THE DECLINE OF WILD HERBIVORES AND THEIR CONSERVATION IN PAKISTAN- A REVIEW

M. Azhar*[, 1], M. R. Khan[2], R. Fatima[3], A. Mushtaque[4], N. Iqrar[5], B. Anwar[6], G. Abbas[7], F. Haseeb[8] and A.Fatima[9]

[1] Veterinary Officer, Punjab Wildlife and Parks Department, Government of Punjab, Lahore, Punjab, Pakistan/Ph. D Scholar, Department of Veterinary Medicine, UVAS, Lahore, Pakistan
[2] Punjab Wildlife and Parks Department, Government of Punjab, Lahore, Punjab, Pakistan
[3] Safari Zoo, Lahore, Punjab, Pakistan
[4] Center of excellence in molecular biology, university of the Punjab, Lahore
[5] MPhil Scholar, Institute of Biochemistry and Biotechnology, University of Veterinary and Animal Sciences, Lahore, Punjab, Pakistan
[6] MPhil Scholar, Institute of Biochemistry and Biotechnology, University of Veterinary and Animal Sciences, Lahore, Punjab, Pakistan
[7] Department of Animal Production, Riphah College of Veterinary Sciences, Riphah International University, Lahore, Pakistan
[8] Department of Clinical Sciences, Riphah College of Veterinary Sciences, Riphah International University, Lahore, Pakistan
[9] M. Phil Scholar, Department of Veterinary Medicine, UVAS, Lahore, Pakistan
*Corresponding Author : azhar.vet11@gmail.com, ghulamabbas_hashmi@yahoo.com

ABSTRACT: *Wild ruminants play a crucial role in keeping ecosystems balanced worldwide. Pakistan, with its varied landscapes and environments, is home to a wide array of these incredible animals. Unfortunately, many of these herbivores are increasingly threatened by factors like habitat loss, poaching, and climate change, putting them at risk of extinction. Herbivores help maintain healthy ecosystems by influencing vegetation through grazing and browsing. This review examines the current status of some of the endangered and critically endangered wild herbivores in Pakistan, their global and national distribution, and the efforts being made to protect them. The article offers an overview of the diverse herbivore species found in different ecosystems across. These species, including the Markhor, barking deer, Marco polo sheep, blue bulls, musk deer, chinkara and others are not only vital to Pakistan's biodiversity but also have global significance.*

Keywords; Pakistan, Herbivores, Conservation, Distribution, Wildlife

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INTRODUCTION

Across the globe, large areas are grazed by wild herbivores that drive the structure, composition and functioning of these ecosystems (Gordon, Hester, & FESTA-BIANCHET, 2004). Ungulates, a crucial component of biodiversity, serve as essential markers of the habitat quality in mountain ranges. About 31 species (38.7%) of Caprinae are found in the Himalayas and nearby mountains (Shackleton, 1997). The majority of the huge herbivores first function as a significant source of income through ecotourism and hunting (Gordon et al., 2004). Herbivores are crucial to the structure and their various wild environments are operating well (Martin, 1993).

Overexploitation, predation, disease and changes in climate and land use have reduced many large herbivore species to levels at which they now need to be actively conserved (Gordon et al., 2004). The populations of some large wild herbivores are critically low as a result of habitat loss, persecution, and overhunting, making them priorities for conservation. The International Union for the Conservation of Nature's 2002 Red Data Book lists 84 of the approximately 175 species of ungulates as critically endangered, endangered, or vulnerable (Baillie, Hilton-Taylor, & Stuart, 2004).

