulus*, Shikra *Accipiter badius*, Pied Bushchat *Saxicola caprata*. Indian Roller *Coracias benghalensis*.

The threats faced by wildlife here include agriculture, fencing, free-ranging dogs, high-tension power lines, invasive plantations, livestock grazing, and humans.

Image 13: Chetnal grassland @Rushikesh Pawar

6.8 Chondi Grassland





Figures 36 & 37: Seasonal variation of blackbuck in Chondi grassland

Chondi village in Bidar taluka of Bidar district in Karnataka, India. The grassland lies under grid 87 (17.97680 N, 77.44414E). The major area is covered in black soil with few patches of red soil. The terrain is undulating.

The grasses observed are *Chrysopogon* spp., *Andropogon* spp., *Cymbopogon* spp., *Dicanthium* spp., *Themeda* spp., and *Heteropogon* spp. The mammal species observed here are Blackbucks *Antilope cervicapra*, and Black-naped Hare *Lepus nigricollis*, Birds species observed here are Great Grey Shrike *Lanius excubitor*, Bay-backed Shrike *Lanius vittatus*, Pallid Harrier *Circus macrourus*, Black-winged Kite *Elanus caeruleus*, Paddyfield Pipit *Anthus rufulus*, Shikra *Accipiter badius*, Pied Bushchat *Saxicola caprata*, Indian Roller *Coracias benghalensis*, Painted Francolin *Francolinus pictus*, and Grey Francolin *Ortygornis pondicerianus*, and Indian Crested Porcupine *Hystrix indica*

The threats faced by wildlife here include agriculture, fencing, livestock grazing, high-tension power lines, and humans.

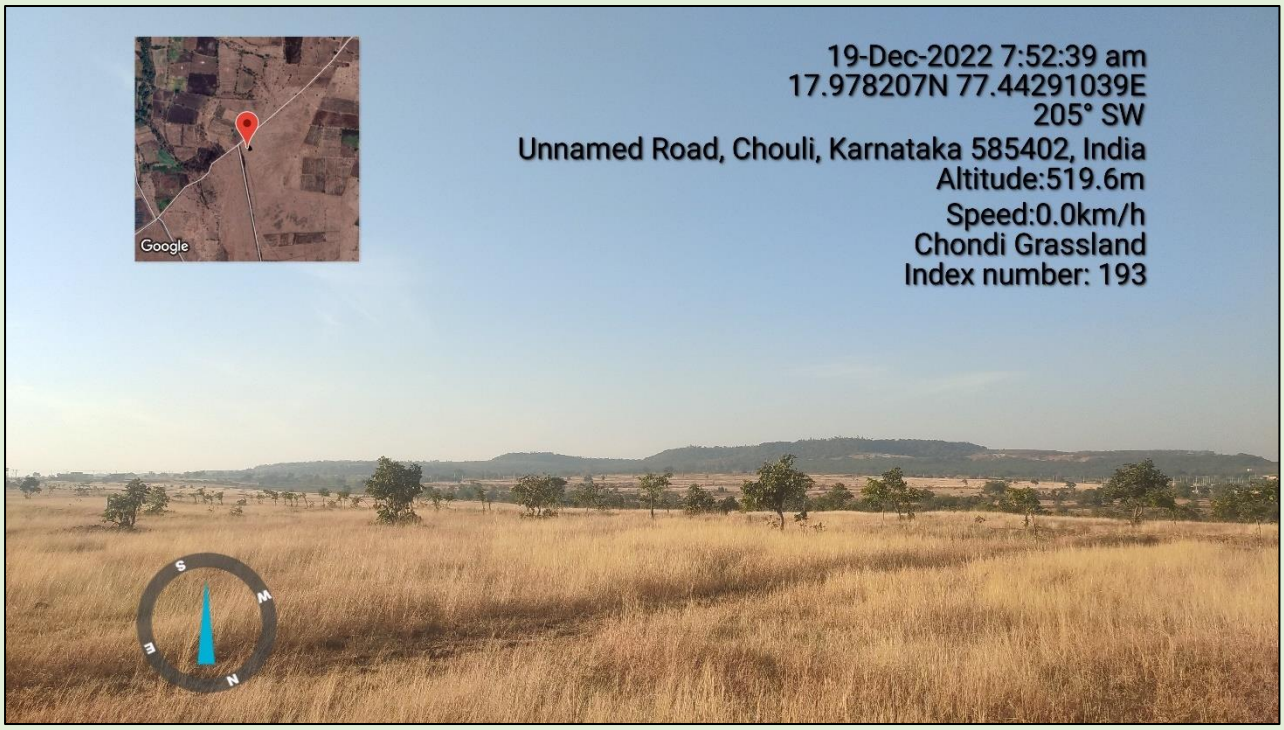
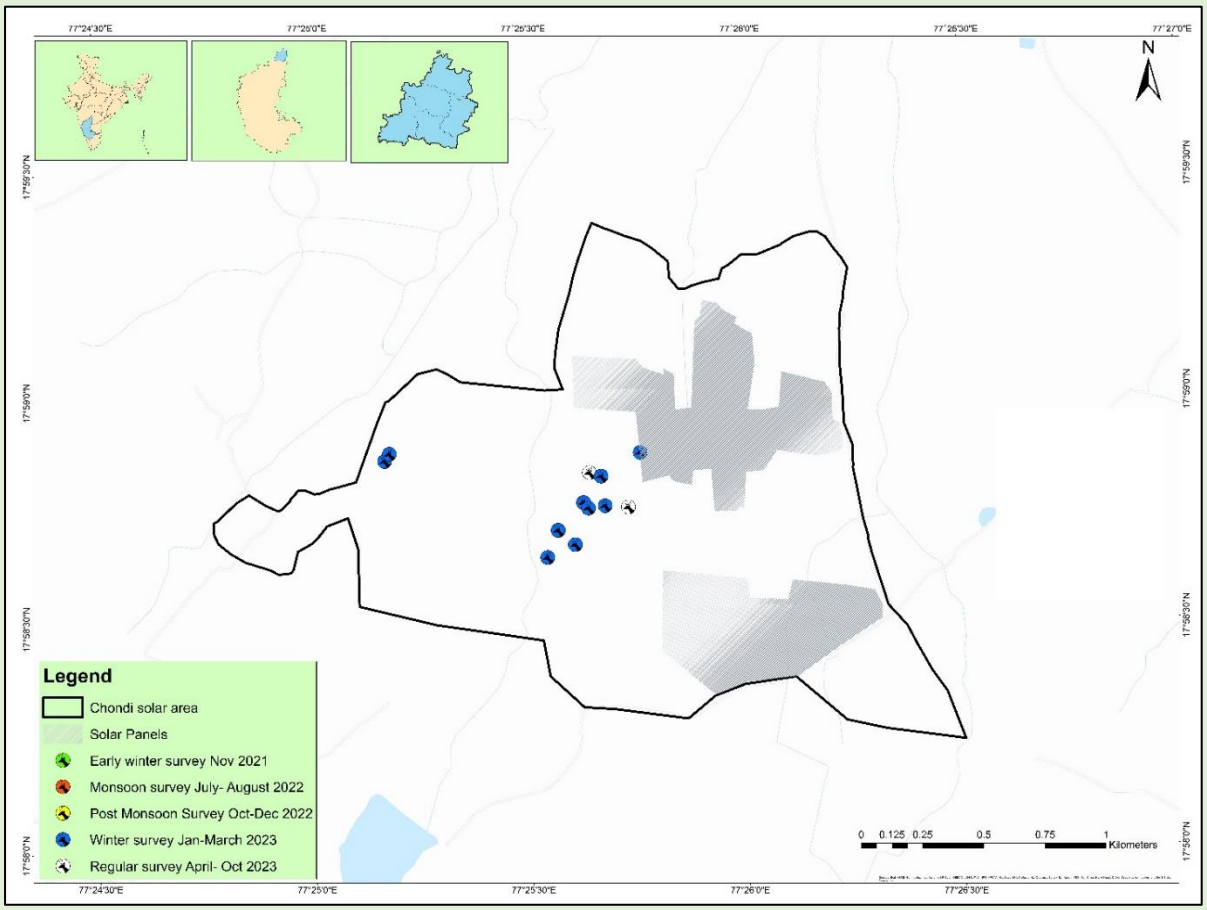
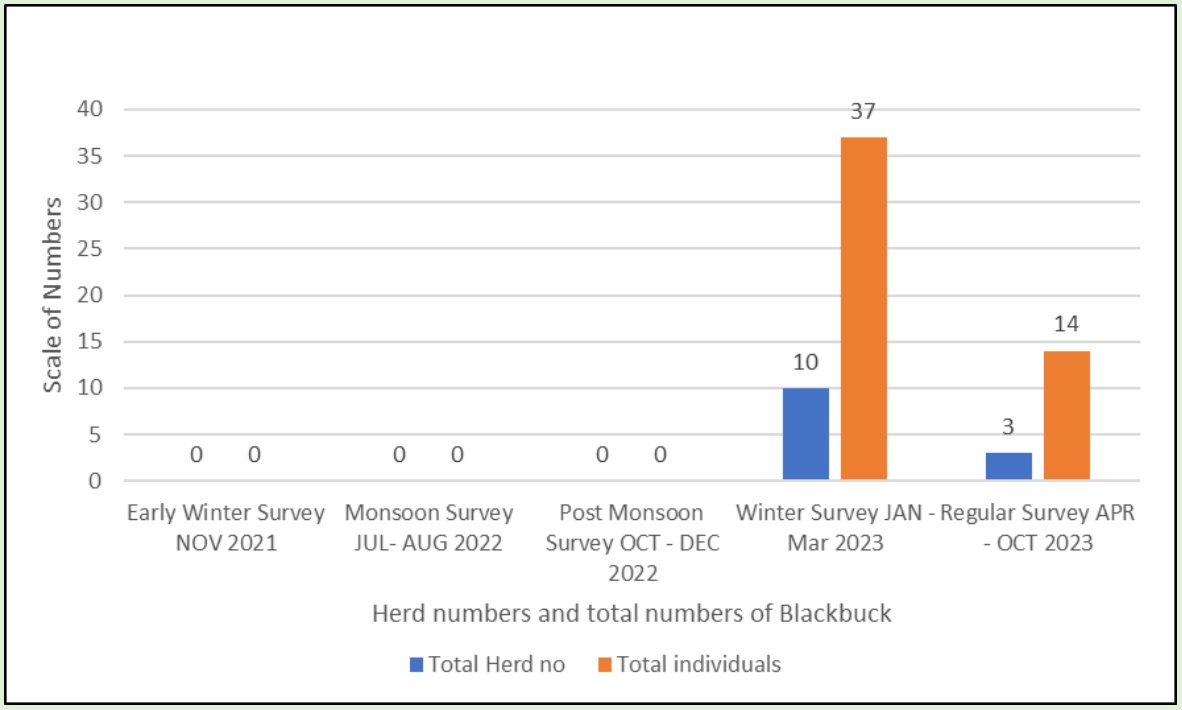


Image 14: Chondi grassland @Rushikesh Pawar

6.9 Chondi solar area





Figures 38& 39: Seasonal variation of blackbuck in Chondi solar grassland

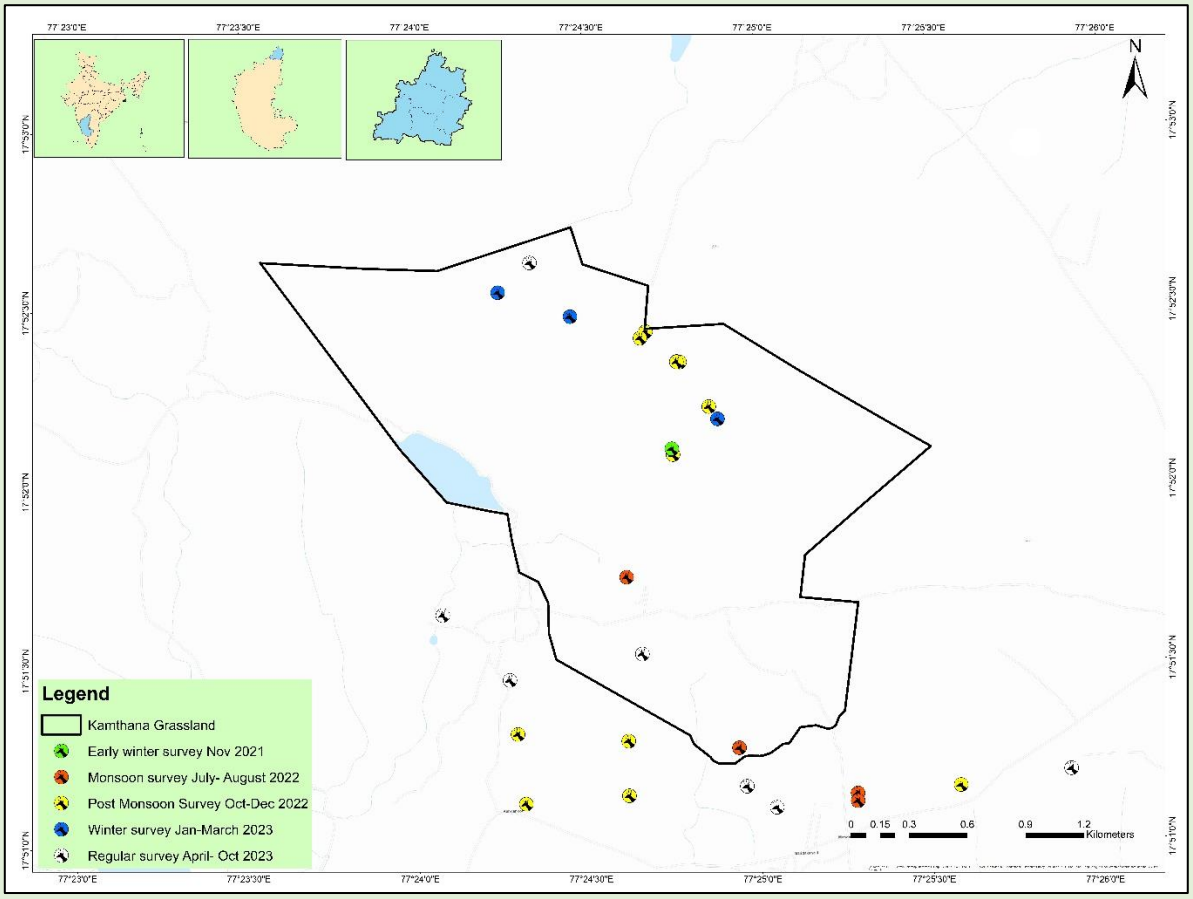
Chondi Solar area is located near Chondi tanda of Bidar district in Karnataka, India. The grassland is near to the solar area where previously the large grassland was present. The grassland comes under grid 86 and the area is situated at Lat 17.97993 Long 77.42265. The major area is covered in black soil with few patches of red soil. the terrain is undulating.

