

Population tendencies of Blackbuck *Antilope cervicapra* in four consecutive years at Basur Amruth Mahal Kaval Blackbuck Conservation Reserve, Karnataka, India

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ABSTRACT

This study was carried out to ascertain the status and trends of blackbuck population (N_t) in four consecutive years from 2017 to 2020 and to investigate the causative factors taking away their livelihood in a fragile and dynamic habitat of Basur Amruth Mahal Kaval Blackbuck Conservation Reserve with an area of 7.36 km². Our results emerged with population changes (N_t) with total of 238, 262, 277 and 296 individuals in each year respectively displaying steady state increase. Adult females increased from 136 to 189 whereas adult males (59-60) showed near stable numbers prior to increased predation chances at the habitat edges between open grassland and tall bushes where fawns might be rarely detected. The population density ($\Delta Dp= 32.336$ to 40.217 individuals per sq. km) showed gradual increasing trend. The dwindling blackbuck population prefers open grassland habitat with less fragmentation forces and avoid thick and tall vegetations. Population estimations of blackbuck using line transect methods in these areas with mixed vegetations containing tall shrubs (*Prosopis juliflora*, *Dodonaea viscosa*) probably lead to biased detections. Habitat fragmentation, reduced grassland area due to invasive growth of weeds including *Barleria mysorensis*, overgrazing and poaching activities are the timeline issues of conservation in this area.

Key words : Blackbuck, Population trends, Basur Kaval, Conservation Reserve, Open grassland

Introduction

As in most parts of the world, a majority of grasslands in India have been converted into agricultural fields, leading to fragmentation and the remaining areas face heavy grazing by domestic livestock (Dabodghao and Shankarnarayan, 1973; Singh and Joshi, 1979a, 1979b; Singh *et al.*, 2006; Kanhal and Chalise, 2011).

Blackbuck (*Antilope cervicapra* Linnaeus, 1758) is a species of Bovidae family. Blackbuck groups are

largely found in many regions of India and Nepal, except for the north-eastern region. Blackbuck is one among the antelopes endemic to the Indian subcontinent (*Antilope cervicapra cervicapra* in Northern India, *Antilope cervicapra centralis* in Central India, *Antilope cervicapra rajputane* in Western India and *Antilope cervicapra rupicapra* in Southern India) distributed with their dwindling nature of population (Bhatta, 2008). It is also known by a number of other names like Kala Hiran, Krishna Mriga, Krishna Saar, etc. The conservation status of Blackbuck is listed in

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Red Data Book of IUCN (International Union for Conservation of Nature and Natural Resources) as near-threatened since 2003, in CITES (Convention on International Trade in Wild Flora and Fauna) is categorized in Appendix III. It is classified in schedule I of Wildlife Protection Act, 1972.

Basically a species of open plain, it is found in a wide range of habitats from arid grassland, scrubland, to marshy coastal plains and open woodlands (Ranjitsinh, 1989). The blackbuck can utilize a wide scale of habitats including tropical and subtropical weed land, dry deciduous forests, open plains (grassland), river banks and semi-arid habitats, and can forage on crops and pastures. They are generally sedentary, but they may move for long distances in search of water and forage during summers (Rahmani and Sankaran, 1991).

Population of blackbuck were previously recorded the in this area. The estimated blackbuck density was 26.23 individuals per sq km (SD=6) and the derived abundance for the total area of 7.36 km² was 193 individuals (Sagar and Anthony, 2017).

As a result of their occurrence in human-dominated landscapes, some common problems reported are depletion of forage in areas with very high livestock densities, and crop damage by blackbuck (Jhala, 1993; Manakadan and Rahmani, 1991). Hunting by humans may also influence blackbuck densities. In most parts of India, the only areas outside protected areas where they are found in significant numbers are sites where the religious beliefs of local communities forbid the hunting of these antelopes. Another recent but rapidly growing problem is the invasion of semi-arid grasslands throughout India by the exotic woody plant *Prosopis juliflora*. The conversion of grasslands into woody habitats will result in a further decrease in blackbuck numbers, since blackbuck densities are highest in open grasslands and scrub, and decrease as woody vegetation cover increases (Mungall, 1978; Ranjitsinh, 1989; Isvaran 2005).

Hoping that population assessment of blackbuck provides the basis for conducting all other ecological researches including habitat ecology, behavioural ecology and conflict studies, the present study was conducted to explain the population trends of blackbucks in four consecutive years from 2017 to 2020 at Basur Amruth Mahal Kaval Blackbuck Conservation Reserve and to give an outline account of their detection issues.

Materials and Methods

Study Area

“Basur Amruth Mahal Kaval Blackbuck Conservation Reserve” (locally known as “Basur Kaval”) with an area of 1820.11 acre or 7.36 Sq. km is situated in Kadur taluk of Chikkamagaluru district, Karnataka under the control of Forest Department and Department of Animal Husbandry and Veterinary Science. It is located between 13°-40′-57.28″ to 13°-38′-21.02″ latitude North and between 76°-04′-23.59″ to 76°-04′-16.05″ longitude East. The vegetation of the conservation reserve is mainly comprised of southern tropical thorn forest (Champion and Seth, 1968) and an Indian Peninsular open grassland ecosystem of *Sehima-Dichanthium* grass cover type (Dabadghao and Shankarnarayan, 1973). With an apparent plain surface, the conservation reserve located within the Deccan Plateau with an average altitude of 774 meters, indicates an ideal and suitable habitat for the blackbucks and their movements as they prefer only plain tracts.