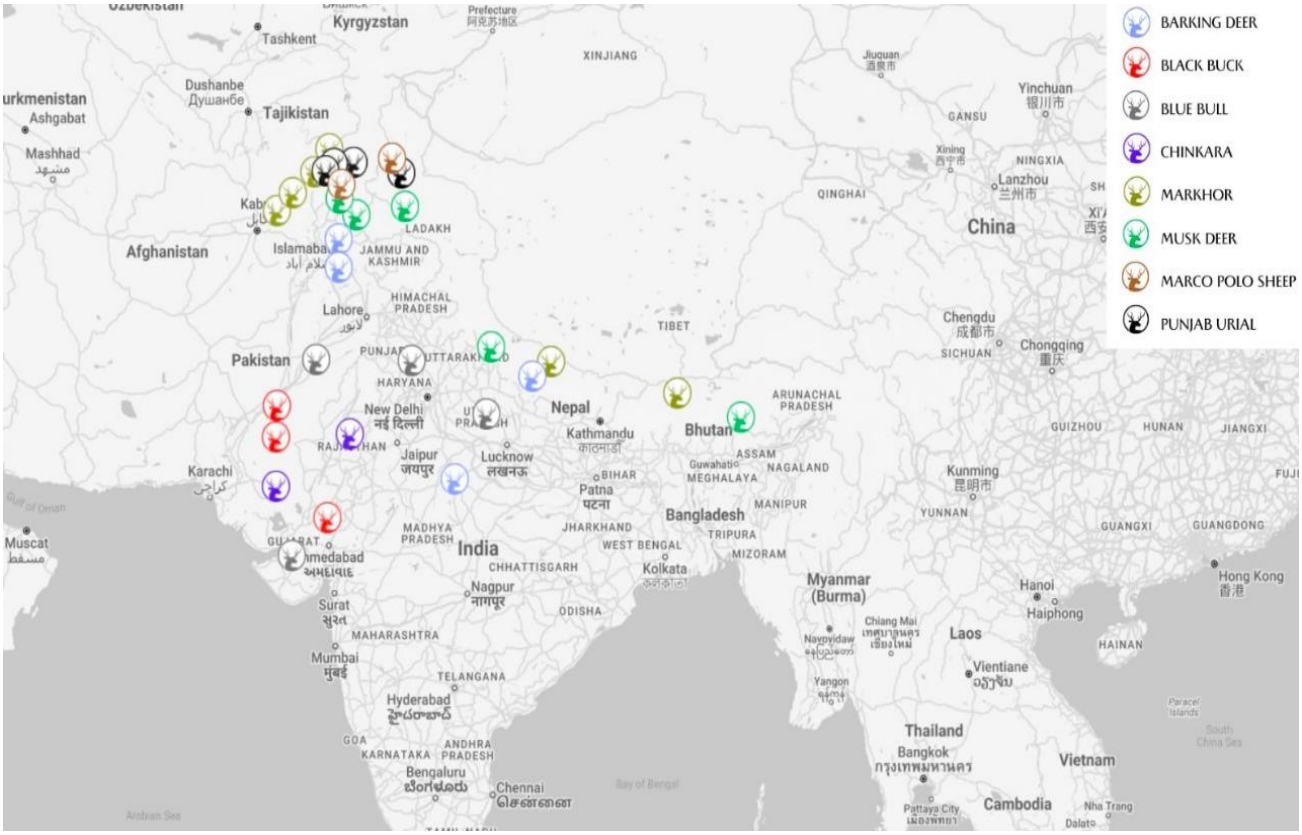
Despite increased efforts to reconcile conservation and agricultural interests, real and perceived negative interactions between wild and domesticated herbivores continue to be an important driver of the on-going global decline of wild herbivores. These creatures face an excessive amount of danger. In comparison to 25% of all mammals, nine (or 75%) are categorized as threatened on the 2008 Red List (Schipper et al., 2008).

The realization of these investments includes habitat destruction and degradation, relocation of human populations into previously remote areas and massive-scale infrastructural development including road and rail which in turn lead to the aforementioned surge in bushmeat hunting in these areas (Bahaa-el-din, Mills,

Hunter, & Henschel, 2015). In the following study, we have covered the endangered and the critically endangered wild ungulates of Pakistan, their distribution, their conservation projects internationally and particularly in Pakistan.

Musk Deer (*Moschus chrysogaster*): The musk deer belongs to the genus Moschus and family Moschidae. It is a diminutive mammal with a stocky build and a small head. Leg length differences between the fore and hind legs suggest a preference for leaping when browsing the shoots (Anwar & MINHAS, 2008). The musk emitted by adult male musk deer (Moschus spp.) is what makes them renowned. Musk deer are shy, lonely creatures. One of the first ingredients utilized in Asian traditional medicine and fragrance, musk is one of the most expensive scented animal products, costing even more than gold (Xiuxiang et al., 2006). Musk (Kasturi) is renowned for its fixative and fragrance qualities. Musk has been used as a scent since at least the 8th century (Green, 1986). By the end of September, when they enter the breeding season, musk deer start to mate. On the basis of their overall conduct and past reproductive histories, healthy adult men and females must be chosen (He et al., 2014). Muscone, a component of musk, accounts for 0.5-2.0% of musk and is one of the earliest and expensive raw materials used in perfumery (Green, 1986).

Distribution around the globe: From just north of the Arctic Circle south to the northern boundary of Mongolia and to Korea, the genus Moschus is scattered throughout the forested, hilly regions of Asia. The musk deer can be found further south, avoiding the Gobi Desert, in China, Burma, Assam, and the Himalayan region (Green, 1986).Due to climatic fluctuations, exposure effects, and a diversity of habitats, the Himalayan region is known for its high species richness and endemism (Lamsal, Kumar, Aryal, & Atreya, 2018).The Himalayan highlands are home to four endangered deer species: the Kashmir musk deer Moschus cupreus, the Himalayan musk deer Moschus leucogaster, the Alpine musk deer Moschus chrysogaster, and the Black musk deer (*Moschus fuscus*)(Singh et al., 2020).



Distribution in Pakistan: It is associated with the sub-alpine scrub forest in Pakistan, which is located above the coniferous forest at elevations of 3000–4000 meters, in the Machiara and Neelum Valley of the AJK, Indus Kohistan, Chitral, Astore, Chilas, and Gilgit. Despite living alone, they utilize community latrines to help preserve separate areas (Anwar & MINHAS, 2008).