The grasses observed are *Cymbopogon* spp., *Chrysopogon* spp., *Andropogon* spp., *Dicanthium* spp., *Themeda* spp., and *Heteropogon* spp. The mammal species observed here are Blackbucks *Antilope cervicapra* and Black-naped Hare *Lepus nigricollis*, *The* Bird species observed are Great Grey Shrike *Lanius excubitor*, Bay-backed Shrike *Lanius vittatus*, Pallid Harrier *Circus macrourus*, Black-winged Kite *Elanus caeruleus*, Paddyfield Pipit *Anthus rufulus*, Shikra *Accipiter badius*, Pied Bushchat *Saxicola caprata*, Indian Roller *Coracias benghalensis*, Painted Francolin *Francolinus pictus*, Grey Francolin *Ortygornis pondicerianus*, and Indian Crested Porcupine *Hystrix indica*

The threats faced by wildlife here include solar parks, agriculture, fencing, livestock grazing, and humans.

Image 15: Subadult male blackbuck near Chondi solar area @ Rushikesh Pawar

6.10 Kamthana



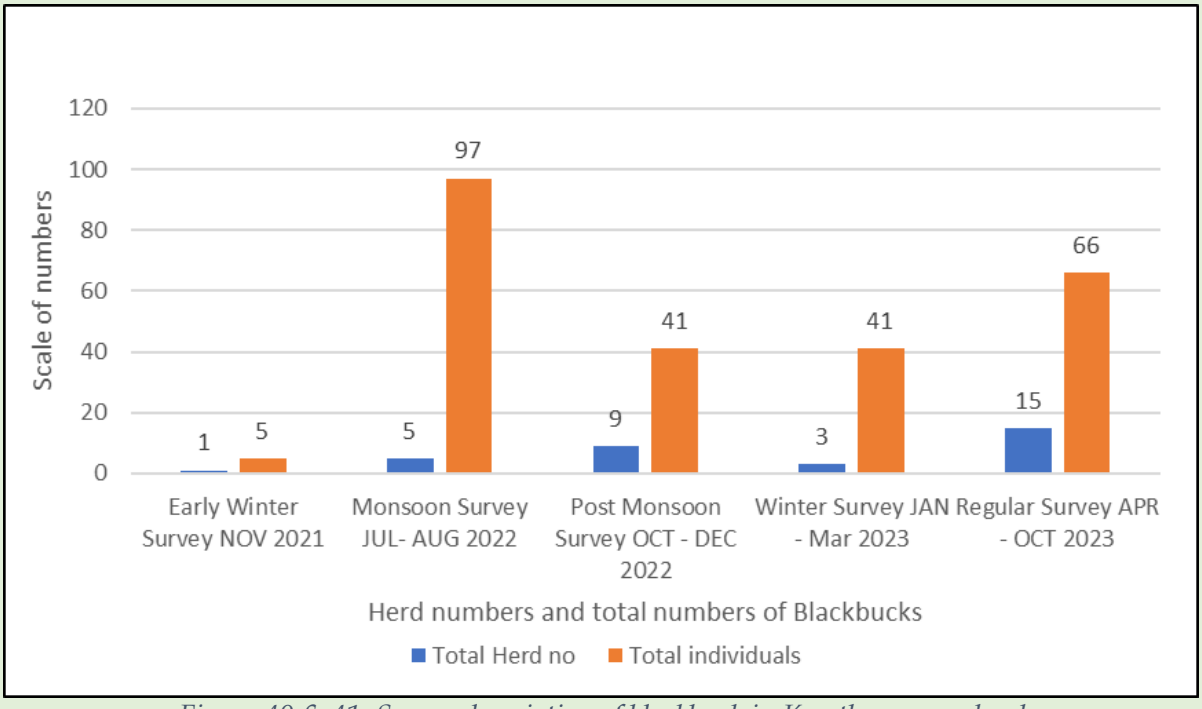


Figure 40 & 41: Seasonal variation of blackbuck in Kamthana grassland

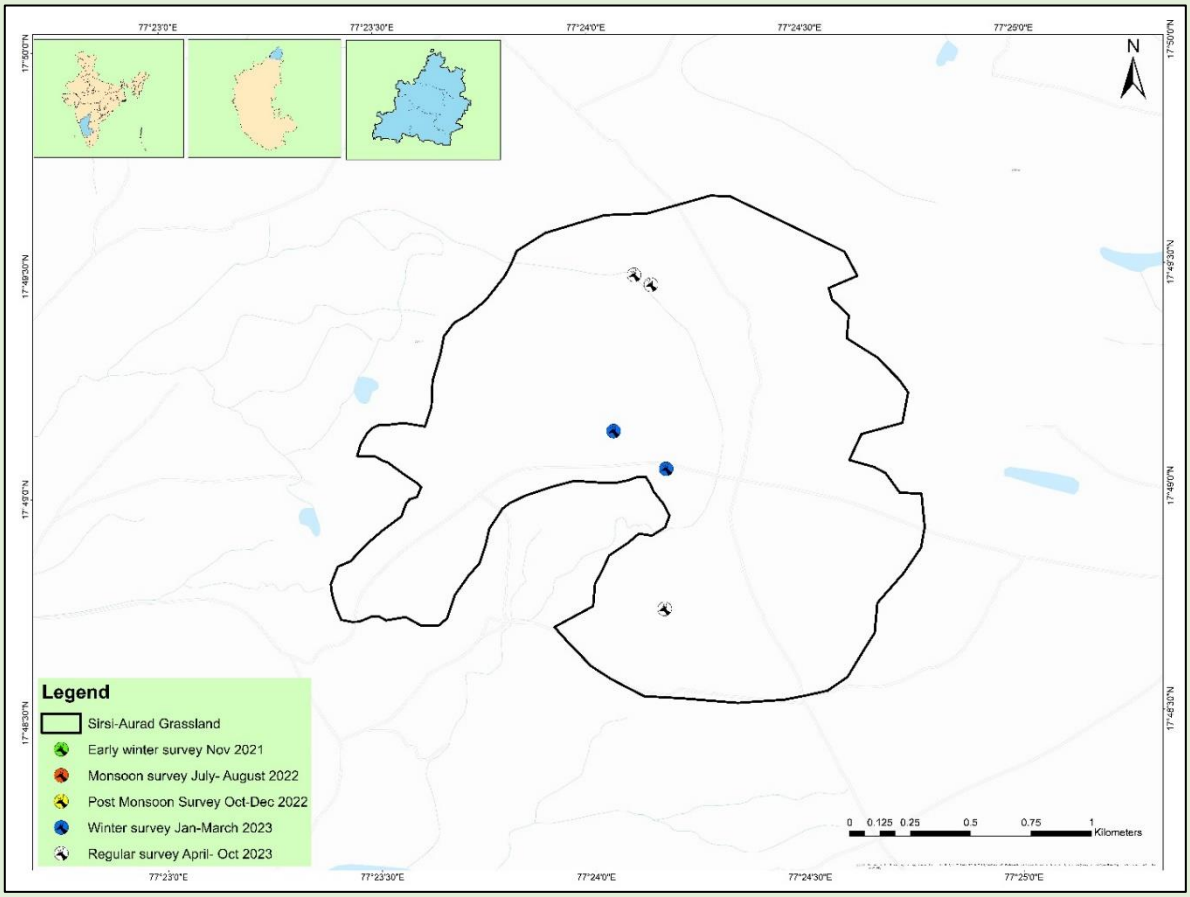
Kamthana grassland comes under Grid 120 (17.864074 N, 77.410662 E). The nearest major town for economic activities is Bidar, located approximately 10 km away from Kamthana.

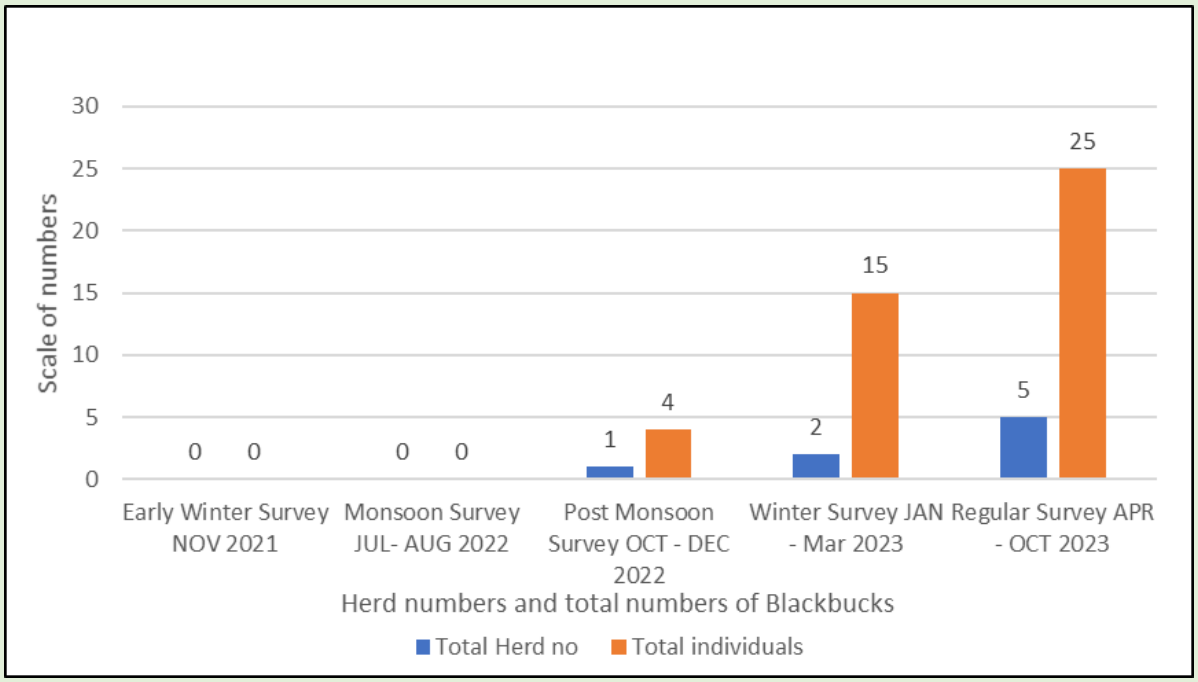
The survey area of Kamthana comprises open grasslands with small patches of agricultural land where crops such as Toor *Cajanus cajan*, Soybean *Glycine max*, Sugarcane *Saccharum officinarum*, Sunflower *Helianthus annuus*, and Roselle *Hibiscus sabdariffa* are cultivated. Additionally, there are forested areas where flora including *Azadirachta indica*, *Butea monosperma*, *Lantana camara*, *Ziziphus*, *Mangifera indica*, *Tamarindus indica*, *Eucalyptus*, *Feronia elephantum*, *Pongamia pinnata*, *Bauhinia purpurea*, and *Senna tora* are present.

Various species of grasses found in the area include *Heteropogon* spp., *Chrysopogon* spp.., *Dicanthium* spp., and *Andropogon* spp. The fauna consists of animals like the Blackbuck *Antilope cervicapra*, Jungle Cat *Felis chaus*, Bengal Fox *Vulpes bengalensis*, and Black-naped Hare *Lepus nigricollis*. The birds in the area are the Spotted Owlet *Athene brama*, Yellow-wattled Lapwing *Vanellus malabaricus*, Indian Nightjar *Caprimulgus asiaticus*, Pallid Harrier *Circus macrourus*. Furthermore, the grassland faces threats from dogs, humans, fencing, and vehicles.

