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(RESEARCH, TRAINING & EDUCATION)
(TAMIL NADU FOREST DEPARTMENT)



**SPECIES CONSERVATION
PLAN FOR THE TARGET
ANIMALS OF THE
INNOVATION CUM
INCUBATION CENTRES FOR
BIODIVERSITY
CONSERVATION PROGRAM,
TAMIL NADU**

Funded by the State Planning
Commission

2025





**SPECIES CONSERVATION PLAN FOR THE TARGET ANIMALS OF
THE INNOVATION CUM INCUBATION CENTRES FOR
BIODIVERSITY CONSERVATION PROGRAM, TAMIL NADU**

PROJECT NAME: ESTABLISHMENT OF INNOVATION CUM INCUBATION CENTRES
FOR BIODIVERSITY CONSERVATION IN SCHOOLS AND COLLEGES ACROSS
TAMIL NADU

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INTRODUCTION

Tamil Nadu is richly endowed with biodiversity hosting a variety of ecosystems including diverse forests. Tamil Nadu supports a total forest cover of 20.34% of the geographical area (ISFR 2023). The Tamil Nadu Forest Department has undertaken several initiatives to conserve many cryptic, endangered and vulnerable wild species. The state department has extended efforts to improve, strengthen, and manage the forest resources and biodiversity of Tamil Nadu through various management initiatives. There are 35 wildlife Sanctuaries (18 wildlife and 17 bird sanctuaries), five national parks, five tiger reserves, five elephant reserves, and 20 Ramsar sites for the protection and conservation of forests (TNBB 2025).

These protected areas are the hotspot regions for the innumerable variety of wildlife. These regions are their prime habitat and resources for many cryptic and vulnerable species. Still, many species are threatened by the recent Anthropocene and the ever-growing human influence on forest ecosystems. These forest ecosystem disturbances highlight the urgency for more conservation initiatives. To address the major threat and significant challenges faced by wildlife in Tamil Nadu and as part of the TANII State Innovation Fund, the State Planning Commission along with the Advanced Institute for Wildlife Conservation (R, T & E) have initiated the Innovation cum Incubation centre program to conserve, protect and provide awareness on 13 iconic target species in eight forest divisions of Tamil Nadu.

The innovation cum incubation centres aim to create a scientific temper and cultivate the spirit of curiosity and innovation among young minds towards biodiversity conservation. The program seeks to establish innovation cum incubation centres for biodiversity conservation in schools and colleges across Tamil Nadu, and the idea is to enhance the research and awareness efforts within their respective eight forest divisions and their target animals for conservation (Table 1). With this background, the Advanced Institute for Wildlife Conservation (R, T & E) has developed the Species Conservation Action Plan to conserve the target animal of the

various Innovation cum Incubation centres. The species conservation plan addresses threats such as habitat destruction, rapid urbanization, and illegal anthropogenic activities that impact the conservation of target animals.

Table 1: The eight forest division hosting the Innovation cum Incubation centres and their target animal for conservation

Sl. No	Forest Division	Target Animal for conservation
1	Hosur	Four-horned antelope, and Smooth-coated otter
2	Salem	Bengal fox
3	Villupuram	Pelicans
4	Sathyamangalam	Vulture species (Egyptian, Indian, White-rumped, and Red-headed),
5	Srivilliputhur	Grizzled giant squirrel
6	Tirunelveli	Indian spotted eagle and Egyptian Vulture
7	Thoothukudi	Blackbuck
8	Kanyakumari	Great pied hornbill, and Nilgiri langur

The current conservation action plan for the target species is based on several field visits conducted between 2024 and 2025 across the eight forest divisions. It is a comprehensive field initiative that has gathered and refined the information through several brainstorming sessions with various stakeholders, i.e., forest officials, field staff, local people, researchers, and non-governmental organisations. The researchers from AIWC/Centres and the program's forest department officials studied the ecology of target animals under the guidance of senior forest officials. The species conservation plan aims to ensure the survival and strengthen wildlife protection in their designated division. This action plan mainly focuses on the targeted species (Table 1), which face critical risks according to the IUCN Red List. This conservation action plan provides a comprehensive approach to mitigate the current threats for these iconic target animals, and its implementation would safeguard these species from local extinctions.

