

Nilgai: A Growing Challenge to Indian Agriculture

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ABSTRACT

Nilgai (*Boselaphus tragocamelus*) has emerged as one of the most significant vertebrate pests causing crop damage in the northern and western states of India. Due to habitat degradation, rapid exploration in agriculture, legal protection, absence of natural predators are major factor for rapid increasing population. Nilgai damages a wide range of agricultural and horticultural crops through feeding and trampling, resulting in considerable economic losses. Sustainable Nilgai management requires an integrated approach that combines effective crop protection with wildlife conservation. Non-lethal methods remain the preferred management strategy, while culling remains a controversial option under specific circumstances. This article provides an overview of the biology, distribution, crop-raiding behavior, agricultural impacts and their sustainable management of Nilgai in India.

Keywords: Nilgai (*Boselaphus tragocamelus*), Vertebrate Pest, Crop Damage, Human-Wildlife Conflict, Repellents, Sustainable management

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1. INTRODUCTION

Blue bulls (*Boselaphus tragocamelus* (Pallas, 1766)) are the largest antelope found in Indian continent (Prater, 1971). It belongs to the order Artiodactyla, family Bovidae, sub-family Bovinae and tribe Boselephini. It was described by Peter Simon Pallas in 1766 and was categorized into the only member of genus *Boselaphus* (Wilson and Reeder, 2005). It is also known as nilgai because of its morphological characters; the color coat of the adult male is iron-grey which defined the English and vernacular name 'nil' refers to blue and 'gai' refers to cow and bull in case of male individual in Hindi. The maximum nilgai population is found in four Indian states—Haryana, Madhya Pradesh, Rajasthan, and Uttar Pradesh—with an estimated population ranging from 100,000 to 150,000 individuals, accounting for approximately 60% of the total nilgai population in the

country (Sankar and Goyal, 2004). Nilgai are now considered major agricultural pests in several northern Indian states because they cause considerable damage to agricultural crops through grazing and trampling (Chauhan and Singh, 1990; Chauhan, 2011). Its feeding habits include grazing on wheat, sugarcane, maize, pulses, and poplar, causing substantial economic losses. Crop loss due to nilgai is generally reported in the 10 to 30% range in depredation-affected areas (Chellappan *et al.* 2025). Several factors have been attributed to the increasing pestiferous activities and population of nilgai, including the ban on hunting and trapping, legal protection under the Wildlife (Protection) Act, 1972, the lack of natural predators, deforestation for agricultural expansion, overgrazing of grasslands by livestock, non-availability of preferred dietary items in their natural habitat, a long breeding period, a high

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rate of multiple births, maternal care of young, and religious protection by Hindu communities, particularly the Bishnoi, who consider nilgai to be closely related to cows (Sridhara, 2006; Aryal, 2007; Chauhan, 2011; Kumar *et al.*, 2019). Managing nilgai populations has become a major challenge because effective conservation of wildlife must be balanced with the protection of farmers' livelihoods. Various mitigation measures, including fencing, crop guarding, repellents, compensation schemes, habitat management, sterilization, and regulated population control, have been suggested with varying degrees of success. Therefore, understanding the ecology, population dynamics, and crop-raiding behaviour of nilgai is essential for developing sustainable management strategies that reduce crop damage while ensuring wildlife conservation (Chauhan, 2011).

2. MORPHOLOGICAL DESCRIPTION OF NILGAI

Nilgai (*Boselaphus tragocamelus*) is a large gregarious bovine with a sloping back, deep neck with short erectile mane, narrow bony head, barrel-shaped chest, tufted tail, developed interdigital glands, and slender legs that are slightly shorter behind, (Gosling, 1985). In general, the head and body length of the Nilgai measure 1.7 – 2.1 m. The Nilgai species demonstrate sexual dimorphism, where the male is larger and heavier than the female counterpart (Schmidly, 2004). The body color of the adult male is bluish-grey to brownish-grey, while the female is yellowish-red to reddish-brown (Sheffield *et al.*, 1983). On the other hand, young animals are pale to light brown (Schaller, 1967; Schmidly, 2004). Adult males

have horns and a coarse beard below the throat, while the female lacks horns and has a rudimentary beard (Schmidly, 2004). The calves are born with light brown color which is later replaced by bluish-grey to brownish-grey at about 4 years of age. The most distinguishable feature of Nilgai is the large white patch found on the throat (gular patch), which extends to the lower jaw, and the white coloration of the lips and cheeks, abdomen, and the surfaces of the lower legs (fetlocks). The ventral surface, inner thigh, and tail are also white (Eldredge, 2002). The Nilgai also has two large white patches on each cheek and a white inner ear with black coloration around it. The tail is also white on the ventral side; hence their common name of 'whitetailed gazelle' (Eldredge, 2002; Schmidly, 2004).