Threats to conservation: The musk deer is traditionally hunted to remove the musk gland as it is known to be traded. Hunting techniques frequently disregard the sex

and age of the animals. Along with adult males, both females, who lack a musk gland, and immature males, who release very little musk, are murdered (Green, 1986). It has long been traditional to shoot musk deer for musk, whether legally or illegally. As a result, musk deer populations eventually dropped detrimentally, and in certain former range areas, Moschus spp. even went extinct (Xiuxiang et al., 2006). Although habitat deterioration has probably contributed to the Himalayan musk deer's declining population and, in the long run, may pose an equally substantial threat, overexploitation has been primarily responsible for the species' fatalities (Green, 1986).The gradual domestication process introduced by the wild animal breeding business modifies an animal's biological makeup as it adapts to live in captivity (He et al., 2014).

Conservation status and measures in Pakistan: All Moschus spp. species are included on the IUCN Red List as endangered (He et al., 2014). To meet the rising demand for musk, musk deer must be protected, and musk must be extracted from captive animals (Xiuxiang et al., 2006). The captive habitat cannot meet the behavioral and natural demands of musk deer, which may have an impact on their welfare. Musk deer in the wild are known to be vigilant, timid, and solitary. A comparable effect might have an impact on how successfully farming or captivity-based living go (He et al., 2014). Only after obtaining a comprehensive understanding of the state of musk deer farming in China can realistic strategies for the conservation of musk deer and its improvement be established (Xiuxiang et al., 2006). Its IUCN status has been reported to be Endangered (Sheikh & Molur, 2003).

Barking Deer or Indian Muntjac (*Muntiacus muntjak*): Considered the most basic of all living Cervidae, this small, solitary woodland ruminant has retained numerous physical traits indicative of extinct taxa of the subfamily Muntiacinae (Zulfiqar & Minhas, 2011). Barking deer are categorized as omnivores and are both browsers and grazers (Habiba et al., 2021). As in other ungulates, a particular stimulus or a group of stimuli that results in the same or a similar level of motivational state elicits each barking deer vocalization (Oli & Jacobson, 1995).

Distribution around the globe: They are indigenous to South East Asia, which includes Southern China, Bangladesh, Taiwan, Japan, the Boso Peninsula, Oshima Island, and Indonesian islands in addition to India and Sri Lanka (Zulfiqar & Minhas, 2011). The Indo-Malayan countries, China, Taiwan, Japan, Sri Lanka, North India, and Nepal are all home to Muntiacus spp. In Chitwan, barking deer are frequently spotted on meadows. They love Sal (Shorea robusta) and riverine forests (Nagarkoti & Thapa, 2007).

Distribution in Pakistan: In Pakistan, isolated populations of the barking deer, also known as the Indian muntjak (*Muntiacus muntjak*), can be found in Margalla Hills National Park, Khanpur Range, and Lathrar (Hameed & Mian, 2009). The Northern Red Muntjac is a timid, little cervid animal that is only found in Pakistan's outer Himalayan foothill forests (Habiba et al., 2021). This deer is only found in a small area of Pakistan, which includes Kahuta, Margalla Hills National Park, and some other locations. They were documented in Azad Jammu and Kashmir at the Pir Lasorha National Park and Choch in the District Kotli, in the District Mirpur, and in the District Bhimber (Zulfiqar & Minhas, 2011).

Threats to conservation: IUCN criteria include habitat encroachment, poaching, competition with free-ranging livestock, feral dogs, and hunting as the top concerns (Hameed & Mian, 2009). Muntjacs are threatened in a number of places, despite being classed as the least concern on the IUCN's list of endangered species. Among these dangers, habitat loss, encroachment, disruption of habitat, hunting, and pouching are widespread throughout its geographical range (Zulfiqar & Minhas, 2011).

Conservation status and measures in Pakistan: There used to be a healthy population of the species in the Margalla Hills (Pakistan), but by the 1970s, there were only around 20 to 30 heads left. After the MHNP was established, the habitat was protected, and by 1990, there were 67 individuals living there (Hameed & Mian, 2009). Although this deer is listed on the third schedule of the Azad Jammu and Kashmir Wildlife Act of 1975 (protected animals, meaning those that cannot be hunted, killed, or captured), there are no conservation practices in place (Zulfiqar & Minhas, 2011).It is Endangered (Sheikh & Molur, 2003).

Marco Polo Sheep (*Ovis ammon polii*): The Marco Polo sheep, *Ovis ammon polii*, a subspecies of the argali, first caught Marco Polo's attention because of its long, winding horns. The animal then became a sought-after trophy of foreign hunters, a position it still holds today (Schaller & Kang, 2008).The Argalis species is the biggest and has the longest horns (Valdez, Michel, Subbotin, & Klich, 2016). The Marco Polo sheep live in the most aligned, high-elevation environment compared to other argalis and are unselective feeders like other wild sheep. Outside of rutting season, sexual segregation would be evident in Marco Polo sheep, and their annual breeding cycle would affect the proportion of single-sex and mixed-sex groupings (Wang, Blank, Liu, Wang, & Yang, 2018).