This effort would benefit wildlife and human communities by ensuring the future survival of these targeted species as well as the conservation of the associated natural resources. The plan has been prepared by AIWC, Tamil Nadu Forest Department in collaboration with all the Biologists, Technical Assistants and the field staff from each innovation cum incubation centre. This present outcome connects the gap between research and conservation activity. It promotes the preparation of other state-wide biodiversity conservation action plans, which help maintain long-term ecological balance and environmental sustainability in Tamil Nadu.

1. HOSUR FOREST DIVISION

1.1. SMOOTH-COATED OTTER

Domain : Eukaryota
Kingdom : Animalia
Phylum : Chordata
Class : Mammalia
Order : Carnivora
Family : Mustelidae
Genus : *Lutrogale*
Species : *L. perspicillata*

Binomial Name : *Lutrogale perspicillata* (Geoffroy Saint-Hilaire, 1826)

Common Name : Smooth-Coated Otter

Tamil Name : ஆற்று நீர்நாய்

IUCN Category : Vulnerable

WPA, 1972 : Schedule – I; Part – A of WPA 1972 Act



Figure 1: Smooth-coated Otter in River Cauvery

BACKGROUND

The Smooth-coated Otter, *Lutrogale perspicillata* (Geoffroy Saint-Hilaire, 1826) is a semi-aquatic carnivore mammal species, categorised as 'Vulnerable' by the IUCN Red List (IUCN, 2022) and is listed under CITES Appendix II to regulate international trade (CITES, 2017). The smooth-coated otter is the only species of the genus *Lutrogale* under the Mustelidae family, which includes other otters, weasels, and badgers (Wilson & Reeder, 2005). It is closely related to the Asian small-clawed otter (*Aonyx cinereus*) and the Eurasian otter (*Lutra lutra*) (Morettiet *al.*, 2017). *L. perspicillata* is identified by its larger size, smoother fur, and more social lifestyle (Hussain, 1999). This species has a unique body specially adapted for an aquatic lifestyle, with webbed feet and a strong tail for swimming (Menon, 2014).

The Smooth-coated Otter is predominantly present and adapted to freshwater wetlands, rivers, mangroves, estuaries, and coastal regions (de Silva *et al.*, 2015). Smooth-coated otters are widely distributed in South and Southeast Asian countries such as India, Bangladesh, Nepal, Myanmar (Gomez, 2016), Thailand, Malaysia, Indonesia, and Iraq (Khan *et al.*, 2014; Duplaix & Savage, 2022). In India, this species is distributed in Chilika Lake, the Western Ghats, and the Terai region (Hussain, 2013), and adaptation to man-made habitats such as shrimp farms and urban waterways in Goa has also been recorded (Anoop & Hussain, 2004).

In Tamil Nadu, it is widely distributed across the major rivers and freshwater systems (Arivoli & Narasimmarajan 2021; Gowtham *et al.*, 2022; Baskaran *et al.*, 2022; Jayasurya *et al.*, 2023; Narasimmarajan *et al.*, 2024). In the Hosur Forest Division, research has recently documented the huge presence of this species, specifically in the Cauvery River (Baskaran *et al.*, 2022), Rasimanal, Biligundulu, Uginiyam, and Urigam Region, due to the availability of suitable habitat preferred by this species. Research conducted between December 2010 and February 2011 identified a 31 km

stretch from Dubbaguli (Yellolapatti) to Biligundulu (Musulumaduvu) as a significant habitat for these otters (Baskaran *et al.*, 2022). The species population in this division were observed to include seven separate groups, totalling 36 individuals (Baskaran *et al.*, 2022). These otters preferred to eat predominantly fish and insects, molluscs, crabs, frogs, reptiles, and birds (Trivedi & Variya, 2023).

Smooth-coated otter survives in riparian habitats along the Cauvery River, where the availability of large fish populations, dense riverine vegetation, and less anthropogenic activities provides a potential habitat (Jayasurya *et al.*, 2023). Otters usually prefer undisturbed riverbank areas with thick vegetation (Prakash *et al.*, 2012), shallow freshwater bodies with huge fish availability (Hussain & Choudhury, 1997), and protected mangrove swamps such as the Sundarbans (De Silva, 2011). Deciduous and riverine forests characterise the Cauvery North Wildlife Sanctuary, with extensive wetland ecosystems. Rocky riverbanks, sandbanks, and shallow pools provide potential foraging habitat (Moun *et al.*, 2023). The distribution of the species in the Hosur Forest Division is mainly noticed along the Cauvery River stretch, particularly in areas with low human activity and rich aquatic biodiversity (Baskaran *et al.*, 2022).

