

Architect of one's own destruction

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The fast spread of invasive species is a major threat to grassland habitats as it converts them to scrublands and woodlands. Mesquite or 'Videshi babul' (*Prosopis juliflora*), an invasive species native to South and Central America was introduced in arid parts of India to provide firewood and to check desertification. The pods of mesquite are nutritious (Figure 1) and form an important component of the diet of ungulates (hoofed mammals) found in the region, especially during summer. These ungulates consume the pods containing seeds of the mesquite and play the role of seed dispersers by spreading the seeds through their dung, thus assisting the process of colonization of open grasslands by mesquite.

Jadeja *et al.*¹ studied the pattern of dispersal of mesquite by the wild ungulates found within the grasslands of Velavadar National Park, Bhavnagar district, Gujarat. They set up pre-programmed infrared digital camera traps on multiple fruiting mesquite trees to find out which species of ungulates feed on their pods. Careful analysis of the photographs showed that nilgai (*Boselaphus tragocamelus*), wild pig (*Sus scrofa*) and blackbuck (*Antelope cervicapra*; Box 1) were the three ungulate species that fed on these pods. The blackbucks were found to be more frequent than the other two species, with the male blackbucks consuming more mesquite pods than the females (Figure 2).

The team¹ was further interested to determine whether the differences in blackbuck group size and composition had any effects on the dispersal pattern of mesquite seeds. The site of seed deposition



Figure 1. Legume of *Prosopis juliflora* (photo credit: Shivani Jadeja).

has a strong influence on the survival and germination of a seed and in turn influences the population dynamics of the plant. Therefore, by observing the movement, habitat use and defecating pattern of the dispersers, it is possible to predict the regeneration pattern of the plant species. The team¹ first divided the blackbucks into three different social categories based on their social and mating strategies. (1) Female-biased herds consisting of many female individuals with a few juvenile males and occasionally one or more adult males (Figure 3a). (2) Bachelor herds with non-breeding male individuals coming together (Figure 3b). (3) Breeding territorial males with each individual having its own separate territory either far apart from each other (dispersed; Figure 3c), or clustered and close to one another forming a lek (Figure 3d; Box 2). The ranging and movement patterns of blackbucks from all the three categories were studied by observing them at different times of the day using binoculars or a spotting scope.

Box 1. Blackbuck

Blackbuck is an antelope species endemic to the Indian subcontinent. Once found all across the landscape, blackbucks are now restricted to scattered grassland pockets in the country. They have been categorized by the International Union for Conservation of Nature as 'near threatened'. Blackbucks are grassland dwellers and need wide open spaces. The male and the female sexes can be differentiated by their colouring. Most adult males are of monochromatic colouring; black dorsally and white ventrally and have long spiral horns, whereas females and fawns have an inconspicuous light-brown colouring. Being antelopes, blackbucks unlike deer species like the chital (*Axis axis*), do not shed their horns annually. The horns of young male blackbucks grow, adding a spiral for each year.

The different groups were found to differ in their movements or their ranging behaviour. The territorial males had restricted movement within their territories. In addition, they exhibited scent-marking behaviour by depositing their dung at particular locations to form dung piles. This is a way of marking their territory. On the leks, the dung piles were found to be closer and clustered. On the contrary, females and bachelor males were found to move around much larger areas and they did not exhibit scent-marking behaviour or deposition of dung piles. Once the areas used by each of the groups were confirmed, the researchers set up 2 m × 2 m plots on territories and at different locations in the landscape and collected blackbuck dung pellets which they broke open to check for the presence of mesquite seeds. Just as hypothesized, the difference in the behaviour among the two sexes regarding food selection, and the different movement and scent-marking behaviour that the social categories adopt, were reflected in the pattern of seed deposition and seedling recruitment in the landscape.

It was found that the territorial male blackbucks on a lek (Figure 4) deposit higher proportion of mesquite seeds followed by males with dispersed territories. On the other hand, female-biased groups and males in bachelor herds were found to have very little influence on the seed dispersal process. Seedling recruitment was found to follow a pattern similar to that of the deposition of seeds. The proportion of seeds, both those deposited on the leks and the ones that germinate on them was high, thus aiding the colonization of open spaces by mesquite.