3. DISTRIBUTION AND HABITAT

It is endemic to peninsular India and small parts of Pakistan and Nepal, has been extirpated from Bangladesh, and has been introduced in the United States (Texas), Mexico, South Africa, and Italy. It prefers open grassland and savannas and locally is a significant agricultural pest in India. They are found in different types of habitats from level ground to hillsides. They prefer arid areas, grassy steppe woodlands, scrub areas, flood plain, dry deciduous forests, riverine forest and agricultural land areas. They avoid dense forest and deserts. They are both browsers and grazers (Rahmani, 2001). They also occur around agricultural areas. Mustard, cotton, poplar, jowar, guar, bajra serve as a hiding cover for blue bull (Chauhan and Singh 1990). It



Figure 1. Sexual dimorphism in Nilgai (A) Male (B) Female

weigh 109 – 270 kg and reach sexual maturity at 4 – 5 years, compared to females that weigh 100 – 212 kg with maturity at two years (Schmidly, 2004). The male Nilgai has a thick skin covered with heavy hair all over the body, with short (15 – 20 cm), smooth, conical

horns and a coarse beard below the throat, while the female lacks horns and has a rudimentary beard (Schmidly, 2004). The calves are born with light brown color which is later replaced by bluish-grey to brownish-grey at about 4 years of age. The most distinguishable feature of Nilgai is the large white patch found on the throat (gular patch), which extends to the lower jaw, and the white coloration of the lips and cheeks, abdomen, and the surfaces of the lower legs (fetlocks). The ventral surface, inner thigh, and tail are also white (Eldredge, 2002). The Nilgai also has two large white patches on each cheek and a white inner ear with black coloration around it. The tail is also white on the ventral side; hence their common name of 'whitetailed gazelle' (Eldredge, 2002; Schmidly, 2004).

4. BEHAVIOR

Nilgai are partial social animals and the group size varies with the varying season. Their group composition changes constantly, but three distinct categories have been classified based on the composition: (i) one or two cows with young calves, (ii) 3 to 6 adult and yearling cows with calves, and (iii) only male consisting groups size varying in number from 2 to 18. In India also the larger groups are rare but have been reported from various locations. The home range of nilgai varies geographically and between sexes. In India, a radio-collared female in Sariska Tiger Reserve exhibited a mean seasonal home range of 3.6 km² and an annual home range of 7.3 km² (Sankar, 1994). In contrast, studies conducted in Texas reported a home range of 0.6 km² for females and a mean home range of 4.7 km² for adult males (Sheffield *et al.*, 1983). Nilgai use to mark their territories by using the same sites again and again for their dropping create dung piles which is of about 50 cm in radius. It use to follow harem mating system where a bull has a "harem" of 2-10 females and their young ones, in the breeding season rutting males use to wander and move in search of group of females to find the reproductively active females to mate after the search is over, they start defending the group and most importantly the active females from the intrusions by other males and to mate known as 'roving territoriality' (Sankar, John Singh & Acharya, 2004; Singh, 1995). The breeding season is extended and varies by location. Female nilgai attain sexual maturity around the age of two, with their first calving occurring at three years old (Mungall, 2000; Sheffield *et al.*, 1983). The gestation lasts from 243 to 247 days, or roughly eight months, and females can conceive again immediately afterward. Typically, nilgai cows give birth to one calf, although approximately fifty percent may have twins, and the occurrence of triplets is rare (Sheffield *et al.*, 1983). Male nilgai achieve sexual maturity at about three years; however, most often they will begin breeding before reaching five years, as their testes and sperm production become active (Lochmiller & Sheffield, 1989).