Distribution around the globe: China, Afghanistan, Pakistan, Kyrgyzstan, and eastern Tajikistan are the locations where Marco Polo argali (*O. a. polii*) is found (Salas, Valdez, Michel, & Boykin, 2018). The Pamir Mountains, which are located primarily in Tajikistan into

China, Afghanistan, Pakistan, and Kyrgyzstan (Schaller & Kang, 2008). One of the most significant wildlife sites in Asia's highlands is Taxkorgan in China and the nearby Khunjerab National Park in Pakistan. The region's international protected area is supported by significant populations of large ungulates and carnivores, including the snow leopard and Marco Polo Sheep. It is believed that the floral diversity primarily came from the Palearctic, Pamir-Tian Shan, and Tibetan phytogeographic zones (B. Khan et al., 2016).

Distribution in Pakistan: The IUCN Red List classifies the subspecies as Vulnerable after seeing the habitat of the Marco Polo sheep in China and Pakistan in 1974. The sheep can cross into Pakistan from China by five recognized routes, although at three of them (Kilik, Mintaka, and Karchanai), they are restricted to a small area of habitat close to the border (Schaller & Kang, 2008). At least nine large mammal species, including the Marco polo sheep, are thought to live in Gilgit-Baltistan, where three massive mountain ranges—the Karakoram, Hindu Kush, and Himalayas—converge (B. Khan et al., 2016).

Threats to conservation: Anthropogenic reasons like illegal hunting, competition with livestock, and habitat degradation are likely to blame for the apparent extirpation of the population that once lived in the Misgar Valley. The historical abundance of argali in Pakistan was attributed to the hunting ban imposed by Mir Muhammad Nazim Khan of Hunza (1892–1935). Because of poaching on the Chinese side, the species was forced to seek refuge in the Kilik and Khunjerab Pass regions until 1949, when the Chinese government outlawed argali hunting (H. Ali, Younus, Din, Bischof, & Nawaz, 2019).

Conservation status and measures in Pakistan: They are classed as Near Threatened on the IUCN (Salas et al., 2018). Due to their roving tendencies in far-flung and hostile environments, Marco Polo sheep (*Ovis ammon polii*), which are found in the rough mountainous landscapes are challenging to assess and conserve (Haider, Khan, Anwer, Ali, & Ali, 2018). Environmental niche models are useful spatial ecological tools for understanding future actions for species management and policy and for better evaluating the relationship between species distributions and environmental conditions (Salas et al., 2018). We advise government officials to engage in negotiations with their Chinese counterparts on removing the fence from the Kilik and Khunjerab passes (H. Ali et al., 2019). Critically endangered is the IUCN status of the Marco polo sheep as described by (Sheikh & Molur, 2003).

Markhor (*Capra falconeri*): There are reportedly five distinct markhor subspecies in Pakistan. The so-called Chiltan markhor, one of the four subspecies, was discovered to be a wild goat (*Capra hircus*), leaving only the straight and flare-horned markhors (Schaller & Khan, 1975).Markhors are powerful mammals with broad, muscular, and relatively short legs. Its coat has a range of colors, including grey, blackish brown, and brown. The typical adult male flare-horned markhor measures around 170cm in length overall and stands around 100cm tall at the shoulder. The size of adult males is approximately half to that of females (S. Ali, 2008). Markhor from Kabul typically have a larger neck ruff than those from Sulaiman (Schaller & Khan, 1975).

Distribution around the globe: The markhor is only found in a small region of South Asia, mainly in Pakistan and Kashmir which is governed by Pakistan, whereas there are also a few isolated groups in southern Russia, Afghanistan, and Indian-controlled Kashmir (Schaller & Khan, 1975). The flare horned markhor is found in northern Pakistan, Afghanistan, India, Uzbekistan and Tajikistan (Bhatnagar et al., 2009).

Distribution in Pakistan: For the Pakistan region, there is no accurate information on markhor distribution and status, with the literature consisting primarily of historical hunting reports (Schaller & Khan, 1975). In the vicinity of the Torghar Hills, the Suleiman markhor, Capra falconeri megaceros, and the Afghan urial, Ovis orientalis cycloceros, are mostly stationary animals (Woodford, Frisina, & Awan, 2004). The Northern Areas of Pakistan accommodate most of the species' range (Bhatnagar et al., 2009).

Threats to conservation: The natural habitats of wild animals have mostly been damaged by human activity, putting many species in danger of going extinct. Because of the harmful effects of human activity, researchers are protecting threatened species by maintaining their habitats. These ungulates are thought to have vanished from the majority of their ancestral ranges in Pakistan as a result of habitat loss (Khattak et al., 2022). Insurgency-related consequences, increased local resource use, poaching, and extensive development are major threats to the markhor's range (Bhatnagar et al., 2009).