Figure 2. Blackbucks at Velavadar National Park, Gujarat (photo: Shivani Jadeja).

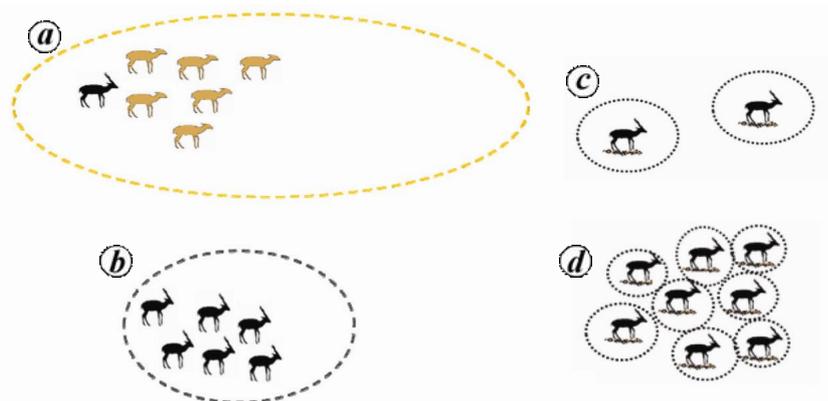


Figure 3. Pictorial representation of the different groups of blackbuck based on their social behaviour (Illustration: Shivani Jadeja). **a**, Female-biased groups; **b**, Bachelor herds; **c**, Territorial males on dispersed territories; **d**, Territorial males on a lek.



Figure 4. Male blackbucks on a lek, Velavadar National Park (photo: Shivani Jadeja).

Box 2. Lekking

Lekking is a rare behavioural phenomenon exhibited by less than 2% of birds and 1% of mammal species. In the species or groups that adopt this mating strategy, the males congregate and form small territories around themselves which they defend from the other males. The females visit the males at these congregations called the lek. Velavadar National Park in Gujarat and Tal Chappar Wildlife Sanctuary in Rajasthan are the only two places in the world where blackbucks display lekking behaviour in the wild. In Velavadar National Park, lekking by blackbucks is observed during their peak mating seasons, i.e. February–March and September–December.

Male blackbucks display lekking behaviour only in areas where females are found in large groups². The group size of females in turn depends on habitat structure and food availability². Large female blackbuck groups prefer large, open, grasslands to close woodland habitats for the visibility they provide². Therefore, the process of conversion of grasslands into woodlands due to the spread of mes-

quite may in turn lead to a change in the behaviour of the lekking males². The lekking males in such cases may relocate to newer open grounds and with it would continue the process of dispersal of mesquite in the landscape, or there might occur a change in the mating strategies adopted by the adult males from lekking to dispersed territories. It may also lead to a change in the social organization of

the population from large herds to smaller groups.

'Blackbuck populations across the country although disjunct geographically, do not face any immediate danger of going extinct. They will continue to persist in the landscape in small groups, if not in large congregations. The disappearance of large grassland tracts may however lead to the extinction of the rare and extraordinary lekking behaviour exhibited by the blackbuck' says, Kavita Isvaran (Centre for Ecological Sciences, IISc, Bangalore).

The results of this study will help park managers control the spread of mesquite in the area. Every year, the Forest Department authorities at Velavadar National Park, spend a lot of time, money and effort in clearing mesquite seedlings from the grassland patches within the park. This study may help them prioritize their efforts on areas which have high seed survival and recruitment, thus making the process less tedious. On whether action needs to be taken to eradicate mesquite from the area is a question which the researchers contemplate, as mesquite constitutes a major part of the blackbuck's diet during summer season and drought periods that frequent the landscape. However, researchers confirm that allowing further spread of this invasive plant may negatively impact the blackbucks by destroying the open spaces essential for their long-term survival in the landscape.

This study throws light on how a simple process of seed dispersal can give rise to complex interplays leading to possible alterations of landscape and ultimately the behaviour of the disperser itself.

1. Jadeja, S., Prasad, S., Quader, S. and Isvaran, K., *Oikos*, 2013, **122**, 1441–1452; doi: 10.1111/j.1600-0706.2013.00320.x.
2. Isvaran, K., *Behav. Ecol. Sociobiol.*, 2005, **57**(3), 283–294.

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