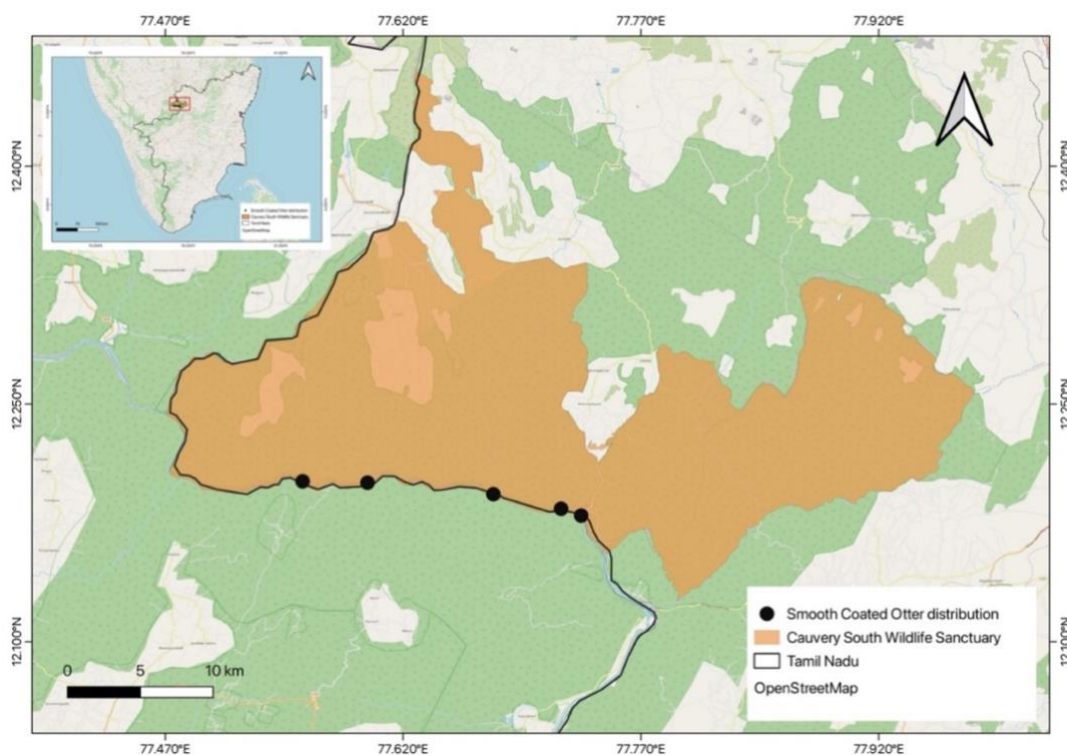


Figure 2: Geographical Distribution Map of Smooth Coated Otter in Hosur Forest division (The species distribution data was provided by the research team of the forest division).

Primarily piscivorous, they feed on fish (Hussain, 1999; De Silva, 2011), with additional dietary components such as crustaceans, insects, molluscs, frogs, reptiles and birds (Gopi & Hussain, 2003; De Silva, 2011; Baskaran *et al.*, 2022) and occasionally small mammals (De Silva, 2011). They employ cooperative hunting, herding fish into shallow waters for easy capture (Kruuk, 2006), and in some areas, they scavenge from human settlements and fish farms (Hussain, 2013).

Habitat destruction due to wetland degradation, urbanization, and dam construction (Prakash *et al.*, 2012), pollution from industrial waste and pesticides used for agricultural purposes (Anoop & Hussain, 2004), and human-wildlife conflict due to fish farm predation (Gopi & Hussain, 2003), have produced significant threats. Additionally, the illegal wildlife trade for their fur (Gomez *et al.*, 2016) and the report showing increasing demand for otters in the pet trade (Shepherd & Nijman, 2018) could be reasons for otter population declines. Climate change-induced threats such as rising sea levels, saltwater intrusion, and extreme weather further impact their habitats (De Silva, 2011; Hussain, 2013). Steps for conservation in India, including projects in the Western Ghats, Chambal River, and Sundarbans (Hussain, 2013), have raised awareness, while efforts in Malaysia and Singapore have successfully reintroduced otters into urban wetlands (Sivasothi & Nor, 1994). Community-based conservation programs engaging local fishermen in Bangladesh and Nepal have also facilitated human-otter coexistence (de Silva, 2011).