Methodology

Line transect method (Buckland *et al.*, 2001) was used to conduct census of blackbucks. Based on the uneven and irregular shape of the boundary and its co-ordinating linear dimensions, three transects of

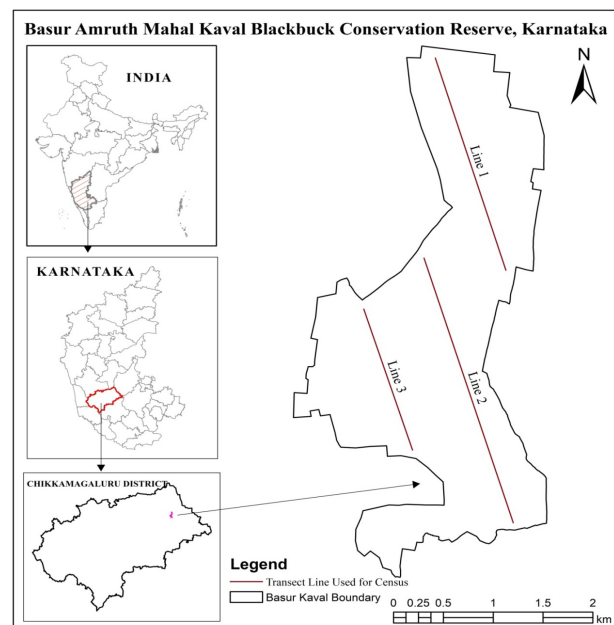


Fig. 1. Map with transects laid in the study site.

Table 1. Table showing population trends of blackbucks from 2017 to 2020.

Year	Brown Male	Black Male	Adult Female	Fawn	Unidentified	Density ΔDp (Animals per Sq km)	Total (N _i)
2017	35	24	136	40	3	32.336	238
2018	38	23	155	46	0	35.597	262
2019	36	24	166	51	0	37.635	277
2020	31	28	189	48	0	40.217	296

different lengths (2.4 km, 3km, 1.6 km) were laid with the random initials and ends and the lines inclined at an angle 15° to the north. The transect lines were positioned at a perpendicular distance of 740m apart from each other in order to avoid individuals being detected on two neighbouring lines. In addition to that, linear heterogeneity in landscape elements with density gradation in vegetation composition, may lead to biased detections during sampling (Sagar and Anthony, 2017). Hence transects were placed in such a manner that the course of a line covers more than one type of vegetation which may reduce the sampling biasness during survey and the results associated with them.

Results

The Conservation Reserve was surveyed using three transect lines for four consecutive years (Δt) 2017, 2018, 2019 and 2020, total (N_i) of 238, 262, 277 and 296 individuals were estimated respectively displaying significantly a steady state increase in resident blackbuck population. The comparison between four years population figures showed decreasing numbers in males and that increasing of females, as a result rising difference in male-female ratio. The ratio decreased from 1:2.3 to 1:3.2 from 2017 to 2020. The number of female individuals marked discrimi-

nate signs from 136 to 189 and the male numbers retained from 59 to 59 which significantly a declining sign when compared to females increasing at steady state in four successive years as shown in the graph 1.

The blackbuck density ΔDp (32.336 to 40.217 individuals per sq. km) also showed increasing gradually. But the average density Dp of four years was 36.446 individuals per sq. km. During the survey it was inferred that blackbuck individual count was highest at the open grasslands and lowest within the bushes.

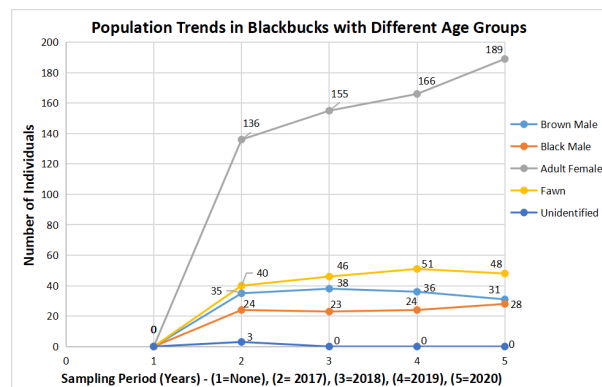
Discussion

Decline in male-female ratio

The population figures of four years showed a steady state increase in overall individuals, but a declining number of males and that increasing of females, rising difference in male-female ratio. The ratio decreased from 1:2.3 in 2017 to 1:3.2 in 2020. Wolf ecological studies reported that adult male blackbuck suffered much higher levels of predation, particularly in the breeding season, than adult females or juveniles (Jethva and Jhala 2004). Further, even in the absence of predation, male mortality may be higher than female mortality for stress in male-male competition for access to mates (Jarman and Jarman 1973). As per the observations in Ballavpur Wildlife Sanctuary, West Bengal, where in the absence of blackbuck predators, male mortality was still greater than female mortality (Chattopadhyay and Bhattacharya 1985). The decline in the number of adult males hampers the reproductive behaviours and eventually inbreeding has its own adverse effects on the population diversity and viability (Menon, 2000).