5. IMPACT ON AGRICULTURE

The severe crop damage cause by blue bulls has been reported particularly in northern states of India. The Crop damage in fields can be recognized through fallen hair, hoof marks, the presence of faecal material, browsing damage and uprooted plants (Gautam & Bissa, 2014). Crop raiding by nilgai is

common in agricultural fields adjoining forest areas, particularly in northern India. It usually raids crops at night and returns to nearby forests during the daytime, causing significant crop losses through feeding and trampling (Bohra *et al.*, 1992; Prajapati & Singh, 1994; Mathai, 1999; Chhangani *et al.*, 2010). It is more destructive during the winter season and prefers mature crops such as paddy, maize, mustard, chilli, cauliflower, cowpea, black gram and cabbage, while wheat, potato, radish and pumpkin are preferred during the early stages of growth, and lentils during all growth stages. Vegetables are also considerably damaged by blue bulls (Meena, 2017). In areas where their population density is low, losses to wheat, gram, moong, guar and cotton crops were reported to be 20–30%, 40–55%, 40–45%, 20–35% and 25–40%, respectively, whereas in high-density areas, damage to wheat, gram and moong was 35–60%, 50–70% and 45–60%, respectively. Mustard was rarely eaten but was damaged by trampling (Meena, 2017). It shows a preference for gram, wheat seedlings and moong. Khanal *et al.* (2018) reported 14.48% and 10.38% damage to vegetables and pulses, respectively, in Nepal. Nilgai is a generalist feeder, acting as both a browser and a mixed feeder, feeding on grasses, herbs, twigs and branches (Bagchi *et al.*, 2004; Leslie, 2008). It usually raids crops after the availability of forest grasses declines and feeds on seedlings of wheat, mustard and gram during winter, whereas crop damage is comparatively low during the rainy season because of the higher availability of natural vegetation (Meena, 2017). The movement of herds from one area to another depends on crop availability (Meena, 2017). Maximum damage is caused to millet crops, although nilgai also feed on wheat, paddy, maize, jowar, bajra and vegetables. Farmers reported that, besides feeding, considerable crop loss also occurs due to trampling, resting, movement through fields and fighting activity (Meena, 2017).

6. MANAGEMENT STRATEGIES

Nilgai management aims to minimize crop damage while conserving the species. Since nilgai is protected under the Wild Life (Protection) Act, 1972 so non-lethal management methods are generally preferred. The commonly adopted management strategies include:



Figure 2. Damage by Nilgai: A-C Browsing of wheat, mustard and castor crops by nilgai, D. Bajra field damaged by roosting of Nilgai, E. Grazing of cumin crop by Nilgai

6.1 Habitat Protection

Government and common people must respect the natural habitats while planning developmental activities like agriculture, horticulture, construction of roads and dams and other urbanization activities within or on the periphery of the forest lands or protected areas. Such activities cause the destruction of forest with serious impact on wildlife, which forces wild herbivores to feed in the cultivated fields. There is an urgent need to understand the impacts of such activities and to stop these interventions in the most critical wildlife habitats.

6.2 Guarding

It is the oldest and most widely adopted method for preventing nilgai damage, practiced by nearly 60% of farmers protect their crop fields from nilgai by using drums, tins, firecrackers, iron

instrument that produce sound through a potassium chlorate-sulphur reaction, and by throwing stones with a traditional slingshot (gophan or gulail) to scare the animals away (Babbar *et al.*, 2022).

6.3 Fencing

Fencing is the one of most effective physical barriers against crop raiding. Chain-link fencing, circular razor facing, HDPE nylon net fencing, electric or solar fencing and bio-fencing with thorny plant species (*Prosopis juliflora* or *Euphorbia cauducfolia*) are commonly used to restrict the movement of nilgai into cultivated fields. However, the high installation and maintenance costs often limit their large-scale adoption by farmers (Khanal *et al.*, 2018, Babbar *et al.*, 2022).