Conservation status and measures in Pakistan: Several species of markhors are endangered as a result of over hunting, which has caused concern for the species' survival (Schaller & Khan, 1975). Following consultation with local Pathan tribal chiefs and expert wildlife biologists from the USA, The Torghar Conservation Project is a private conservation initiative that was established in 1986. The Suleiman Markhor, *Capra falconeri megaceros*, and the Afghan urial, *Ovis orientalis cycloceros*, on Pathan tribal areas in the Torghar Hills of Qilla Saifullah District, Balochistan, Pakistan, were the TCP's primary targets (Woodford et al., 2004). The habitat suitability index (HSI), a crucial indicator of habitat quality, serves as an indicator of a

given environment's capacity to support a given species. Ecological models, such as habitat suitability models (HSMs), give researchers the chance to look at how wildlife and habitats interact and to find potential sites for threatened species. The HSM specifies appropriate substitute habitats for conservation policies and aids in evaluating a specific environment (Khattak et al., 2022). It has been reported to be Endangered (Sheikh & Molur, 2003).

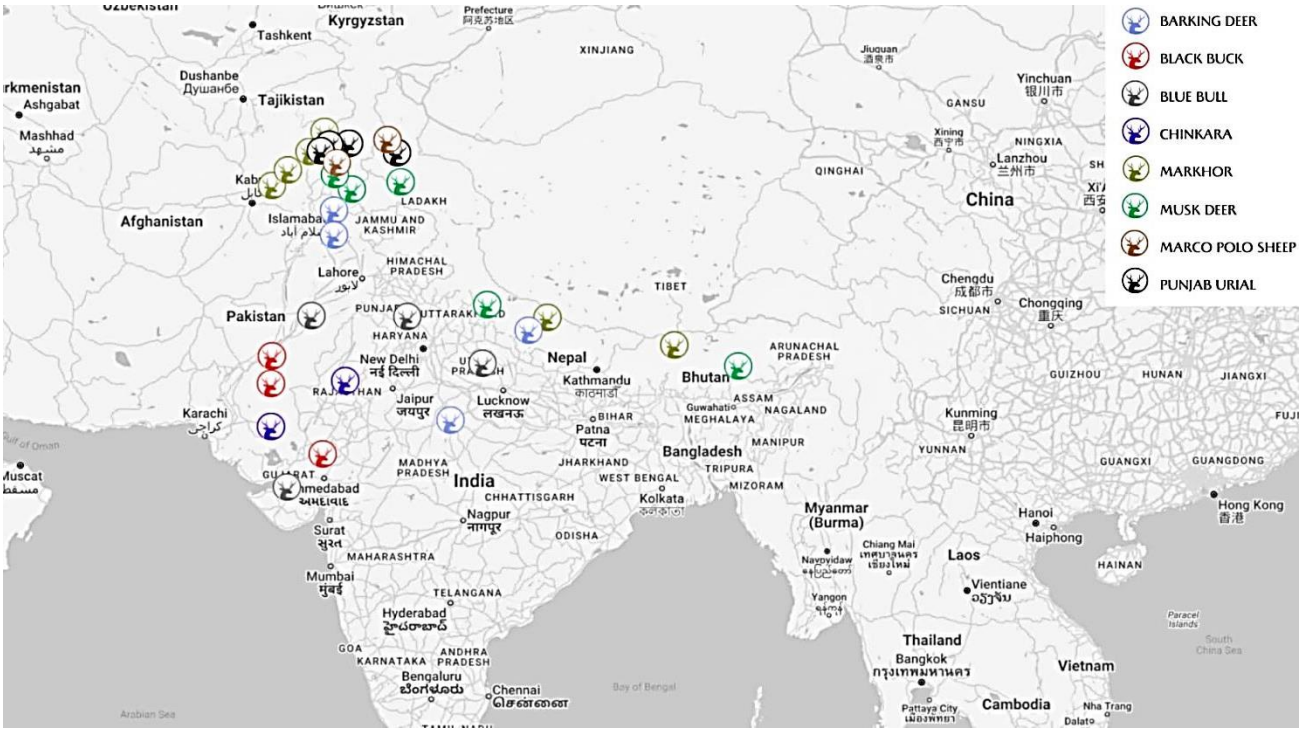


Fig. 1: Distribution map of the wild ungulates around the world and in Pakistan

Punjab urial (*Ovis vignei punjabiensis*): The Punjab urial is an endangered wild sheep that is native to northern Punjab, Pakistan. Punjab urial sheep are social and sexually dimorphic like other wild sheep. Adult males weigh around 40 kg, and their long, curling horns can extend to 100 cm in length. Female adults have straight horns that are 12 cm long and weigh 25 kg. Beginning in early April (Awan, Festa-Bianchet, & Gaillard, 2008).The rut occurs in the final week of October and the first week of November, while peak parturition occurs in the first half of April. In comparison to other seasons, the Punjab urial formed larger groups in the winter and smaller groups during the lambing season (Awan, Festa-Bianchet, & Ahmad, 2006).

Distribution around the globe: There are numerous domestic and wild sheep species in the genus Ovis. While domestic sheep are common on most continents, wild sheep populations and ranges have significantly declined in recent decades. Mountain ranges in eastern Eurasia and western North America are home to the wild ovis. It can be found in Afghanistan, Kashmir, Iran, Kazakhstan, Oman, Pakistan, Turkmenistan, Uzbekistan, and Tajikistan. The urial (*Ovis vignei*) is a widely scattered species (Bajwa et al., 2023).