Image 16: Kamthana grassland @Rushikesh Pawar

6.11 Sirsi-Aurad





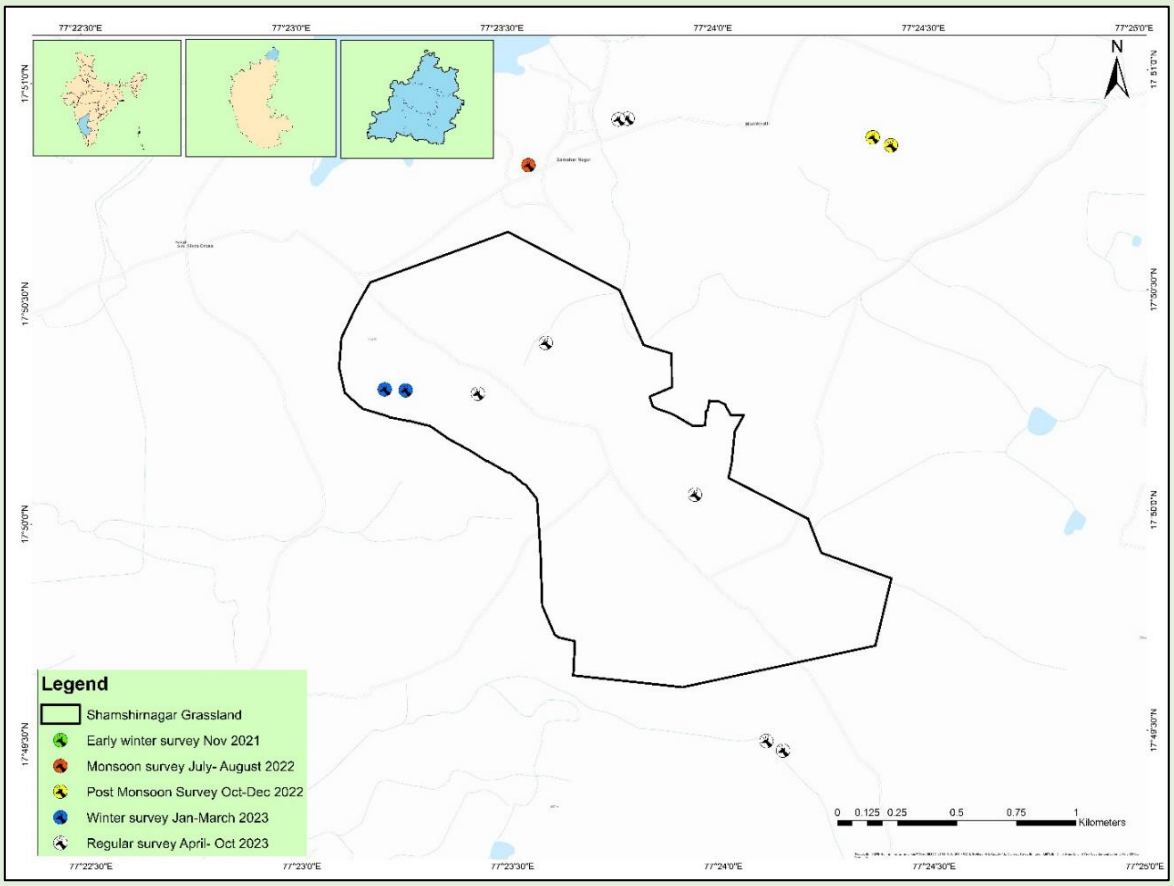
Figures 42 & 43: Seasonal variation of blackbuck in Sirsi-Aurad grassland

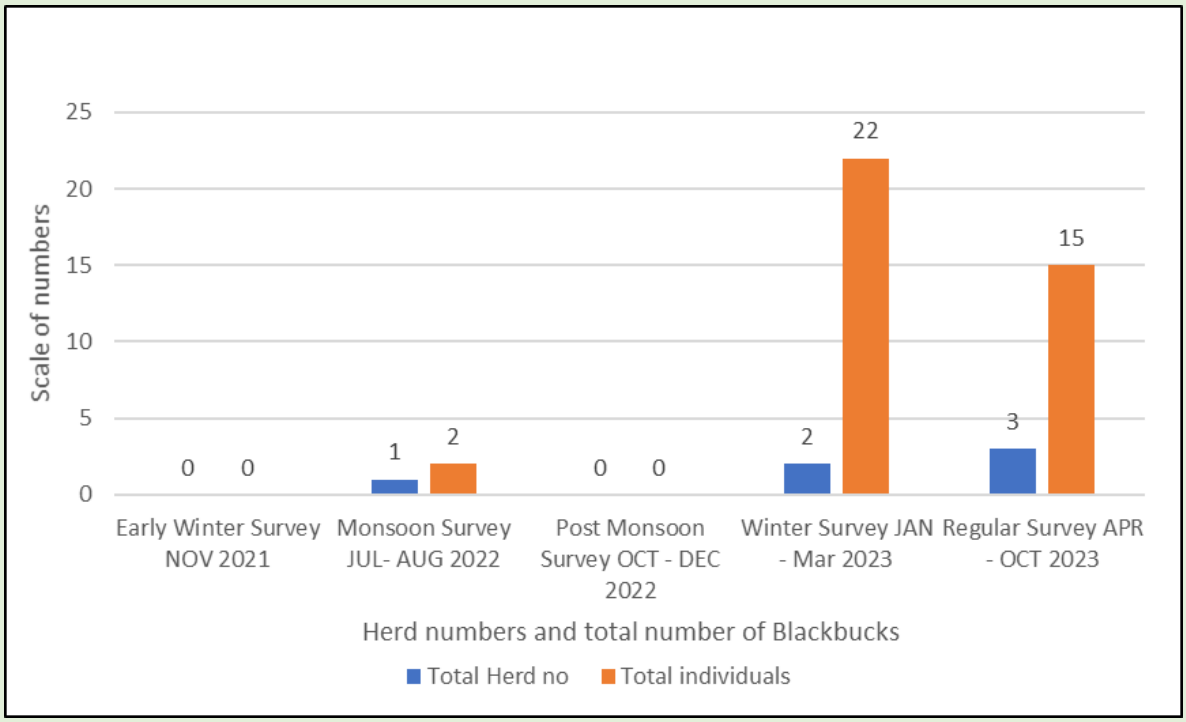
Sirsi-Aurad grassland comes under grid 120 which is situated at 17.819229 N, 77.402970 E. The survey area of Sirsi-Aurad grassland consists of open grassland with few patches of agricultural land where crops like Tur *Cajanus cajan* and Soybean *Glycine max* are cultivated.

The terrain is flat with few stony patches. The presence of grasses like *Heteropogon* spp., *Chrysopogon* spp., *Cymbopogon* spp., and *Andropogon* spp. are observed. Trees like *Azadirachta indica*, *Butea monosperma* are present. Mammal species observed here are Blackbuck *Antilope cervicapra*, Bengal Fox *Vulpes bengalensis*, Small Indian Civet *Viverricula indica*, Jungle Cat *Felis chaus*, Indian Crested Porcupine *Hystrix indica*. Avifauna observed here are Pallid Harrier *Circus macrourus*, Montagu's Harrier *Circus pygargus*, Indian Eagle Owl *Bubo bengalensis*, Indian Bushlark *Mirafra erythroptera*, Paddyfield Pipit *Anthus rufulus*. The grassland faces threats from dogs, humans, and vehicles.

Image 17: Sirsi-Aurad grassland @ Nayan Khanolkar

6.12 Shamshirnagar





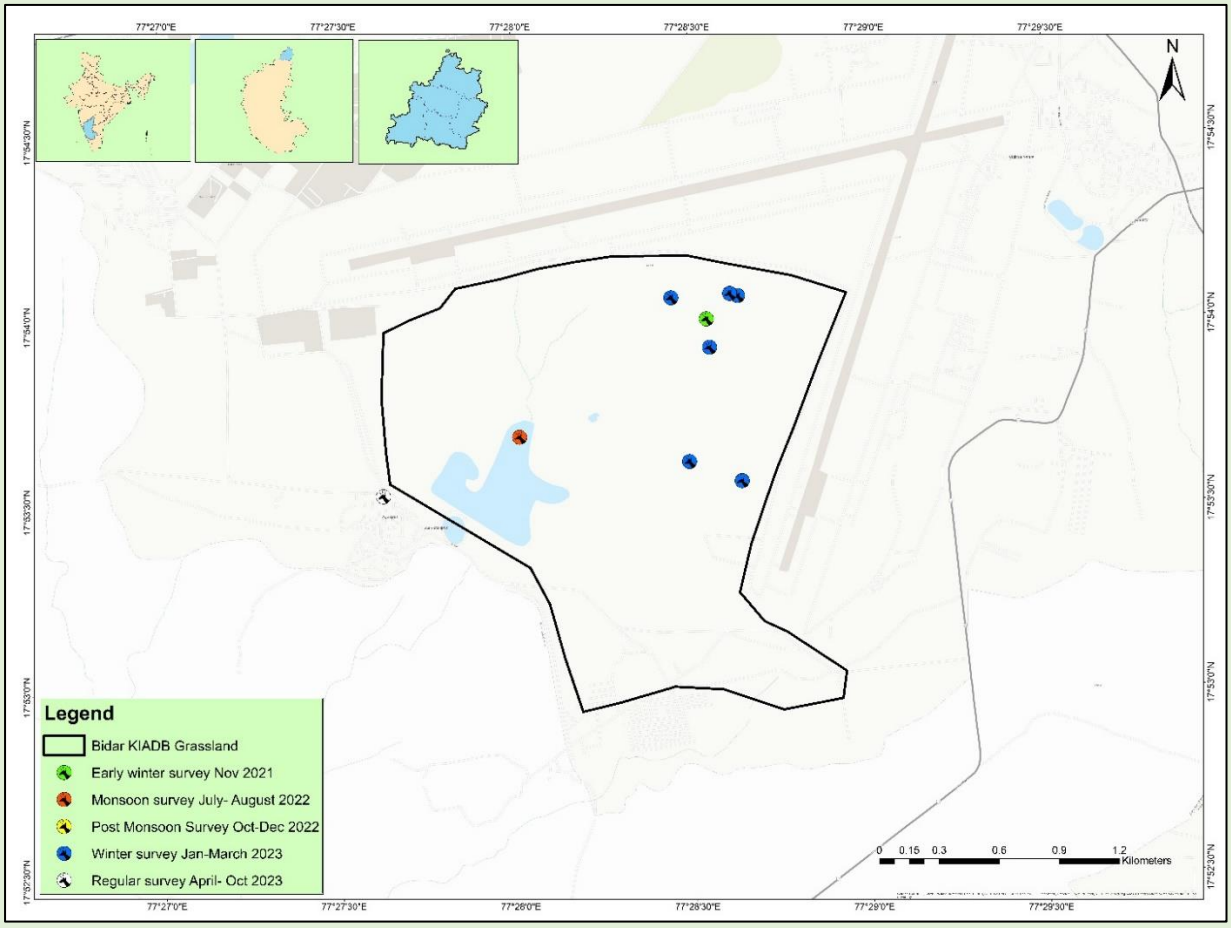
Figures 44 & 45: Seasonal variation of blackbuck in Shamshirnagar grassland

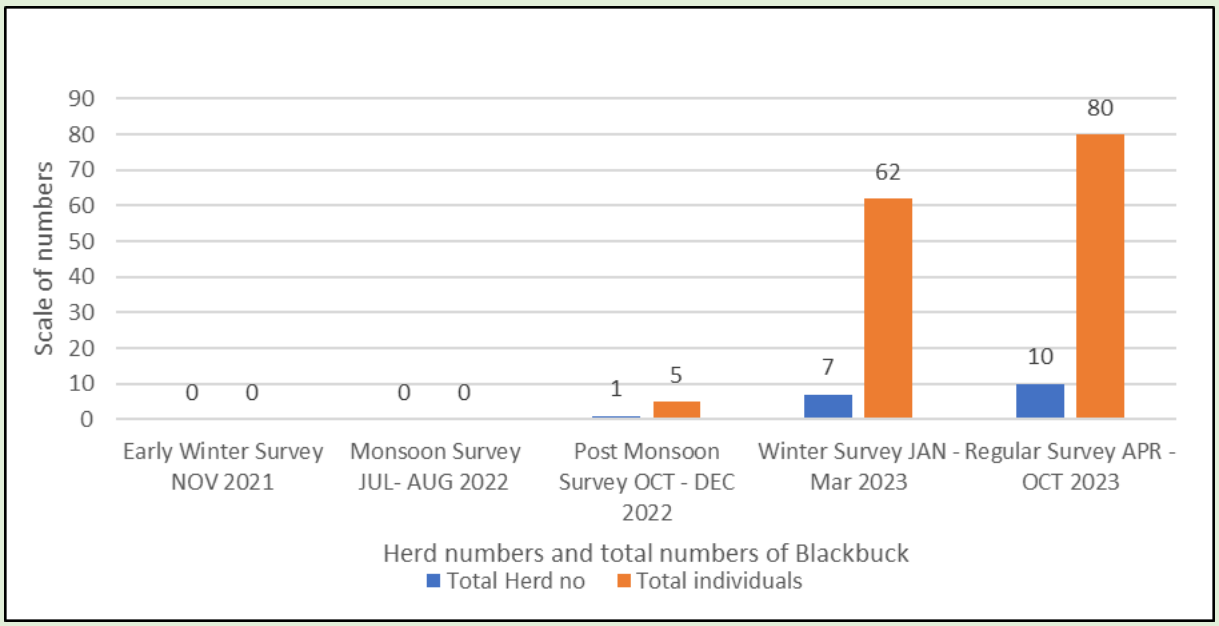
Shamshirnagar grassland comes under Grid 120 which is situated in the 17.839196 N and 77.391788 E. The survey area of Shamshirnagar consists of open grassland with few patches of agricultural land where crops like Tur *Cajanus cajan*, Soybean *Glycine max*, and Sugarcane *Saccharum officinarum* Ginger *Zingiber officinale* are cultivated. The terrain is flat with the presence of grasses like *Heteropogon* spp., *Chrysopogon* spp., *Cymbopogon* spp., and *Andropogon* spp. Trees like *Azadirachta indica*, *Butea monosperma* are present. Mammal species observed here are Bengal Fox *Vulpes bengalensis*, Jungle Cat *Felis chaus*, Blackbuck *Antilope cervicapra*, and Small Indian Civet *Viverricula indica*. Avifauna observed here is Pallid Harrier *Circus macrourus*, Montagu's Harrier *Circus pygargus*, Indian Bushlark *Mirafra erythroptera*, Paddyfield Pipit *Anthus rufulus*, Rufous-tailed Lark *Ammomanes phoenicura*, Rain Quail *Coturnix coromandelica*, Grey Francolin *Francolinus pondicerianus*, Painted Francolin *Francolinus pictus*.