Increase in crude population density

Crude density ΔDp calculated for four years showed increasing sequence (32.336 to 40.217 individuals per sq. km) while the area of open grassland is de-



Graph 1. Graph displaying population trends in males, females and fawns from 2017 to 2020.

creasing every year due to outgrowth of perennial shrubs. This may lead to crowding in their limited space of natural habitat in future (Kanhhal and Chalise, 2010).

Orientation towards habitat openness

During the survey, blackbucks were observed most of their time spent in open grasslands with short grasses, they remained calm and more alert when detected in scrub and other tall vegetation areas. This proportion includes outgrowth of perennial shrubs, sparse and dense scrub vegetations including *Eucalyptus* plantations creating habitat edge (Levin, 2009) with the open grassland vegetation. During the day, blackbucks usually rest in open areas despite heat. They are more vigilant when close to tall vegetation, suggesting that their perception of the threat from predators increases when they are close to tall vegetation (Isvaran, 2007). Like many other antelopes which have evolved in open plains, blackbucks rely on early detection and speed to escape from predators (Mungall, 1978; Ranjithsinh, 1989). This shows why blackbucks prefer open habitats and avoid tall vegetations which may not support their early detection of possible threats and flee strategy.

Steady state increase in blackbuck population despite predation pressures:

Adult female numbers showed remarkable rise (136, 155, 166 and 189), which is a significant on the sex ratio, while other groups including brown and black males were apparently stable at their count during four years of study. Blackbucks showed greater tendency of anti-predatory strategies. Indian Leopard (*Panthera pardus*) hunting territorial and lekking blackbuck males have been recorded; probably ambushing at the habitat edges between two vegetations, i.e., grassland and scrub covered with either *Dodonaea viscosa* or *Prosopis juliflora* bushes.

Blackbucks are group living animals except solitary, territorial males (Isvaran 2007). They show remarkable variation in group size, both among and within populations. The important factors to maintain such variations are distribution, abundance of resources, habitat structure and predation pressures (Crook, 1965, Jarman, 1974).

Detection issues

Since uncertainty in the vegetation composition, density gradation and irregular shape of the boundary, the transect lines were positioned in order to

meet the standards of transect method. But during the survey, we might have left animals undetected due to bushes and thick vegetation hiding them from the surveyors. Also some individuals might be detected multiple times. Hence it can be stated that transect line surveys in these landscapes with grassland-perennial shrub complex may lead us to biased counting of animals.

The line transect method/ density method/ distance sampling method that depends upon the detection probability sometimes lacks the accuracy in estimating the population of this species as biased detections and results were expected in these areas of vegetation composition with linear heterogeneity and density gradation (Sagar and Anthony, 2017). Lack of habitat management at vegetation level paved the way for extensive outgrowth of perennial shrubs against grass cover.

Summary

Considering vegetation composition estimating the population sizes of this species through line transect method that depends upon the detection probability lacks the accuracy as biased detections and results were expected in these areas. As the blackbucks are a species of open grasslands (Schaller, 1967), total count approach method holds good for their census which employs 10-12 volunteers, 5-6 watchtowers and 2-3 patrol vehicles. At present it was not possible to use some of these implements.

Local emigration of these blackbuck herds put them in the risk of facing anthropogenic environments. Crossing a well traversed road with intensive vehicular use, cattle-proof trench at the boundary, electrocuted/solar and barbed fences, crop fields with use of pesticides, are the obstacles associated in their way to the open crop fields and back in to the home ranges. Habitat openness should be maintained in a balanced approach and provide a suitable habitat for blackbuck herds within the boundary and curb the intensity of human-blackbuck conflicts around the conservation reserve.

Suggestions

Habitat Management

1. Being it a pasture land, planting trees of any kind should be stopped immediately as it alters the openness of grassland vegetation and makes

the habitat unsuitable for the blackbucks and other grassland dependent species.

2. Outgrowth of perennial shrubs such as *Dodonaea viscosa*, *Lantana camara*, *Prosopis juliflora*, *Barleriamysorensis* etc., must be controlled by uprooting method at annual cycles. The conservation reserve has plantations of *Eucalyptus tereticornis*, *Acacia auriculiformis* that were planted before the area was declared as a conservation reserve. This should be removed phase by phase completely and maintained with freshly grown palatable grasses.

Conservation Strategies

1. Watchtowers of 20 – 30m heights at 4 - 5 relatively elevated locations of the conservation reserve should be built for monitoring populations of wild animals and to observe poaching activity suspicions.
2. Forest staff including Watchers should be provided with night patrolling equipment.
3. A strong conservation network among people and enthusiasts around the Kaval has to be created to gather quick information on poaching activities and curb immediately.
4. Restriction of over use of vehicles inside the conservation reserve is required.

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