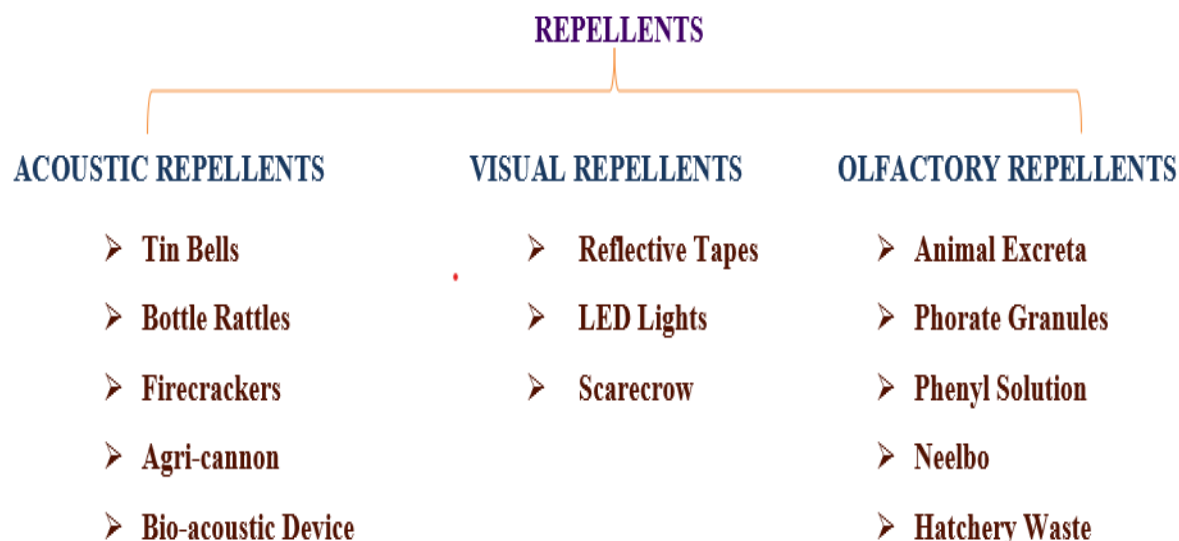


Figure 3. Classification of repellents used for Nilgai management

6.4 Trench method

Digging of 3 ft wide and 1^{1/2} feet deep trench around the cropped area at the distance of 1ft from the crop keeps away the Nilgai from the field.

6.5 Employing trained dog

Use of trained dogs can scare away the blue bulls. Barking of the trained dog definitely deters the blue bull and also warns the farmer about the crop raiding activities of blue bull.

6.6 Biological control

Sterilization of male blue bull is theoretically effective because socially they live in a harem system in which one adult male and several adult females live in bisexual groups. This method definitely controls the population of vertebrate pest which live in social groups. However, there are no effective chemosterilants available to affect this strategy (Arukha *et al.* 2016).

6.7 Gonadotropin baits

A contraceptive vaccine (GnRH) is used in bait to reduce reproductive hormones and control Nilgai population. Bait is prepared by mixing 100 g wheat flour with onion and garlic paste for 3-4 days, and on the 5th day a GnRH dose is added. In 2015, the Rajasthan Government permitted the use of non-lethal darts for fertility control.

6.8 Culling

Culling is the selective reduction of excessive Nilgai populations to minimize crop damage. Although hunting is prohibited under the Wildlife Protection Act, 1972, controlled culling by trained Forest Department experts may be allowed in severe

cases. Cultural and religious importance of Nilgai makes this method controversial.

6.9 Enclosures (Corrals)

Corrals are fenced areas used to confine Nilgai and control their breeding. However, this method is expensive, requires large land areas, continuous maintenance, feeding, and fertility control, making it practical mainly for government agencies rather than individual farmers.

7. INITIATIVES TAKEN BY ICAR

Keeping in view the severity of the problem in agriculture associated wild animal species; ICAR has launched an All India Network Project on Vertebrate Pest Management during XII Plan period. Besides studies on birds and rodents, management of higher vertebrates is an important component of the Network. The Project envisages undertaking detailed studies on ecology and management of three most important wild animal species, *viz.*, Nilgai (*Boselaphus tragocamelus*); wild boar (*Sus scrofa*) and monkey (*Macaca* sp.) to minimize the crop losses *vis a vis* farmer - animal conflict in agricultural landscape.

8. CONCLUSION

Nilgai has become a serious challenge for Indian farmers, causing major losses in agricultural field and affecting rural livelihoods. Implementing integrated, eco-friendly, and non-lethal management practices can help reduce crop damage and conserve the protected wild animal.