The wildlife here faces threats from fencing, free-ranging dogs, livestock grazing, roads, and humans.

Image 18 Shamshirnagar grassland @Rushikesh Pawar

6.13 KIADB plot





Figures 46 & 47 Seasonal variations of blackbuck in KIADB grassland

The Karnataka Industrial Areas Development Board (KIADB) Grassland area, which comes under grid 104 situated at 17.897638 N and 77.474538 E, was selected to study Blackbuck movements and other grassland-dependent species. KIADB grassland area is situated near

Bellura Road. Bidar Air Force Base is on the east and north sides of the grassland, the area has an Air Force base wall on these two sides. Bellur and Zamistanpur villages on the west and south, respectively.

The terrain of the area is undulating and stony; a red soil type has been observed. The area is covered with a mixture of semi-arid grassland, agricultural land, fallow land, and scrubland. *Heteropogon* spp., *Dicanthium* spp., and *Chrysopogon* spp. are the dominant grasses observed in grasslands. A sesame *Sesamum indicum* crop is cultivated on agricultural fields. The region and the surrounding area consist of Bauhinia *Bauhinia purpurea* and *Pongamia pinnata* plantations. *Acacia nilotica* shrub is present in the sighting area. The invasive species *Hyptis* is found all over fallow land and grassland. In Mammals, Blackbuck *Antilope cervicapra* is dominantly present in the area. The residential as well as migratory birds sighted in this area were, Indian Courser *Cursorius coromandelicus*, European Roller *Coracias garrulus*, Pallid Harrier *Circus macrourus*, Ashy-crowned Sparrow Lark *Eremopterix griseus*, Paddyfield Pipit *Anthus rufulus*, Siberian Stonechat *Saxicola maurus*, Yellow-wattled Lapwing *Venellus malabaricus*, Chestnut-bellied Sandgrouse *Pterocles exustus*, Eurasian Hoopoe *Upupa epops*, Red-wattled Lapwing *Venellus indicus*, Little Ringed Plover *Charadrius dubius*, Wood Sandpiper *Tringa glareola*, Painted Francolin *Francolinus pictus*, and Eurasian Collared-dove *Streptopelia decaocto.*

The grassland ecosystem in this area is host to a diverse range of wildlife, which unfortunately face a variety of challenges as a result of human settlements and activities. Residential plots and industrial developments are key factors in habitat loss and degradation, while fencing and grazing animals can disrupt natural movements and feeding patterns. Additionally, domestic dogs and human activity pose a significant threat to the local wildlife, while noise pollution and road traffic can further exacerbate the situation by causing disturbance to the delicate ecosystem. The confluence of these factors creates a challenging environment for the animals that inhabit this grassland.

Image 19: Territorial herd in KIADB grassland, Bidar @ Minal Pawar

7) Other grassland-associated antelope species and mammals in Bidar

7.1 Chinkara

The gazelle species Chinkara *Gazella bennettii* is native to Asia, including Iran, Afghanistan, Pakistan, and India. Chinkara has a reddish-buff summer coat with smooth, glossy fur, which becomes lighter, almost white, in winter. They have dark chestnut stripes on the sides of their face from the corner of the eye to the muzzle, bordered by white stripes. Chinkara are native to Iran, Afghanistan, Pakistan, and India, and they live in arid plains and hills, deserts, dry scrub, and light forests. The species is present in dry deciduous forests, open woodlands, and sandy dune areas within the annual rainfall range (Rahmani 1990). The chinkara is distributed in arid and semi-arid regions of India, with low density in most areas (Jaipal 2015). Chinkara are very adaptable and are present in dry deciduous forests, open woodlands, sandy dune areas, and arid and semi-arid regions of India (Rahmani 1990) (Jaipal 2015).

The species prefers arid plains and hills, deserts, dry scrub, and light forests, and are known to be very shy creatures, avoiding human habitation. The total population size of Chinkara is estimated to be around 50,000-70,000. The species is considered to be facing threats from habitat depletion, including in protected areas such as the MWS sanctuary (Gaikwad and Narwade 2016). Overhunting for meat and trophies in Afghanistan, Iran, and Pakistan, as well as habitat loss due to agricultural and industrial expansion and overgrazing, are major threats to the chinkara. A study conducted in the Desert National Park, Rajasthan, focused on the feeding ecology of chinkara, finding that they mainly feed on twigs, leaves, flowers, and fruits of small trees, bushes, grasses, and herbs (Jaipal 2015). Another study aimed to assess the distribution, density, group size, and conservation of the chinkara in Rajasthan, India (Rahmani 1990). The status of the chinkara was observed to be threatened by habitat depletion, including in the MWS sanctuary, which was declared a sanctuary for their protection (Gaikwad and Narwade 2016). In Bidar, there is a small population present in Dapka and surrounding Maharashtra border areas.

Image 20: Herd of Chinkara at Dapka area, Bidar @ Vivekanand Baburao

7.2 Four-horned Antelope

The Four-horned Antelope *Tetracerus quadricornis* is a solitary species that occurs in open deciduous forests at low densities in India. The four-horned antelope is a small, slender

antelope with four horns, two on the forehead and two on the back of the head. It has a reddish-brown coat with white underparts and a white stripe on the upper lip (Jones 2009). The Four-horned Antelope is endemic to the Indian subcontinent and is distributed in all Indian states south of Uttar Pradesh, except Kerala (Baskaran *et al.* 2011). It is currently reported from 104 and 3 sites in India and Nepal, respectively. The species occurs in open deciduous forests at low densities. It is primarily a browser and concentrates feeder and is not as dependent on water as previously suggested (Krishna *et al.* 2009). The distribution of the Four-horned Antelope within tropical dry deciduous forests can be treated as an indicator of high tree diversity and hence habitat quality (Sharma *et al.* 2014). It is classified as 'Vulnerable' (C2a(i)) in the IUCN Red List (Jones 2009).

Within India, the species is protected under Schedule I of the Wild Life Protection Act (1972) (Jones 2009). The species has been the subject of little scientific and conservation attention (Krishna *et al.* 2009). A survey was conducted in southern India to assess the ecological status, habitat use, and the immediate local threats to the species in the forests of the Eastern Ghats (Jones 2009). Another study aimed to assess the distribution, density, group size, and conservation of the Four-horned Antelope in Rajasthan, India (Krishna *et al.* 2009). A study conducted in the tropical forests of southern India focused on the behavioral ecology of the Four-horned Antelope (Baskaran *et al.* 2011). Habitat loss is listed as a major threat to the species, but observations suggest that its abundance and distribution are considerably affected by habitat changes due to local and landscape-level factors (Krishna *et al.* 2009). The species is also threatened by hunting and poaching for its meat and horns (Jones 2009).

Image 21: Four-horned antelope in Bidar, Article Published in The Hindu, Kalaburagi edition (2021) @ Pavan yaragudi

7.3 Nilgai

Boselaphus tragocamelus, also known as the Nilgai, is a species of antelope found in India. The Nilgai is among the largest of the Asian antelopes, standing about 120-150 cm at the shoulder with a body length of 180-200 cm (Leslie 2008). They have a short coat that is yellow-brown in females and turns blue-grey in adult males, while calves are pale brown. Nilgai is endemic to the Indian subcontinent and is distributed in all Indian states south of Uttar Pradesh, except Kerala. It is also found in the foothills of the Himalayan Mountains southward to Mysore. The Nilgai prefers open grassland and savannahs and is locally a significant agricultural pest in India. They live in dry areas with a variety of land types, ranging from grassy, steppe woodlands to hillsides. The species is not of special conservation concern and is well distributed in India. However, it is considered an unconventional pest of agriculture in some areas (Leslie 2008).

A study was conducted in the Beer-Sonty reserve forest in Haryana, India, to assess the ecology of the Nilgai and its status as an unconventional pest of agriculture (Chopra and Rai Babbar 2009). Another study aimed to assess the effectiveness of different management strategies against the nilgai antelope population in the Punjab Province of India. A study conducted in Texas, USA, focused on the ecology and behaviour of the nilgai antelope. The species may damage human food crops in the areas in which they are found (Leslie 2008). Hunting by humans threatens the nilgai antelope. In Bidar, there is a small population present in Dapka and surrounding Maharashtra border areas.

Image 22: Females and the subadult herd of Nilgai near the Dapka grassland area, Bidar @ Vivekanand Baburao

7.4 Indian Fox

The Indian Fox *Vulpes bengalensis* is a small carnivore found in India. It is a small carnivore with a body length of 100-140 cm and a tail length of 10-15 cm. It has a brownish-grey coat with black streaks on the body and darker flanks. The species is sexually dimorphic, with males being larger than females (Vanak 2005). The Indian Fox is endemic to the Indian subcontinent, ranging from the Himalayan foothills and Terai of Nepal through the southern portion of the Indian Peninsula to southern and eastern Pakistan, eastern India, and southwestern Bangladesh. It is reportedly the most widespread fox species known to occur in India, with its presence confirmed in 10 of the 13 sites surveyed in southern India, including Rollapadu Wildlife Sanctuary in Andhra Pradesh. The Indian Fox inhabits a variety of habitats, including scrublands, grasslands, and agricultural fields. It is tolerant to human presence and can be found in agricultural fields and the vicinity of rural habitation. The Indian Fox is listed as Least Concern in the IUCN Red List of Threatened Species.

In India, it is listed under Schedule II of the Indian Wild Life (Protection) Act, which affords a lower degree of protection (Vanak 2005). The species is protected in several protected areas in India, but less than 2% of potential Indian Fox habitat is covered under the existing protected area network of the states of Karnataka and Andhra Pradesh. A preliminary survey of sightings, pugmarks, and dens was undertaken in seven districts of Andhra Pradesh and Karnataka states in southern India to determine the distribution of the Indian Fox. A pilot survey was undertaken of its distribution in parts of southern India to identify regions where additional research is required (Vanak 2005). A study in Karnataka, India, presented preliminary observations on the distribution, den characteristics, and diet of the Indian Fox (Kumara *et al.* 2012). Lack of habitat protection is perhaps the greatest threat to the Bengal Fox, with less than 2% of potential Indian Fox habitat covered under the existing protected area network of the states of Karnataka and Andhra Pradesh. Hunting for its skin and flesh, as well as the conversion of its grassland habitat to agriculture, industry, and increasingly bio-fuel plantations, have affected its population density. In Bidar, Aurad, and Bhalki tehsils mostly fox was sighted.

Image 23: Indian Fox near to Konmelkunda grassland area @ Minal Pawar

7.5 Indian Jackal

The Indian Jackal *Canis aureus indicus* is a medium-sized canid species with a golden-yellow to pale-grey coat, often with a black saddle pattern on the back. It has a bushy tail and large, erect ears (Vanak 2005). The species is widely distributed across India, occurring in various habitats, including grasslands, scrublands, and agricultural areas (Vanak 2005). Indian jackals are generalists, adapting to the local abundance of food resources. They occupy a wide variety of habitats and utilize a variety of food resources. They are known to range over large distances in search of food and suitable habitat (Kebede 2017). The status of the Indian jackal is of "least concern" according to the IUCN Red List. In India, it is listed under Schedule II (Part I) of the Indian Wildlife (Protection) Act. They are present in all protected areas of India except for those in the high-elevation regions of the Himalayas (Kebede 2017).

A study on the movement patterns and habitat use of the Golden Jackal *Canis aureus* in the Bhal regions of Gujarat provides insights into the ecology and behaviour of the Indian Jackal (Prerna *et al.* 2015). Additionally, a review of the worldwide status, distribution, ecology, and dietary habits of the Golden Jackal summarizes the main threats and problems of jackal management (Negi 2014). The Indian Jackal faces threats such as illegal poaching and trade, local policies of extirpation, poisoning, and occasional hunting as a game species. However, there is no significant trade in jackal products, although skin and tail are occasionally sold (Kebede 2017). In Bidar, the population of Indian jackals is very scattered.

Image 24 Indian Jackal @ Rushikesh Pawar

7.6 Indian Grey Wolf

The Indian Grey Wolf *Canis lupus pallipes* is a critically endangered species found primarily in the Indian subcontinent. The Indian Grey Wolf is a subspecies of the grey wolf, characterized by a golden-yellow to pale grey coat, often with a black saddle pattern on the back. It is a medium-sized canid with a bushy tail and large, erect ears. The Indian Grey Wolf is restricted to lowland India and Pakistan, primarily in grassland habitats that are threatened by human encroachment and land conversion. Indian grey wolves can be found in agro-pastoral areas that are not beyond the boundaries of protected forests. However, their habitats are becoming isolated due to the expansion of human settlements, deforestation, and cropland expansion.