Distribution in Pakistan: In Pakistan, below an elevation of 1,500 meters, the Punjab urial is spread between the Jhelum and Indus rivers (Awan et al., 2006). According to the IUCN list , the species has been designated as vulnerable internationally, with a trend towards population decline, and is endangered in Pakistan (Khattak, Liu, & Teng, 2019).

Threats to conservation: Although all forms of Punjab urial harvesting are prohibited, older males are treasured as trophies while lambs are frequently kept as pets. In Pakistan, having a pet is a status symbol (Awan et al., 2006). Humans are rapidly developing, which is having an impact on wildlife's natural habitats. To reduce the impact of these changes, wildlife reservoirs, zoos, and enclosures must be modified. Today, one of the most significant conservation tools is captive breeding (Khattak et al., 2019).

Conservation status and measures in Pakistan: The Punjab Wildlife Protection and Conservation Act of 1974 protect Punjab urials (Awan et al., 2008). Trophy hunting

is allowed but is strictly regulated. Understanding the population dynamics of urial is necessary for its management and protection (Awan et al., 2008). In Asia, poaching, habitat fragmentation, and competition with domestic cattle are all threats to many large herbivore populations. Lack of understanding of fundamental population dynamics and inadequate assessment of specific risks frequently make it difficult to protect Asiatic ungulates (Awan, 2006). In the 20 kilometers square core area of the game reserve, where urial are found in the highest concentration, livestock grazing is strictly restricted. In other areas of the reserve, where urial are found in lesser concentrations, livestock grazing is only permitted with a few cattle and sheep. In the lower elevation regions where urial is hardly seen, there are just a few roads that are accessible to humans. Under both federal and state law, the Punjab urial is protected. It is prohibited to hunt urial (Bajwa et al., 2023). The IUCN status is Endangered (Sheikh & Molur, 2003).

Blue Bull (*Boselaphus tragocamelus*): *Boselaphus tragocamelus*, the nilgai antelope, is a native of Pakistan, Nepal, and much of India. Within the Boselaphini tribe, Nilgai are monotypic members of the Boselaphus genus and belong to the bovidae family and bovinae subfamily (Zoromski, 2019). It is the only animal in its genus (Khanal, Aryal, Morley, Wright, & Singh, 2018). Nilgai and cattle battled intensely for grass and forbs when food supplies and variety were poor (Sheffield, 1983). For most of the year, Nilgai frequently forms sexually distinct groups, though group size changes according to the season. Males often reside alone (Zoromski, 2019).

Distribution around the globe: In Texas, nilgai antelope (*Boselaphus tragocamelus*) are an uncommon species of ungulate. Since their introduction in 1924–1949, nilgai, a native of India, Nepal, and Pakistan, have spread throughout much of coastal southern Texas and northeastern Mexico (Zoromski, 2019). In Bangladesh, it is currently extinct. In lowland Terai regions and outside of Nepal's network of protected areas, the population of Nepal is sparsely scattered (Khanal et al., 2018).

Distribution in Pakistan: In Pakistan, several zoos, safari parks, and wildlife parks have been created. The main locations created as the captive breeding centers in Sindh are the Karachi Zoo, the Safari Park, Karachi, and the Sufi Anwar Shah Safari Park, Mirpur Mathelo. In Lahore, the Lahore Zoo and The Safari Park accommodate a number of endangered wildlife species (M. Z. Khan et al., 2014). Only the Nagarparkar Taluka has records of nilgai, striped hyaena, and wild ass (A. A. Khan, Khan, & Chaudhry, 2015).

Threats to conservation: The nilgai is one of the mammalian species that have become endangered in Pakistan as a result of overhunting, climate change, habitat loss, competition with other species, deforestation, and the rising human population (M. Z. Khan et al., 2014). The growth of exotic ungulate ranching and hunting in Texas is a result of the O. virginianus hunting industry's success (Lohmeyer, May, Thomas, & Pérez de León, 2018). In their natural habitat, tigers (*Panthera tigris tigris*), dholes (*Cuon alpinus*), and golden jackals (*Canis aureus*) are known to prey on adult nilgai (Zoromski, 2019). Illegal hunting, poisoning, electric fences, and habitat loss are just a few of the dangers facing nilgai (Khanal et al., 2018).

Conservation status and measures in Pakistan: The nilgai is endangered in Pakistan (M. Z. Khan et al., 2014). The goal of the captive breeding program for threatened and endangered species is to create captive populations that are large enough to be stable. In order to safeguard the population against disease and preserve the gene pool to prevent the issues associated with inbreeding, this entails maintaining a healthy age structure, guaranteeing effective reproduction, and maintaining the age structure (M. Z. Khan et al., 2014). Conservation issues have been exacerbated by conflict with nearby farming communities caused by nilgai that cause crop damage. Protected areas serve as places of refuge and sanctuaries for biodiversity around the world and are crucial for conservation (Khanal et al., 2018). It is described to be Endangered (Sheikh & Molur, 2003).