CURRENT THREATS IN HOSUR DIVISION

In the Cauvery Wildlife Sanctuary, smooth-coated otters face multiple threats including river pollution, habitat destruction, and anthropogenic activities. Extensive pollution from plastic, sewage and industrial effluents degrade the water quality causing disturbances in the fish population. An increase in the invasive fish

population, especially the catfish family, creates disturbances in the availability of preferred fish resources in their habitat. It primarily leads to the decline of native fish resources in their preferred habitat. This results in reduced availability of primary food sources for otters. Illegal sand mining causes serious destruction of otter habitats. Also, certain fishing practices introduce changes in otters behaviour. Local people believe that otter meat and whiskers are good for some medicinal practices, and this myth increases the prospect of poaching. These activities display critical threats which could lead to the decline of smooth-coated otters in the Hosur division.

CONSERVATION PLAN

A. Habitat Protection

- It is essential to regulate illegal sand mining to protect the otters' preferred habitats used for grooming and living.
- The primary habitats for otters are riverbanks and sandbars, making it crucial to conserve these areas. Additionally, to prevent soil erosion close to the riverbanks, suitable native vegetation may be planted.

B. Pollution Control

- Pollution control rules and guidelines to be strictly followed to prevent contamination from industry effluents, pesticide and insecticide residues.
- In some regions along the Cauvery Basin, there are tourism activities which alter their habitat and shrink the resources for otters.
- Conduct awareness programs with greater focus on school and college students about the impact of plastic and water pollution and impacts on otter conservation.

C. Enhance food availability

- Restrict the fishing activities, particularly the use of nets in otter areas.

- Declare no fishing activities in their habitat, and also notify the restricted zone for fishing purposes.
- There is a drastic decline of native fishes in the Cauvery waters (Kumar *et al.*, 2020; Raj *et al.*, 2021; Lohith *et al.*, 2021). There is a need to control invasive fishes, like African catfish, in the areas preferred by otters to ensure the availability of a variety of food resources.

D. Prevent Poaching

- Regular patrolling in the otter habitats and record keeping by concerned forest frontline staff to prevent poaching and other illegal activities.
- Implement strict legal action and ensure penalties against forest and wildlife offenders.

E. Research

- Conduct a population estimation study to assess the current population size of otters within the division and track habitat conditions and movements.
- Study the otter behaviour to evolve better and refined methods of conservation.
- Collaborate with the reputed research institute to discover otters' current distribution and status and make a local plan for long-term survival.

1.2. FOUR-HORNED ANTELOPE

Domain : Eukaryota
Kingdom : Animalia
Phylum : Chordata
Class : Mammalia
Order : Artiodactyla
Family : Bovidae
Subfamily : Bovinae
Tribe : Boselaphini
Genus : *Tetracerus*
Species : *T. quadricornis*

Binomial Name : *Tetracerus quadricornis* (Blainville, 1816)