In India, it is listed under Schedule I (Part I) of the Indian Wildlife (Protection) Act. The Indian grey wolf is critically endangered and faces numerous threats, including habitat loss, interbreeding with stray dogs, and habitat fragmentation by linear infrastructure, which increases the risk of roadkill. Studies have focused on the distribution and population status of the Indian grey wolf in various regions of India, including southern India and the Chota Nagpur Plateau. These studies emphasize the need for a better understanding of its distribution and population status to aid in conservation efforts (Gubbi *et al.* 2020; Sharma *et al.* 2019). The Indian grey wolf faces numerous threats, including habitat loss, interbreeding with stray dogs, and habitat fragmentation by linear infrastructure, which increases the risk of roadkill. The expansion of human settlements, deforestation, and cropland expansion have further isolated their habitats, leading to issues such as interbreeding with stray dogs and increased risk of roadkill. The population of Indian grey wolf in Bidar is very low. There are several areas of Chetnal and Alur-Bellur grasslands where the Indian Grey Wolf was sighted.

Image 25: Indian Grey Wolf at Chetnal grassland, Bidar @ Rushikesh Pawar

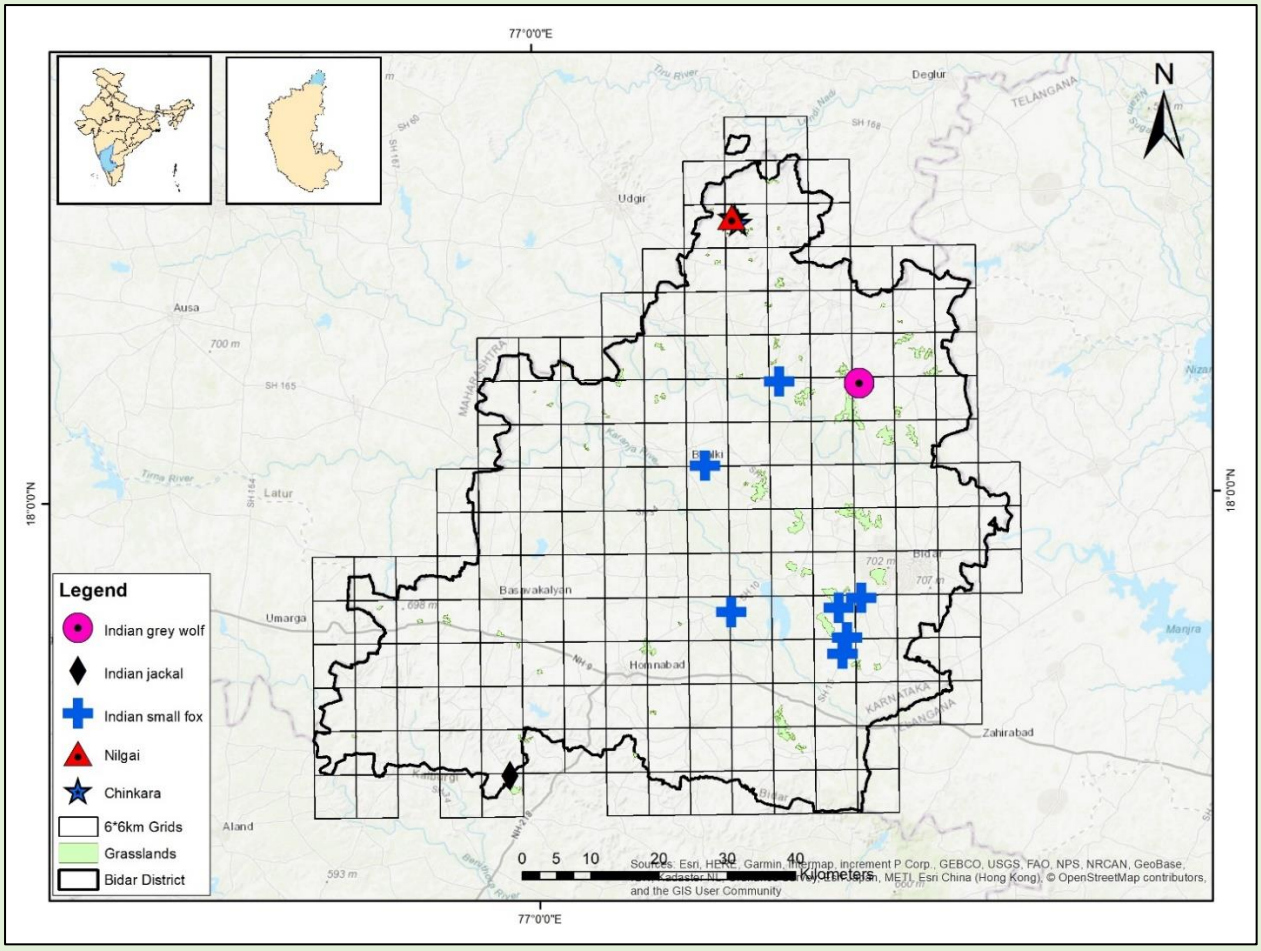


Figure 48 Grassland-associated antelope species and mammals in Bidar

8. Major issues to be addressed

8.1 Free-ranging dogs

Image 26 "Free-ranging dogs are posing an emerging threat to wildlife."@ Rushikesh Pawar, Pooja Gosavi, Minal Pawar, Nikhil Ghadigaonkar

One of the major threats to the survival of the Blackbuck population is the presence of free-ranging dogs. Free-ranging dogs are domesticated dogs that have strayed away from human settlements and roam freely in the wild. These dogs are known to prey on a variety of wildlife, including the Blackbuck, leading to significant declines in the population of this species.

Studies have shown that the presence of free-ranging dogs has a significant negative impact on the population density of Blackbuck. Free-ranging dogs pose a threat to wildlife and can negatively impact human health and livestock in various countries, including Iran, Italy, Bhutan, and Chile (Nayeri *et al.* 2021, Genovesi 2000, Dorji *et al.* 2020, Bhattacharjee 2018). The impacts of free-ranging dogs on wildlife include predation, competition for resources, and transmission of pathogens (Nayeri *et al.* 2021). In Iran, free-ranging dogs have attacked 17 species, including carnivores and Artiodactyla, with most attacks occurring within or adjacent to protected areas (Nayeri *et al.* 2021). In Italy, free-ranging dogs prey upon all ungulate species and colonial ground-nesting birds and are the main limiting factor in translocation projects involving roe and red deer (Genovesi 2000). In Bhutan, free-roaming dogs pose health hazards to humans, livestock, and wildlife, with 81% of respondents considering stray and feral dogs a problem in the community due to attacks/bites by free-roaming dogs to humans, livestock, and wildlife (Dorji *et al.* 2020). In Chile, free-ranging dogs followed tourists into protected areas, highlighting the importance of the engagement of the tourism sector in wildlife conservation (Schüttler and Jiménez 2022). In Lithuania, free-ranging dogs interact with animals in the environment, with the highest proportion of contacts resulting in the death of roe deer (Bakševičius 2022).

In a study conducted in the Velavadar National Park in India, it was found that the population density of Blackbuck was significantly lower in areas where free-ranging dogs were present compared to areas where they were absent (Goswami *et al.* 2016). Another study conducted in the same national park found that the presence of free-ranging dogs was a significant predictor of the decline in Blackbuck population density (Patel *et al.* 2015). Free-ranging dogs are known to prey on the fawns of Blackbuck, leading to high mortality rates. In a study conducted in the Blackbuck Sanctuary in India, it was found that predation by free-ranging dogs was the leading cause of fawn mortality (Mishra *et al.* 2002). The study also found that the presence of dogs led to a decline in the reproductive success of female blackbucks.

8.2 Habitat Fragmentation due to fencing

Many people fence off their private land for agricultural or residential purposes, but this common practice can harm the Blackbuck. Fencing can lead to fragmentation of grasslands and the loss of suitable habitats for the Blackbuck. This can cause a decline in their population density. Furthermore, fencing can limit wildlife movement, increasing the risk of roadkill and predation.

A recent study in Gujarat found that fencing private plots is a significant cause of habitat fragmentation and loss of connectivity between Blackbuck populations (Sivakumar *et al.* 2018). The study also showed that fencing reduces the availability of food resources for Blackbuck, negatively affecting their survival and reproduction. Moreover, fencing can result in increased human-wildlife conflicts. For example, in the Blackbuck Sanctuary in India, fencing agricultural fields resulted in the deaths of several Blackbuck due to entanglement and drowning in irrigation canals (Chellam and Johnsingh, 1993). Effective conservation strategies are required to protect the Blackbuck and prevent further habitat fragmentation. One such method is to establish buffer zones around protected areas to maintain grassland

connectivity. Landowners can also be encouraged to maintain open corridors and remove fences that limit wildlife movement. Overall, fencing private plots can be detrimental to the survival of the Blackbuck, and conservation efforts are necessary to ensure their long-term survival.

8.3 Human Blackbuck Conflicts

There has been a growing conflict between humans and blackbucks in India in recent years. The primary reason for this conflict is the increasing habitat loss due to human activities such as urbanization, industrialization, and agriculture. This has resulted in the fragmentation and destruction of the blackbuck's natural habitat, leading to a decline in their population and a rise in conflicts with humans. One of the main issues is that blackbucks often feed on crops grown by farmers in rural areas, which can lead to significant financial losses for the farmers. As a result, farmers may resort to using methods such as traps, poison, or hunting to protect their crops from blackbucks, which can result in injury or death of the animals. Additionally, blackbucks are often hunted for their meat, hides, and horns, which are considered valuable in some regions of India. Poaching, illegal hunting, and trade in blackbuck products are significant threats to the species' survival. The government and non-governmental organizations are making conservation efforts to protect blackbucks and their habitat. These efforts include establishing protected areas, anti-poaching patrols, and awareness campaigns to educate local communities about the importance of preserving the blackbuck population. In Bidar, the Blackbuck frequently invades agricultural fields at night. They also damage crops by feeding on tender saplings.

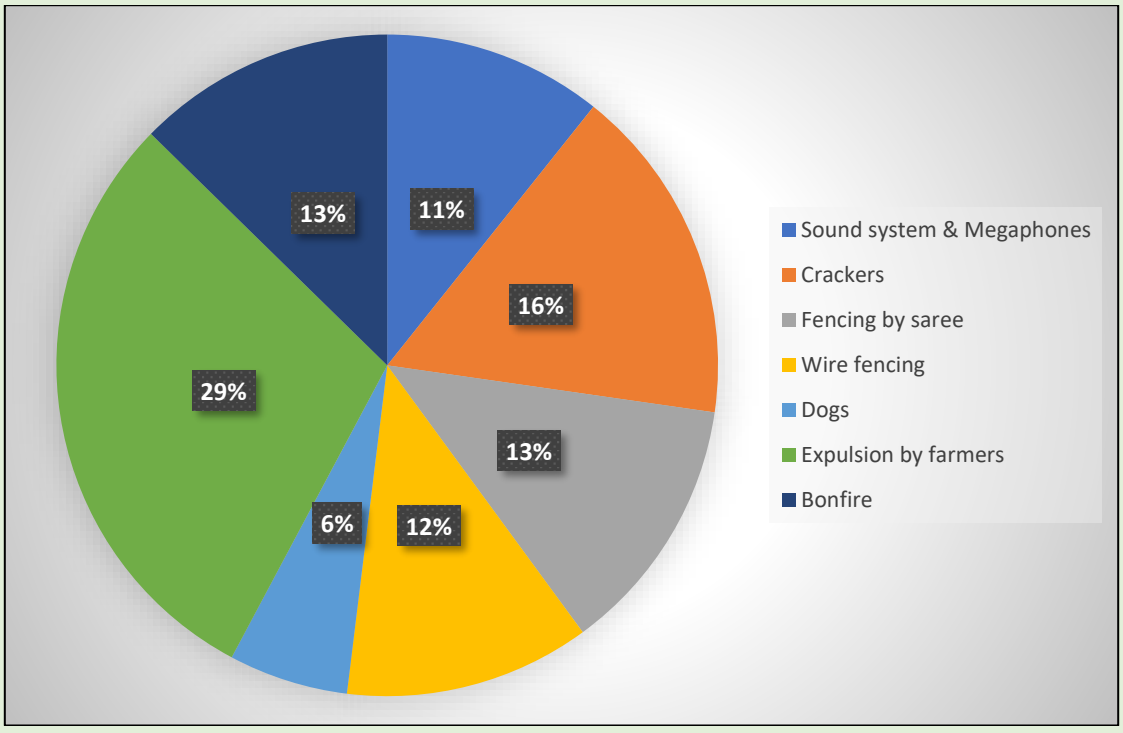


Figure 49 Tactics used by farmers to drive away Blackbucks in Bidar

Image 27 Human blackbuck conflict in grassland and agriculture areas in Bidar @ Rushikesh Pawar