Blackbuck (*Antilope cervicapra*): The medium-sized blackbuck (*Antelope cervicapra*), which is native to the subcontinent, can be found in a variety of shortgrass and savanna environments. It exhibits great sexual dimorphism and a wide range of social and mating structures (Jhala & Isvaran, 2016). Males have whorled horns up to 79 cm long; females do not. As males age, their skin tone gradually darkens, going from tawny to dark brown to black. Females and young animals have yellow front and backs. Both sexes have a white chin, chest, and undersides of the legs (Abid & Tasleem). Blackbuck males live shorter lives than females, and they exhibit a midlife mortality peak that corresponds to a high in mate rivalry. Blackbuck are grazers who can survive on low-quality diets by catabolizing proteins and decreasing mobility (Jhala & Isvaran, 2016).

Distribution around the globe: Blackbuck (*Antilope cervicapra*) was once found throughout peninsular India as well as from what was once West Pakistan, along the Himalayas from Punjab through Uttar Pradesh (in India), Nepal, and what East Pakistan was once (Mirza & Waiz, 1973). The last surviving blackbuck population in Nepal is located in the west-central district of Bardia (Bhatta, 2008).

Distribution in Pakistan: One of the most stunning creatures that may be found close to a human town is the blackbuck (Bhatta, 2008). Blackbucks were once prevalent in Pakistan's Bahawalpur (Punjab province) and

Tharparkar (Sindh province) areas of the northern Cholistan Desert. It is thought that a few dispersed individuals are occasionally seen in the wild not far from the Indian border are a member of the Indian population (Farooq, Iqbal, Khan, Asad, & Wajid, 2022).

Threats to conservation: The blackbuck population is extremely vulnerable to habitat loss and is under a lot of stress from overhunting, which could lead to extinction (Farooq et al., 2022). Policy, legal and institutional, habitat management, database and research are the current management challenges (Bhatta, 2008). The demographic makeup of blackbuck appears to be influenced by wolf predation and gender-specific mating preferences (Jhala & Isvaran, 2016). Threats like overhunting, stress, habitat loss, illnesses, poaching, accidents on the road, fragmented habitats, interspecific competition, predation pressure, etc. have caused the blackbuck population to reach threatened levels (Abid & Tasleem).

Conservation status and measures in Pakistan: They are kept in captivity in a variety of locations because they are extinct in the wild in Pakistan (Farooq et al., 2022). For the management and protection of a species, information about its behavior is crucial. The reintroduction program was launched at the beginning of the 1980s, and some couples were imported from Texas (U.S.A.) to Kirthar (Sindh) and Lal Sohanra National Park (Punjab). A herd of 413 animals was noted in Lal Sohanra National Park (Farooq et al., 2022). Blackbuck conservation also benefited from hormone-mediated preservation, genetic research, and translocation to non-endemic but suitable habitat. Despite certain worries, current conservation practices are helping to protect the blackbuck (Abid & Tasleem). Creating protected areas (PAs), which now occupy 13.9% of the planet's land area, has been a key strategy for preserving biodiversity. For the long-term protection of biodiversity, the ecological basis for creating PAs depends on aspects like the species that live there, their extent, the availability of habitats within a PA, and their connectivity with other PAs or related areas (Prashanth, Saravanan, Mathivanan, & Ganesh, 2016). Short grass with a suitable species composition must be maintained in the grassland since tall grass is not a preferred habitat for blackbucks (Bhatta, 2008). Its IUCN status has been reported to be regionally extinct (Sheikh & Molur, 2003).

Chinkara (*Gazella bennettii*): The Chinkara (*Gazella bennettii*) is a small, quick, and alert antelope. It is not very attentive, but when startled, it stamps its forefoot on the ground while making sneezing-like alarm hisses out its nose, earning it the nickname "the sneezer" in its native country. It can survive significantly longer stretches of time between trips to water sources and is well adapted to living in semi-arid deserts, arid valleys, and dry steppes (Arshad & Hussian Gill, 2010).

Distribution around the globe: This species can be found in large numbers all over central and western India, as well as Pakistan, south-western Afghanistan, and north-central Iran (Idnan et al., 2020). There are 14 species of ungulates in the genus Gazella (family Bovidae, subfamily Antilopinae), and they are widely distributed throughout Asia, Africa, and the Middle East (Hussain, Manzoor, Musthafa, Marikar, & Babar, 2020).

Distribution in Pakistan: It was distributed around the Kala Bagh area in Salt Range and Cholistan Desert, and it was found in Sibbi Plains, Mekran, Turbat, and Lasbela areas of Baluchistan, Kirthar Hills in Sind, Margalla Hills in Islamabad, and in Punjab province. However, in the past, it had an even broader distribution in Pakistan (Arshad & Hussian Gill, 2010).