Common Name : Four-Horned Antelope

Tamil Name : நாற்கொம்பு மான்

IUCN Category : Vulnerable

WPA, 1972 : Schedule – I; Part – A of WPA 1972 Act



Figure 3: Four-horned antelope in Anaibethalla, Anchetty range, Hosur

BACKGROUND

The Four-Horned Antelope *Tetracerus quadricornis* (Blainville, 1816) is also called the Chousingha (Leslie & Sharma, 2009). In Tamil, it is locally called “*Nangu kombu maan*” and “*Kuriga Kondakara*”. With an assessed population around 10,000 individuals, it has been classified as Vulnerable by the IUCN (Dubost *et al.*, 2019). It is also endemic to the Indian subcontinent, primarily in India and Nepal (Sharma *et al.*, 2014). It is identified by the presence of four horns on its head, differentiating it from other antelope bovid species (Bubenik & Bubenik, 2012). This small to medium-sized herbivore is primarily distributed in dry deciduous forests, open grasslands, and hilly terrain as its preferred habitat (Mathur, 1991; Uikey, 2019). In India, four-horned antelope distribution was recorded in Satpura, Kanha, and Pench reserves in Madhya Pradesh (Vaishnav *et al.*, 2021), also in Gujarat, Rajasthan, and parts of Maharashtra, Karnataka, Andhra Pradesh, Telangana, and Tamil Nadu (Dookia *et al.*, 2013; Thorpeand, 2015). Observations from Tamil Nadu have been recorded in some regions, such as Sathyamangalam Tiger Reserve, Mudumalai Tiger Reserve, Kalakad Mundanthurai Tiger Reserve, Srivilliputhur, and Hosur (Baskaran, 2013; Swamy *et al.*, 2020; Baskaran *et al.*, 2011a). The species is diurnal and territorial, usually solitary but at times found in small groups (Sharma *et al.*, 2009). Their shy and secretive nature is one of the reasons that make them prefer areas with dense vegetation for cover, avoiding human disturbances (Leslie & Sharma, 2009). The species in Tamil Nadu’s Hosur Forest Division have been documented in the Anaibethalla, Denkanikottai, Rasimanal, Anchetty, and Ulibanda forest ranges.

CAUVERY NORTH AND SOUTH WILDLIFE SANCTUARY

The Cauvery North (504 Km²) and South (686 Km²) Wildlife Sanctuary is a protected area in Tamil Nadu adjacent to the border with Cauvery Wildlife Sanctuary of Karnataka. It is also an important wildlife corridor between Bannerghatta National Park, Male Madeshwara Wildlife Sanctuary, and the Eastern Ghats forests (Mallegowda, 2015). The Cauvery Wildlife Sanctuary on the Karnataka side was

declared in 1987 (Daniel *et al.*, 2012) because of its rich biodiversity and contribution to the significant role in biodiversity conservation of the Eastern Ghats region. This entire region provides a variety of ecosystems to the wildlife species by possessing habitats such as dry deciduous forests, riverine vegetation, scrublands, and rocky terrains (Baskaran *et al.*, 2011). The Cauvery River crosses through this sanctuary (North and South) in Tamil Nadu, highlighting the richness of the sanctuary ecosystem and creating potential habitat for four-horned antelope, terrestrial and aquatic animals in this location (Baskaran *et al.*, 2011).

The sanctuary is crucial for the protection of riverine ecosystems and the conservation of wildlife species. The Four-horned antelope help in the seed dispersal of different species and plays an important role in the stimulation of the nitrogen cycle (Krishna, 2023). As a species of significant ecological value, the four-horned Antelope has been studied across various dimensions, including its habitat, behaviour, conservation status, and ecological significance. Studies suggest that they primarily graze on grasses but occasionally browse on shrubs and small trees (Sharma *et al.*, 2020). They are highly vigilant animals, relying on swift movement and camouflage to avoid predators such as leopards, tigers, and dholes (Karanth, 2006). Research on their reproductive behaviour indicates a gestation period of approximately 8 months (Baskaran *et al.*, 2011), with females typically giving birth to one or two offspring. Calves are often concealed in dense vegetation to minimize predation risks (Raj *et al.*, 2019). Conservation efforts have focused on improving protected area management, establishing wildlife corridors, and reducing anthropogenic pressures (Singh *et al.*, 2022).