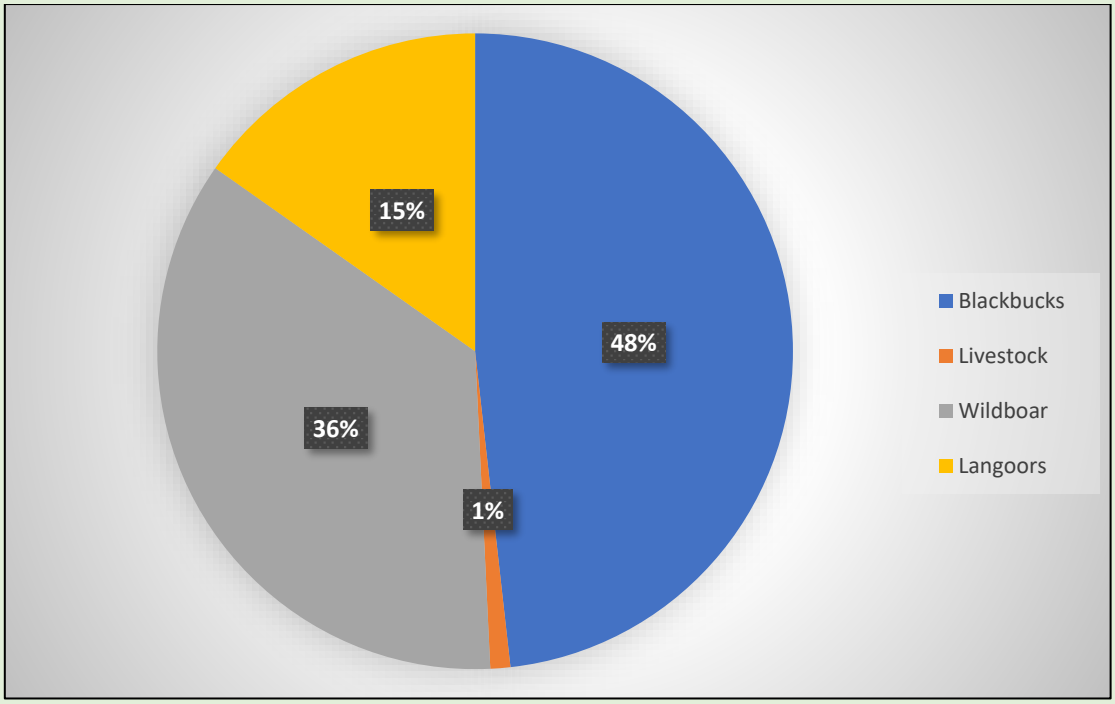


Figure 50 Interview with farmers in Bidar regarding crop raiding by animals.

The study conducted in Bidar aimed to understand the conflict between humans and blackbucks. The data collection involved farmers' tactics for expelling blackbucks. The researchers assessed the pattern of crop raiding through regular field visits and interviews with locals. Based on the observations made, it was found that most farmers expel blackbucks on their own using various tactics, such as crackers, wire fencing, dogs, bonfires, and saree fences. Furthermore, it was observed that only 11% of farmers use sound devices to expel blackbucks.

After analyzing the data collected through surveys and field visits, it is evaluated the effectiveness of different management strategies, such as fencing, crop diversification, or predator control. By comparing the outcomes of different interventions, they determined which approaches are most effective in reducing human-wildlife conflicts and improving the well-being of both wildlife and human populations. The conflict between humans and blackbucks is a complex issue that arises when blackbucks encroach on human settlements or agricultural lands, causing crop damage and posing potential threats to human safety.

To manage and mitigate this conflict, it is necessary to involve and work collaboratively with all stakeholders, including local communities, conservationists, government authorities, and wildlife experts. The following are some technical strategies that can be used to manage and mitigate the conflict:

- Keeping Blackbucks habitats safe and creating buffer zones around them is critical for their survival. The creation of such zones can help prevent conflicts with humans. This can be achieved through habitat restoration, habitat management, and habitat improvement techniques.

- Developing alternative livelihoods for locals can help reduce dependence on agriculture and reduce the risk of crop damage. This can be done by promoting ecotourism, providing vocational training, and creating job opportunities in other sectors. This will require a thorough analysis of the local economy, market demand, and skill requirements.
- Educating communities about conservation and coexistence is important for cultivating a culture of respect for wildlife. This can be done through awareness programs, workshops, and community engagement activities. The educational programs should be designed based on a thorough understanding of the local socio-cultural context and the target audience.
- Establishing protected areas for blackbucks can help ensure their safety and conservation. Such areas can include wildlife sanctuaries, national parks, and other protected areas. The establishment of protected areas will require a thorough analysis of the ecological, social, and economic factors.
- Working with local authorities to manage conflicts is essential. This can include the provision of resources such as fencing, water sources, and other infrastructure to mitigate human-blackbuck conflict. The infrastructure development plan should be based on a thorough analysis of the conflict hotspots, blackbuck movement patterns, and the human population density.
- Monitoring blackbuck populations and researching their behavior is necessary to better understand their movements and habits and to develop effective management strategies. This will require a combination of field surveys, remote sensing, and statistical modelling techniques.
- Offering compensation or insurance to farmers can help alleviate the economic impact of crop damage caused by blackbucks. The compensation scheme should be designed based on a thorough analysis of the crop economics, the extent of damage, and the local insurance market.
- Enforcing wildlife protection laws and deterring illegal activities is crucial for the safety and conservation of blackbucks as well as other wildlife species. This includes preventing hunting, poaching, and other illegal activities that threaten wildlife. The enforcement plan should be based on a thorough analysis of the legal framework, the capacity of law enforcement agencies, and the local community's attitudes toward wildlife conservation.

8.3 Roads

The construction of roads has brought significant challenges for wildlife, as it has led to the fragmentation of their habitats, increased vehicle collisions, created a barrier effect, produced noise and disturbance, led to pollution, habitat destruction, and the spread of invasive species. One of the most significant challenges of road construction is the fragmentation of natural habitats, which makes it difficult for wildlife to move freely and access essential resources. This ultimately leads to population isolation, reduced genetic diversity, and an increased vulnerability to extinction.

Image 28 "Roads vs. Wildlife: A Deadly Encounter" Chetal grassland, Bidar @ Rushikesh Pawar

Vehicle collisions also pose a severe threat to wildlife. They can cause extensive injuries or even fatalities to animals, damage vehicles, and potentially harm human occupants. Roads also obstruct the natural movement patterns of animals, preventing them from accessing important habitats or migration routes while disrupting their natural movement patterns and limiting access to food and water sources.

Noise pollution is another issue that has proven to be detrimental to wildlife. It can disturb communication, breeding behavior, and feeding patterns, leading to stress and reduced reproductive success. Pollution from vehicle emissions, oil spills, and litter can harm wildlife, especially those with sensitive respiratory systems.

Habitat destruction is also a significant threat to wildlife, as it results from clearing vegetation and altering natural landscapes, leading to population declines and local extinctions. Invasive species spread can also occur via roads, altering ecosystems and reducing wildlife habitat quality.

To mitigate these threats, several measures need to be implemented. One such measure is to create wildlife crossings, which allow wildlife to pass safely over or under roads. Another measure is to reduce speed limits in wildlife-prone areas, which gives drivers ample time to react to wildlife and avoid collisions. Creating wildlife corridors that connect isolated habitats via underpasses or overpasses is another way to minimize habitat fragmentation. Lastly, implementing roadkill monitoring and reporting systems can help in the identification of hotspots and aid in the development of targeted mitigation measures.

8.4 Green energy parks and Power stations

Image 29 The large grassland area converted into a solar park, Nirna @ Nayan Khanolkar

High-tension powerlines and solar energy parks can pose threats to wildlife in different ways:

1. **Disruption of migration and movement patterns:** Powerlines and solar energy parks can act as barriers to the movement of wildlife, particularly for species that rely on large-scale migration or movement patterns. These barriers can disrupt natural behaviours, limit access to food and water sources, and hinder breeding and dispersal.

2. **Disturbance and displacement:** Powerlines and solar energy parks can disturb wildlife due to noise, vibrations, and human activities associated with their construction and maintenance. This disturbance can lead to stress, altered behaviours, and displacement from important habitats.

3. **Heat Island effect:** Solar energy parks can create localized heat islands due to the large expanse of solar panels, which can affect local microclimates. This can impact the distribution and behaviour of wildlife, particularly species sensitive to temperature changes.

4. **Habitat loss and fragmentation:** The construction of powerlines, Power stations, and solar energy parks often involves clearing vegetation and altering natural landscapes. This can result in the direct loss of habitat for Blackbuck and many other species, leading to population declines and fragmentation of habitats.

5. **Collision risk:** Specially Birds are particularly vulnerable to collisions with powerlines and solar panels. Powerlines, especially those with long spans or located in flight paths, can be difficult for birds to detect, leading to fatal collisions. Similarly, solar panels can

create reflective surfaces that birds mistake for open space, resulting in collisions. There have been several instances where critically endangered Great Indian Bustard, Lesser Florican, and other migratory birds have collided with powerlines, leading to severe injuries and fatalities. This phenomenon is primarily caused due to the lack of visibility of powerlines to birds, which perceive them as a part of their natural habitat. The increasing number of powerlines and expansion of power infrastructure in areas inhabited by these birds has led to an alarming rise in such incidents, posing a significant threat to their population and survival.

6. **Electrocution:** Birds are fascinating creatures; However, these majestic creatures are at risk of electrocution when they perch or land on power lines or utility poles. This can happen when a bird comes into contact with two wires or a wire and a grounded object simultaneously, creating a potentially fatal electrical shock. Birds with large wingspans such as Raptors and Bustards are particularly at risk because they have a greater chance of touching multiple wires at once. Unfortunately, electrocutions are a common occurrence and can have a significant impact on bird populations. Therefore, it's crucial to take measures to protect and reduce the risk of electrocution.

To mitigate these threats, various measures can be taken, such as:

- Implementing bird flight diverters or markers on powerlines to increase their visibility and reduce collision risks.
- Retrofitting powerlines and utility poles with insulation or bird guards to prevent electrocutions.
- Designing solar energy parks with wildlife-friendly features, such as incorporating native vegetation, creating wildlife corridors, and minimizing disturbance during construction and operation.
- Conduct thorough environmental impact assessments before the construction of powerlines or solar energy parks to identify potential risks and implement appropriate mitigation measures.
- Implementing monitoring programmes to assess the impact of powerlines and solar energy parks on wildlife and make necessary adjustments to minimize negative effects.
- Promoting public awareness and education about the importance of wildlife conservation and responsible energy development practices.

By implementing these measures, it is possible to reduce the threats posed by high-tension powerlines and solar energy parks to wildlife and promote coexistence between renewable energy infrastructure and biodiversity conservation.

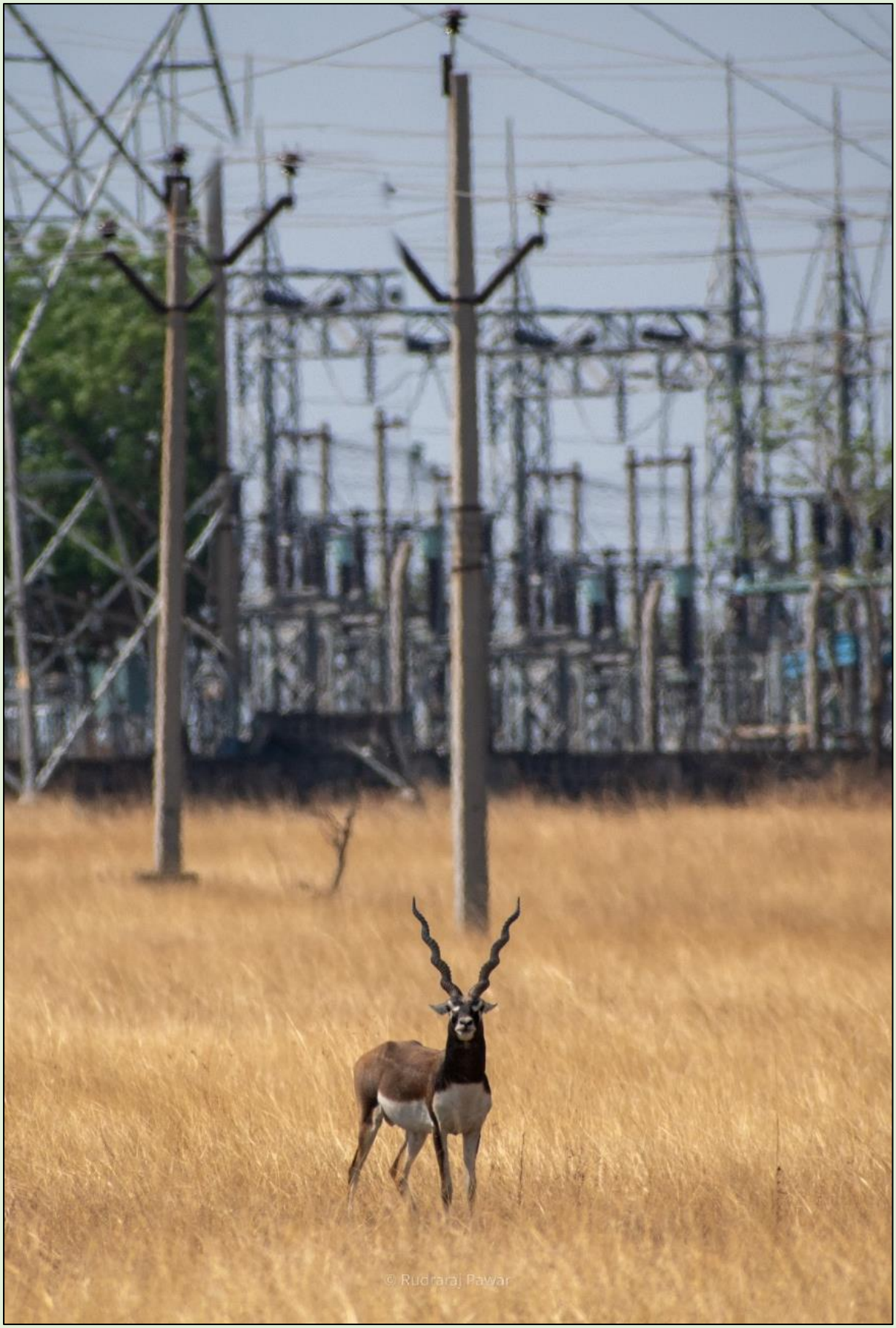


Image 30 "Habitat Destruction: A Threat to Wildlife Survival" Santhpur grassland, Bidar @ Rushikesh Pawar