REFERENCES

- Aryal, A. (2007). *Blue bull (Boselaphus tragocamelus) in Lumbini: A World Heritage Site of Nepal*. *Tigerpaper*, 34(4), 4–9.
- Babbar, B. K., Singla, N., Kaur, H., Verma, M., Rani, K., Bala, B., & Jain, S. (2024). Bio-ecology, behaviour and management of blue bull (*Boselaphus tragocamelus*). *International Journal of Pest Management*, 70(4), 1260–1275.
- Bagchi, S., Goyal, S., & Sankar, K. (2004). Herbivore density and biomass in a semi-arid tropical dry deciduous forest of western India. *Journal of Tropical Ecology*, 20(4), 475–478.
- Bohra, H. C., Goyal, S. P., Ghosh, P. K., & Prakash, I. (1992). Studies on ethology and eco-physiology of the antelopes of Indian Desert. *Annals of Arid Zone*, 31, 83–96.
- Chauhan, N. P. S. (2011). Agricultural crop depredation by nilgai antelope (*Boselaphus tragocamelus*) and mitigation strategies: Challenges in India. *Julius-Kühn-Archiv*, 432.
- Chauhan, N. P. S., & Singh, R. (1990). Crop damage by overabundant populations of nilgai and blackbuck in Haryana (India) and its management. In L. R. Davis & R. E. Marsh (Eds.), *Proceedings of the Fourteenth Vertebrate Pest Conference*. University of California.
- Chellappan, Mani, Ranjith, M. T., & Chaudhary, V. (2025). Towards policy strategies for managing vertebrate pests in arid and semi-arid regions of India. *Annals of Arid Zone* 64(4): 619–634
- Chhangani, A. K., Robbins, P., & Mahnot, S. M. (2010). Major threats to the faunal diversity of Kumbhalgarh Wildlife Sanctuary in the Aravalli Hills of Rajasthan. *Indian Forester*, 136, 1410–1421.
- Eldredge, N. (2002). *Life on Earth: An encyclopedia of biodiversity, ecology, and evolution*. ABC-CLIO.
- Gautam, R., & Bissa, P. (2014). Crop-raiding behaviour of nilgai (*Boselaphus tragocamelus*) in the Shekhawati region of Thar Desert. *Journal of Agroecology and Natural Resource Management*, 1, 224–226.
- Gosling, L. M. (1985). The even-toed ungulates: Order Artiodactyla. In *Social odours in mammals* (Vol. 2, pp. 550–618).
- Khanal, S., Aryal, A., Morley, C. G., Wright, W., & Singh, N. B. (2018). Challenges of conserving blue bull (*Boselaphus tragocamelus*) outside the protected areas of Nepal. *Proceedings of the Zoological Society*, 71(4), 352–362.
- Kumar, K., Bisht, S. S., Sharma, N., Kumar, A., Bora, S., Pandey, N., & Parveen, N. (2019). Studies on crop depredation caused by wild animals in some villages of Chenab Valley, Jammu and Kashmir, India. *Bulletin of Environment, Pharmacology and Life Sciences*, 8, S46–S50.
- Leslie, D. M. (2008). *Boselaphus tragocamelus* (Artiodactyla: Bovidae). *Mammalian Species*, 813, 1–16.
- Lochmiller, R. L., & Sheffield, W. J. (1989). Reproductive traits of male nilgai antelope in Texas. *The Southwestern Naturalist*, 34(2), 276–278.
- Mathai, A. M. (1999). *An introduction to geometrical probability: Distributional aspects with applications*. Gordon and Breach Science Publishers.
- Meena, M. (2017). Agriculture crop damage by antelope (*Boselaphus tragocamelus*) and management strategies: Challenges in India. *International Journal of Zoology Studies*, 2, 157–160.
- Mungall, E. C. (2000). Exotics. In S. Demarais & P. R. Krausman (Eds.), *Ecology and management of large mammals in North America* (pp. 736–764). Prentice Hall.
- Prater, S. H. (1971). *The book of Indian animals* (3rd ed.). Bombay Natural History Society.
- Rahmani, A. R. (2001). North Africa, the Middle East, and Asia. In D. P. Mallon & S. C. Kingswood (Eds.), *Antelopes: Part 4* (pp. 178–187). IUCN.
- Sankar, K. (1994). *The ecology of three large sympatric herbivores (Chital, Sambar and Nilgai) with special reference to reserve management in Sariska Tiger Reserve, Rajasthan* (Doctoral dissertation, University of Rajasthan).
- Sankar, K., & Goyal, S. P. (Eds.). (2004). *Ungulates of India*. ENVIS Bulletin: Wildlife and Protected Areas, Wildlife Institute of India.
- Sankar, K., Johnsingh, A. J. T., & Acharya, B. (2004). Blue bull or nilgai (*Boselaphus tragocamelus*). In K. Sankar & S. P. Goyal (Eds.), *Ungulates of India*. ENVIS Bulletin: Wildlife and Protected Areas. Wildlife Institute of India.
- Schaller, G. B. (1967). *The deer and the tiger*. University of Chicago Press.
- Schmidly, D. S. (2004). *The mammals of Texas*. University of Texas Press.
- Sheffield, W. J., Fall, B. A., & Brown, B. A. (1983). *The nilgai antelope*. Caesar Kleberg Wildlife Research Institute, Texas A&M University.
- Sridhara, S. (2006). An overview of vertebrate pests in India. *Proceedings of the Vertebrate Pest Conference*, 22, 510–521.
- Wilson, D. E., & Reeder, D. M. (Eds.). (2005). *Mammal species of the world: A taxonomic and geographic reference* (3rd ed.). Johns Hopkins University Press.