Threats to conservation: In the recent decades, the Chinkara or Indian Gazelle (*Gazella bennettii*) population has dramatically decreased in Iran, Pakistan, and Afghanistan (Akbari, Moradi, Sarhangzadeh, & Esfandabad, 2014). Numerous threats are posed to Chinkara populations, including overgrazing that is reducing their survival and populations in the Barmer district, urbanization and agricultural land expansion, feral dog predation, illegal hunting and poaching for their flesh, skins, and horns, habitat destruction brought on by large-scale industrialization and petrochemical activities, and illegal hunting and poaching for their parts. In several places, Chinkara deaths and injuries were also caused by electrical shock and iron wire fence around agricultural regions (Chishty, Choudhary, Patel, & Kumawat, 2021).

Conservation status and measures in Pakistan: The IUCN classifies the Indian gazelle, a species native to the wild northern Punjab of Pakistan, as an endangered species. It may be possible to develop efficient conservation policies with a better understanding of the genetics underlying this species' immunological response (Hussain et al., 2020). Although their exact population status in Afghanistan is unknown, Chinkaras are believed to be in scarcity (Idnan et al., 2020). There is no precise estimate of how many Chinkara are being lost to overhunting in Pakistan. The Punjab Wildlife Act designates the Indian Chinkara as a protected species in the province of Punjab. Similar to other animals in the area, there is not enough accurate information on the population status of this species throughout the entirety of its geographic distribution in the nation (Arshad & Hussian Gill, 2010). Programs for wildlife conservation include species-specific knowledge and awareness of all potential issues that could slow population expansion (Idnan et al., 2020). The IUCN status of the Chinkara is vulnerable as described by (Sheikh & Molur, 2003)

Table 1: Wild Ungulates, their distribution, conservation status and efforts for conservation in Pakistan

	Distribution In Pakistan	***Distribution Around the World***	***IUCN Status***	***IUCN Status in Pakistan***	***Conservation Projects***
MUSK DEER (*MOSCHUS CHRYSOGASTER*)	The Himalayas and Karakoram ranges	The Himalayas, Siberia, and Central Asia	Endangered	Vulnerable	Community-based Musk Deer Conservation Initiative in MDNP (Margalla Hills National Park)
BARKING DEER OR INDIAN MUNTJAC (*MUNTIACUS MUNTJAK*)	The Northern regions and some parts of Central and Southern Pakistan	India, Southeast Asia, and China	Endangered	Least Concern	No specific conservation project
MARCO POLO SHEEP (*OVIS AMMON POLII*)	The Karakoram and Hindu Kush	Afghanistan, Tajikistan, and Kyrgyzstan	Critically Endangered	Vulnerable	No specific conservation project
MARKHOR (*CAPRA FALCONERI*)	The Hindu Kush, Karakoram, and Himalayan ranges	Afghanistan, Pakistan, Tajikistan, and Uzbekistan	Endangered	Near Threatened	Markhor Conservation Project e.g. Chiltan Markhor Conservation
PUNJAB URIAL (*OVIS VIGNEI PUNJABIENSIS*)	The Salt Range and surrounding areas	Pakistan and India, particularly in the Punjab	Endangered	Least Concern	Punjab Urial Conservation Project-WWF
BLUE BULL (*BOSELAPHUS TRAGOCAMELUS*)	The captive breeding centers in Sindh are the Karachi Zoo, the Safari Park, Karachi, and the Sufi Anwar Shah Safari Park	India, Nepal, and Pakistan	Endangered	Least Concern	No specific conservation project
BLACKBUCK (*ANTILOPE CERVICAPRA*)	Around The Indian border part of the Indian population	India and Nepal	Regionally extinct	Near Threatened	No specific conservation project
CHINKARA (*GAZELLA BENNETTII*)	The provinces of Punjab, Sindh, and Balochistan	India, Pakistan, and Iran	Vulnerable	Least Concern	No specific conservation project

Authors Contributions

Sr. No	**Author Name**	**Contribution**
1	**Muhammad Azhar**	Main author, conceptualized the idea and formulated materials and methods, applied statistics
2	**Muhammad Rizwan Khan**	conceptualized the idea and formulated materials and methods and helped in sampling
3	**Rida Fatima**	Helped in sampling, write up, analysis and data curation
4	**Abida Mushtaque**	Helped in write up, analysis and data curation
5	**Nazish Iqrar**	Helped in write up, analysis and data curation
6	**Bushra Anwar**	Helped in write up, analysis and data curation
7	**Ghulam Abbas**	helped in writing the contents, addressed the reviewers comments and critically reviewed the final draft
8	**Fahd Haseeb**	Helped in formatting and editing
9	**Arooj Fatima**	Helped in research by providing material needed for research

Conclusion: In conclusion, the decline of wild ungulates in Pakistan poses a significant threat to biodiversity. Human activities such as habitat destruction and poaching have contributed to this decline. Efforts towards ex-situ conservation, such as creating refuges and protected areas, are crucial. However, a comprehensive management plan addressing the conservation challenges is essential. Understanding the spatial density patterns and ecological roles of wild ungulates can aid in effective conservation strategies. Through collaborative efforts between government agencies, conservation organizations, and local communities, it is possible to mitigate the decline and ensure the survival of wild ungulates in Pakistan.

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