9) Discussion – Conservation planning

9.1 Creating Community Conservation Reserves

It is essential to have a well-planned conservation strategy to protect the Blackbucks in the Bidar district. This may include establishing a community conservation reserve at critical locations such as Chetnal, Aliyabad, Chondi, Konmelkunda, etc. Here are some possible approaches to consider:

1. **Conduct a feasibility study:** The first step is to evaluate the viability of establishing a community conservation reserve for blackbucks in the Bidar region. This study should examine the behaviour and ecology of blackbucks, their current population status, and the factors that threaten their survival.
2. **Identify conservation areas**: After completing the feasibility study, potential conservation areas for blackbucks in the Bidar district should be identified. This could include areas with a high density of blackbucks, underutilized areas, or areas with potential for rehabilitation. The local community should be involved in this process as they will be the primary guardians of the reserve.
2. **Develop a conservation plan**: The next step is to develop a plan that outlines the measures required to safeguard blackbucks in Bidar district. This plan should include creating a buffer zone around the reserve to minimize human-wildlife conflicts, decreasing poaching, and hunting, and implementing sustainable land-use practices. Additionally, the plan should involve engaging the local community in conservation efforts, such as creating ecotourism job opportunities and providing education and awareness programmes.
3. **Collaborative efforts**: It is important to collaborate with the district administration, forest department, and other relevant government organizations to obtain support for the project. This may involve obtaining legal protection for the reserve, securing funding for conservation activities, and involving government agencies in monitoring and managing the reserve.
4. **Involve the community**: The final step is to involve the community in the conservation initiatives. The local community should be involved in every aspect of the project, from identifying potential conservation areas to implementing the conservation plan. Community participation can help build support for the project, instil a sense of ownership and responsibility, and ensure the long-term sustainability of the reserve.

In conclusion, establishing a community conservation reserve to safeguard Blackbucks in Bidar district requires careful planning, community involvement, and cooperation with the government. A well-planned and executed strategy can potentially protect the blackbuck population and create a sustainable and ecologically sound environment in the region.

9.2 Konmelkunda Blackbuck Conservation area

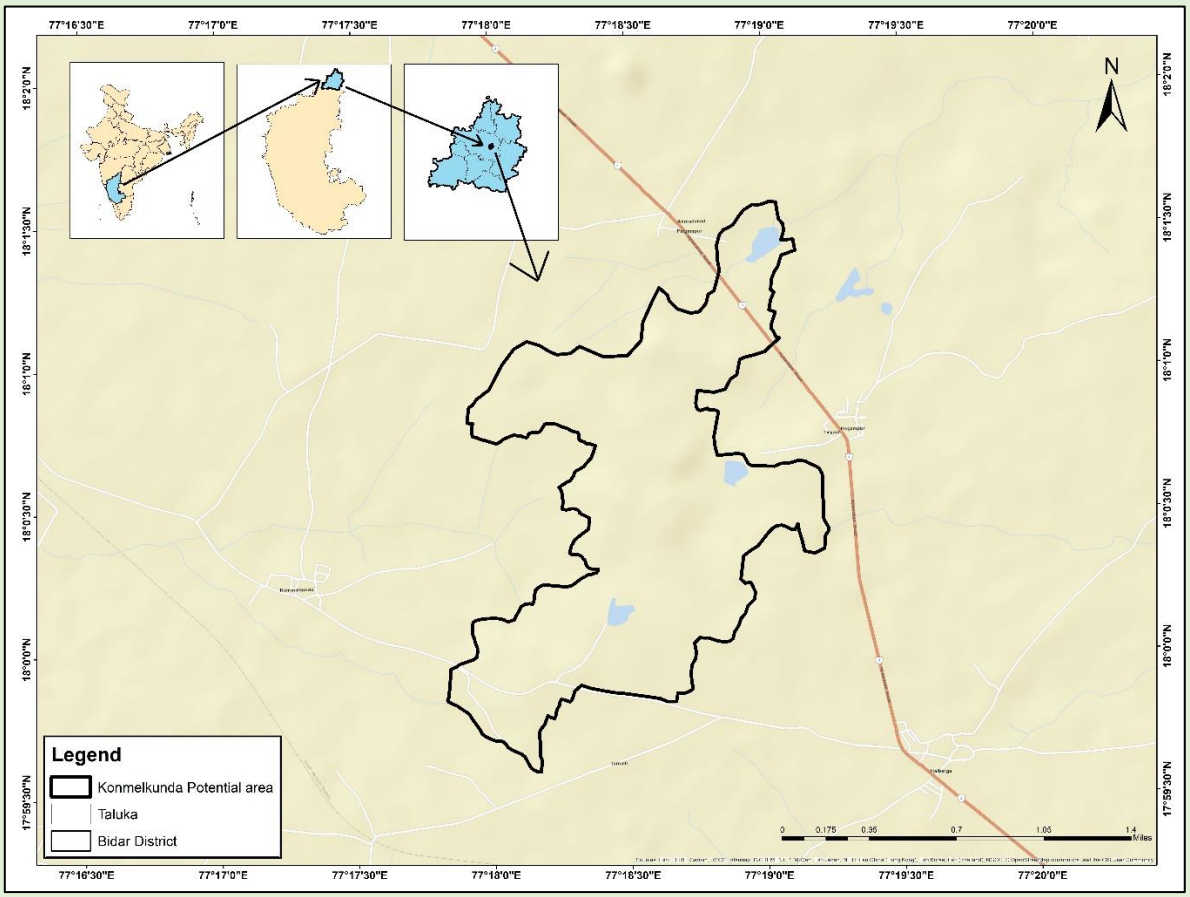


Figure 50 Konmelkunda, Bidar, Karnataka site

The Bidar Forest Department has proposed Konmelkunda as a site for Blackbuck conservation. Konmelkunda is a village located in Bhalki Taluk, Bidar District, Karnataka State, India. It falls under the Gulbarga Division and is 31 kilometers west of the district headquarters in Bidar, and 10 kilometers from Bhalki. The Konmelkunda region boasts a mix of forest, grassland, agriculture, and scrubland, with mostly undulating terrain. Two small water bodies also exist in the area. The majority of Konmelkunda is covered by forest, with *Gliricidia* spp. being a prominent species. The grassland is covered mainly by *Heteropogon* spp., *Cymbopogon* spp., *Chrysopogon fulvus*, and *Chrysopogon gryllus*. After mid-September, the height of *Chrysopogon fulvus* and *Cymbopogon* spp. grow nearly 1 meter, which reduced the visibility in most grass patches. The agricultural area was dominated by Soybean *Glycine max*, Moong *Vigna radiata*, and pigeon pea *Cajanus cajan*, with crop heights of nearly one meter after the second week of September. Scrubland is in a minor area also covered by *Butea monosperma*. Invasive are the major threats to grasslands. They cover major land surfaces. The invasives observed in the landscape are *Hyptis* spp., *Parthenium* spp., *Cassia uniflora*, and *Lantana camara*. The area has a diversity of birds and mammals. The Blackbuck *Antilope cervicapra*, are widely distributed in the area. The territorial, bachelors, and mixed herds are present in the area. Other Grassland indicator species, including the Small Indian Fox *Vulpes bengalensis*, Jungle Cat *Felis chaus*, Bonelli's Eagle *Aquila fasciata*, and Short-toed Snake Eagle *Circaetus gallicus* were also documented in the area.

Image 31: Female Blackbucks in Konmelkunda area @ Rushikesh Pawar

The conservation of blackbuck in Bidar is significant for several reasons:

1. **Biodiversity preservation**: Blackbucks are an integral part of the ecosystem they inhabit. As herbivores, they play a crucial role in maintaining ecological balance by controlling the growth of plant populations. Additionally, they are prey for carnivores, contributing to the delicate balance of predator-prey dynamics in their ecosystems.
2. **Grassland conservation and Flagship species**: Blackbucks play an important role in grassland conservation. Becoming the flagship species, it will conserve the grasslands as well as critically endangered species like the Lesser Florican, Great Indian Bustard, Indian Grey Wolf, and other grassland-associated species in Bidar.
3. **Ecosystem services**: The habitats where blackbucks thrive often provide essential ecosystem services, such as carbon sequestration, water regulation, and soil conservation. By conserving blackbucks, we indirectly protect and support the functioning of these ecosystems.
4. **Ecotourism and education**: Blackbucks can be a flagship species for ecotourism and educational initiatives. Their charismatic presence can attract tourists and raise awareness about the importance of conserving not just Blackbucks but the entire ecosystem they inhabit.
5. **Research and scientific value**: The long-term study on blackbuck has yet to happen in Bidar. Blackbucks offer valuable opportunities for scientific research, including animal behaviour, ecology, genetics, and conservation biology studies. Preserving their populations allows scientists to understand the species better and contribute to broader conservation efforts.
6. **Ethical responsibility**: As humans, we have an ethical obligation to protect and conserve species facing threats from human activities. The declining population of blackbucks primarily results from human actions, such as habitat destruction and poaching. Taking steps to conserve blackbucks is part of our broader duty to safeguard biodiversity and protect the natural world.

Image 32: Plantation carried out at the Konmelkunda site @ Sujit Narwade

Image 33: Informatic posters placed in the Konmelkunda Blackbuck reserve site @ Rushikesh Pawar

9.3 Habitat Restoration

Since almost all the grasslands in Bidar either have plantations of *Gliricidia* spp. or invasive plant species, therefore, once the area gets notified as a conservation or community reserve, restoration of habitats is crucial for repairing and reviving grasslands that have been disturbed or damaged by human activities. The objective of habitat restoration is to bring back the natural habitat and ecosystem functions that existed before the disturbance and to promote the recovery of native plant and animal communities.

Research has demonstrated that grassland restoration can enhance bird habitats by re-establishing their habitats or enhancing their quality. This can ultimately lead to increased breeding success and stability in bird populations. Grasslands are vital habitats for many bird species, including those that depend on grasslands. Habitat restoration can aid in improving

their quality and availability. The restoration process involves three phases: planning, implementation, and monitoring. During the planning phase, the restoration project's goals and objectives are determined, and the site is assessed to determine the best restoration strategies. The restoration plan is then executed during the implementation phase, which may involve removing invasive exotic plants, planting native species, and implementing other restoration techniques.

In the case of grassland restoration, the Bidar Forest department will manage the restoration sites by uprooting exotic species, sowing grass seeds, and safeguarding them from threats. The Bombay Natural History Society (BNHS) can provide scientific and technical support to ensure the effectiveness of restoration efforts. To ensure successful restoration efforts, creating favourable conditions for grass growth on the restored sites is essential. This may include soil preparation, appropriate watering, and nutrient management. The restoration process is time-bound, uprooting invasive exotic plants in the summer, followed by sowing in the monsoon season.

Image 34: Uprooting of Gliricidia spp. plantation in Konmelkunda Blackbuck Reserve site @ Rushikesh Pawar

Bidar Forest Department currently removing exotic plant species such as *Gliricidia* spp,. plantations are crucial for restoring the grasslands to their natural state. These species can be aggressive and outcompete native plants, leading to a decline in biodiversity and the degradation of the ecosystem.

Restoring habitats is essential to repair and revive ecosystems that have been damaged due to human activities or natural occurrences. When it comes to restoring grasslands, can help birds and other wildlife by reviving their habitat or enhancing its quality, which can result in better breeding outcomes and a stable population. By carefully planning, executing, and supervising the restoration process, we can bring back the natural ecosystem functions and habitats that existed before the disruption, supporting the revival of local plant and animal communities.

Image 35: Uprooting of Gliricidia spp. plantation in Alur-Bellur grassland @ Nayan Khanolkar

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9.4 Developing Grasslands

Removing non-native and invasive plant species during the summer is important to restore a site. Once this is done, the site must be carefully examined to see if any native grass species and *Ziziphus* spp. are present. This information will help determine the appropriate grass species for restoration. It is best to choose native palatable grass seeds from the surrounding areas, ensuring they are suitable for the soil and climate of the restoration site.

Seed ball preparation is an effective way to sow grass seeds in degraded areas. This process involves mixing the seeds with a suitable medium, such as compost or soil, forming them into small balls, and then distributing them evenly across the restoration site. Seed balls protect the seeds from being eaten by birds and other animals and provide a suitable environment for germinating.

During the monsoon season, it is important to take several steps to ensure that the restoration site is properly prepared and maintained. One of the most crucial steps is to plough the site with seed balls to promote the uniform growth of grass. It is essential to distribute the seed balls evenly across the site, as this will help to ensure that the grass grows uniformly and that there are no patches of bare soil. After sowing the seed balls, it is critical to protect the site from grazers, dogs, and other animals that may damage the newly developed grassland. This can be achieved by covering the site with a fence or by appointing guards to monitor and protect the site.

To guarantee the success of the restoration project, continuous monitoring is crucial. It is important to involve the local community in monitoring the site and spreading awareness about grassland conservation. The response of other species towards the newly developed grassland should be observed, and the growth of grass and maintenance of the height of grass

for grassland-oriented species should be monitored as well. This will help assess the success of the restoration project and identify any issues that need to be addressed.

Monitoring should be done regularly, and data should be recorded for future reference. This will help in making informed decisions about the maintenance and management of the restored grassland. Additionally, it is important to ensure that the site is adequately maintained, especially during the dry season when there may be a risk of fire. By taking these steps, we can ensure the long-term success of the restoration project and help conserve the grasslands for future generations.

9.5 Addressing the issue of free-ranging dogs

The problem of free-ranging dogs hunting blackbucks in groups is a significant concern for wildlife conservation. To address this problem effectively, provide incentives to the Gram Sabha, the village-level governing body, to implement dog control measures using methods approved by the World Health Organization (WHO). These measures can include vaccination, sterilization, and the relocation of dogs to other areas away from wildlife habitats.

Additionally, private pest control agencies can be engaged to remove and euthanize dogs from critical wildlife habitats. However, it is essential to ensure that humane methods are employed throughout these efforts, taking into account the well-being of both the dogs and the wildlife. For example, the use of nets and other non-lethal methods to capture dogs can be explored.

The active involvement of local communities and authorities is also crucial to achieving successful outcomes. Community education programs can be implemented to raise awareness of the issue and promote responsible dog ownership. This can include providing information on proper dog care, spaying and neutering, and the dangers of allowing dogs to roam free in wildlife habitats.

To safeguard the blackbucks and preserve the overall wildlife population, a collaborative approach is necessary. This approach should foster cooperation and partnership between the forest department, the Gram Sabha, private pest control agencies, and the community at large. By working together, we can effectively address the problem of free-ranging dogs hunting blackbucks and protect our precious wildlife.

9.6 Addressing the issue of Human-Blackbuck conflict

Conflicts between humans and wildlife, including Blackbucks, are a growing concern in Bidar. These conflicts arise due to various reasons, including habitat loss, competition for resources, and human encroachment into natural habitats. If left unaddressed, these conflicts can lead to the decline of Blackbuck populations and threaten their long-term survival. In this regard, a structured approach is necessary to mitigate and resolve such conflicts effectively.

- The first step in addressing these conflicts is to understand the root cause. It is crucial to identify the underlying reasons for the conflicts, whether it's due to habitat destruction, agricultural expansion, or human settlements encroaching on the natural habitat of Blackbucks. Conducting thorough research and assessments can help in identifying the root causes.

- Once the root causes are identified, the next step is to implement habitat conservation and management strategies to preserve and protect the natural habitats of Blackbucks. This can be done through designated conservation areas, wildlife sanctuaries, and national parks. Additionally, implementing habitat restoration programs can ensure sufficient space and resources for the Blackbucks.

- Physical barriers such as fences or trenches can help in preventing Blackbucks from entering agricultural lands or human settlements, thereby reducing conflicts. Properly designed fences can protect crops while allowing wildlife to move freely within their habitats.

- In many cases, conflicts arise when local communities depend on resources that Blackbucks also rely on, such as grazing lands. Introducing alternative livelihood options such as eco-tourism, sustainable agriculture practices, or alternative sources of income can reduce the pressure on natural resources and mitigate conflicts.

- It is also essential to raise awareness among local communities about the importance of wildlife conservation and the ecological role of Blackbucks. Educating people about coexistence strategies, such as proper waste disposal to prevent attracting wildlife to human settlements, can help in reducing conflicts.

- Enforcing existing wildlife protection laws and regulations is crucial to safeguard Blackbucks and their habitats. Implementing penalties for illegal hunting, habitat destruction, or any activities that pose a threat to the species can deter such activities.

- Community-based conflict resolution mechanisms involving stakeholders such as government agencies, local communities, conservation organizations, and wildlife experts can facilitate dialogue, negotiation, and consensus-building to address conflicts effectively.

- Continuously monitoring Blackbuck populations, habitat conditions, and human-wildlife interactions is essential to identify emerging conflicts and assess the effectiveness of mitigation measures. Research efforts can provide valuable insights into the behavior of Blackbucks and help in devising more targeted management strategies.

- Finally, wildlife conservation often requires collaboration across borders, especially for species with large ranges. Collaborating with neighboring countries or regions to implement coordinated conservation efforts can ensure the long-term survival of Blackbucks.

In summary, by adopting a holistic approach that combines habitat conservation, community engagement, education, and effective management strategies, conflicts between humans and Blackbucks can be mitigated, promoting peaceful coexistence while safeguarding the species and their habitats.

9.6 Awareness and Outreach Programme

It is crucial to educate people about environmental issues and the conservation of various habitats and species. One of the species that requires conservation efforts is the Blackbuck, which is facing a rapid decline in population due to factors such as human encroachment, habitat destruction, and poaching.

To address this issue, outreach programs can be organized to educate people about the significance of conserving grasslands and protecting the Blackbuck. These programs can include presentations, workshops, and awareness sessions that focus on the Blackbuck-human conflict and the various factors contributing to the species' declining population.

To engage and educate children, materials with the Lesser Florican and Blackbuck logos can be distributed, generating interest and awareness among future environmental custodians. Additionally, outreach programs can target local communities and build a sense of ownership and responsibility towards the environment, encouraging them to take action and contribute to better conservation outcomes.

Raising awareness and promoting education, will take a step forward in conserving habitats and protecting the species that inhabit them, such as the Blackbuck.

Image 36: Various awareness programmes conducted by BNHS in collaboration with the Bidar Forest department

9.7 Ecotourism model for conservation of grassland

There are several articles related to ecotourism and the conservation of grasslands, forests, and wildlife in different parts of the world. Here are some key points from each article:

- Ecotourism in Ergun grassland, China, has achieved several sustainable development goals, such as providing income for local people, improving community cooperation, and raising conservation awareness. However, ecotourism caused the loss of forb species and subsequent decreases in ecosystem services. Climate change and adverse market conditions limited ecotourism to provide enough revenues for local people. Hence, it was better to integrate ecotourism and livestock feeding rather than replace livestock feeding with ecotourism in grassland conservation. Further community engagement and multiple stakeholders' cooperation are needed to ensure both better public services and vibrant communities (Li *et al.* 2022).

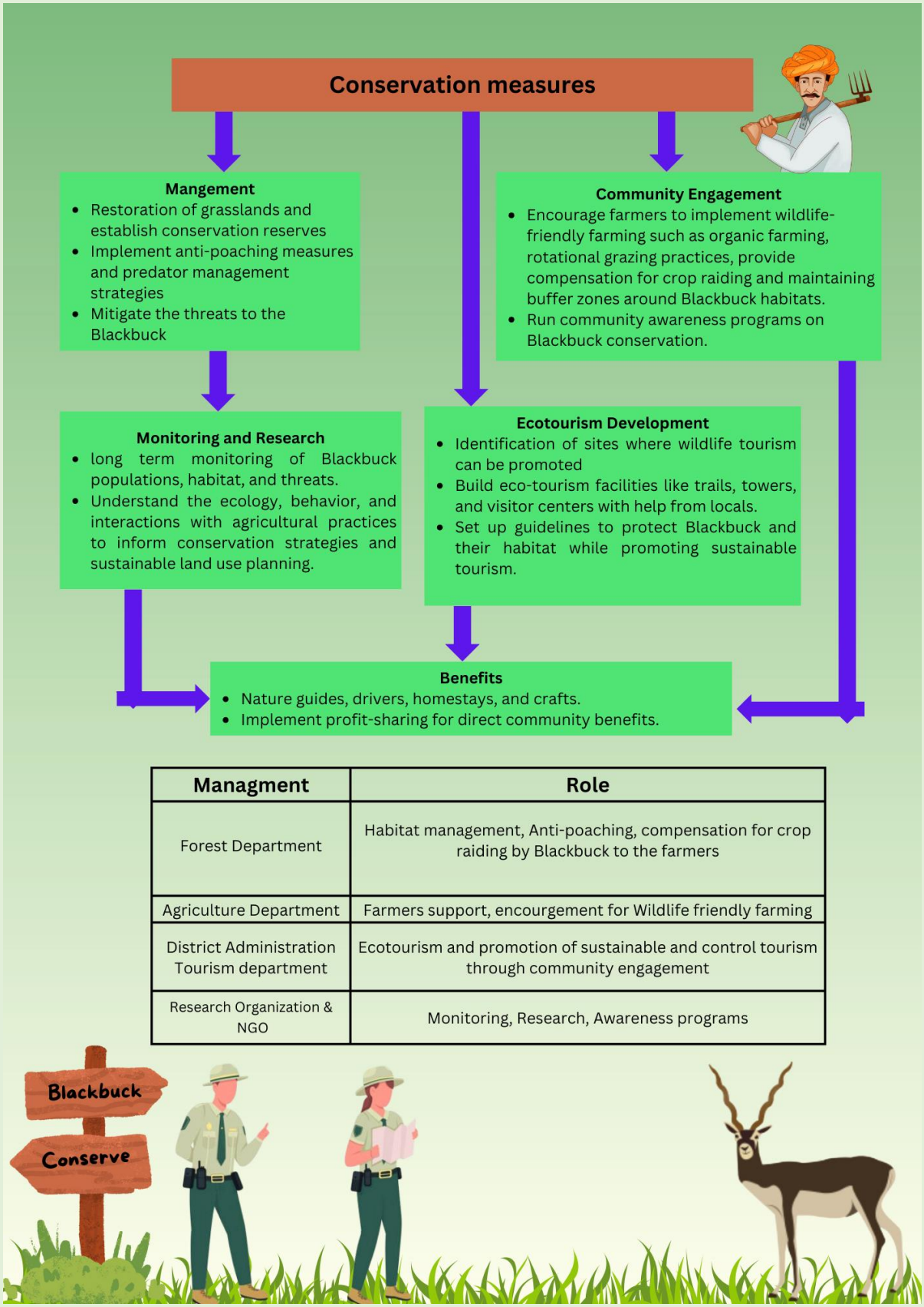
- Ecotourism has higher potential in drier regions where agricultural profit is lower, and this hypothesis would seem to apply to the Great Plains of North America, which has a gradient of precipitation. Rangelands are more common in the western Great Plains, and cattle grazing on grasslands is compatible with ecotourism. A spatial model suggests that northern and western portions of the Great Plains have the highest potential for ecotourism ventures that cater to short-term sightseeing visitors, while three areas in the

northern and central Plains have high potential for ecotourism ventures providing long-term nature-seeking experiences in unique landscapes (Powell *et al.* 2018).

- Ecotourism is supposed to be culturally respectful and an agent to enhance indigenous values, culture, and heritage conservation through the ethical and responsible approach to development. However, in reality, ecotourism has also demonstrated its shortcomings that have caused severe environmental damage and socio-cultural problems. Ecotourism has induced both positive and negative consequences on the local culture and social life in Annapurna Sanctuary Trail in Annapurna region, Nepal. The key objective of ecotourism, i.e. conservation of local heritage and culture, is not fully achieved. However, local people perceived significant benefits in terms of conservation of biodiversity and economic benefits. The lack of control over the construction of private buildings and no specific attention on the vernacular architecture and local cultural practices has pushed communities towards a crisis of cultural identity. It recommends to the relevant stakeholders, specifically the government, for adopting comprehensive policies of ecotourism development particularly to promote cultural heritage conservation and sustainability in the region (Bhatta 2019).

- Ecotourism is a type of sustainable tourism that aims at the conservation of the environment through maintaining a balance between conservation and empowerment of residents. However, for developing countries like India, proper implementation of ecotourism is questionable. The study finds that with the creation of employment opportunities, locals also have been made aware of participation in community development programmes, including eco-development clubs and self-help groups. However, these organizations have failed to empower the communities. Although some positive attitudes have come into discussions, the results mostly indicate that ecotourism certainly has not met the principles of empowerment. Organizational participation has, therefore, not been successful in the reduction of dependence on natural resources in Bhitarkanika Wildlife Sanctuary (BKWS), Odisha, India. The support of the locals is highly essential for a successful conservation policy. Thus, proper strategies need to be designed for an inclusive ecotourism approach in BKWS and beyond, one that is socially effective, psychologically, and politically empowered, culturally progressive, and environmentally sustainable (Das and Chatterjee 2020).

Overall, ecotourism can be a promising solution for channelling tourism revenues to promote nature conservation and poverty alleviation. However, vulnerable socio-ecological conditions may limit the effects of ecotourism in different parts of the world. Ecotourism can provide income for local people, improve community cooperation, and raise conservation awareness, but it can also cause environmental damage and socio-cultural problems. Proper strategies need to be designed for an inclusive ecotourism approach that is socially effective, psychologically, and politically empowered, culturally progressive, and environmentally sustainable.



Managment	Role
Forest Department	Habitat management, Anti-poaching, compensation for crop raiding by Blackbuck to the farmers
Agriculture Department	Farmers support, encourgement for Wildlife friendly farming
District Administration Tourism department	Ecotourism and promotion of sustainable and control tourism through community engagement
Research Organization & NGO	Monitoring, Research, Awareness programs

Figure 51: Overview of the conservation planning for protection of grassland and associated species in Bidar

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