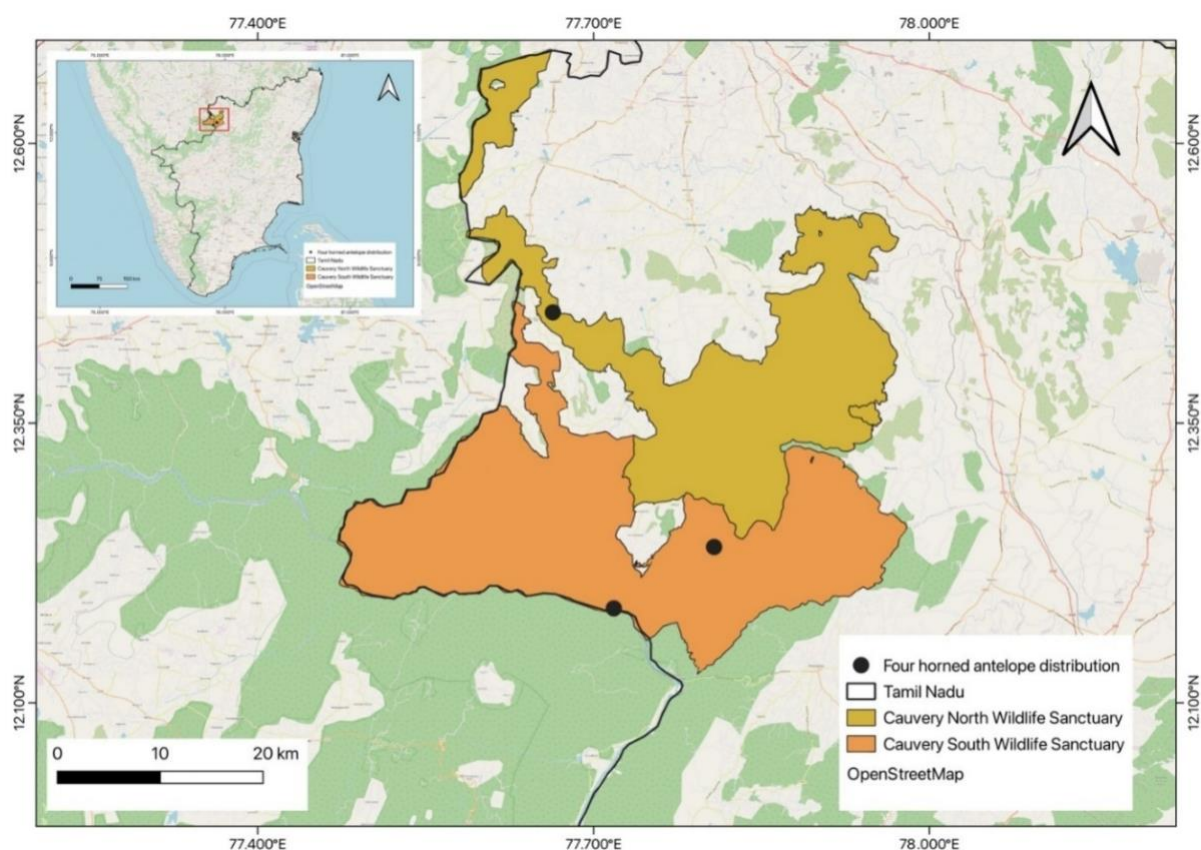


Figure 4: Geographical Distribution Map of Four-Horned Antelope in Hosur Forest division (The species distribution data was provided by the research team of Hosur forest division)

CURRENT THREATS IN HOSUR DIVISION

The four-horned antelope in Hosur and other parts of the country faces many notable threats that impact its long-term survival. The primary threats to the species include habitat loss due to agricultural expansion, deforestation, human encroachment, and poaching for their horns and meat. The animal is reported to be mainly hunted for its skin and horns, as well as for meat and medicinal purposes. The expansion process of the village revenue lands located near the boundaries of protected areas considerably restricts its habitat. Another pressure on wildlife includes activities such as cattle grazing and firewood collection carried out by the local people. Overgrazing by local domestic cattle creates competition for food resources within the sanctuary and also increases the chances of spreading zoonotic diseases. The food availability is also affected mainly by certain invasive species

(*Lantana camara*) within the sanctuary. Additionally, fires during the summer season are one of the significant threats. The firewood collection activities also disturb the natural behaviour of the animal. Sustained pressure from such activities cause stress to the four-horned antelope, loss of habitat, and immigration of other generalist species to their prime habitat.

CONSERVATION PLAN

A. Habitat Protection

- Ensure habitat continuity and establish corridors to connect certain fragmented habitats for easy movement within the protected area.
- As a major district for mining, industries and infrastructure development, the maintaining the forest cover in Hosur will be crucial. They also need to convert the unmaintained Revenue or HR & CE department land near the forest corridors into a protected area.
- Follow the regulations of the Forest and Wildlife (Protection) Act strictly to protect the habitat and prevent poaching and other activities.

B. Grazing Management

- Grazing is one of the major pressures on the Hosur forest; the ground cover of deciduous forests is completely vulnerable to intensive grazing, and ground vegetation is largely limited.
- Declare and label the grazing zones as off-limits for livestock, identifying them as potential grazing habitat for antelope and other wild herbivores.
- Introduce farmers to the stall-feeding techniques and cultivation of fast-growing grass species for their cattle management. This practice can make them independent of the forest resources.

C. Prevention of forest fire

- Monitor the fire prone zones regularly and maintain fire lines, which are necessary.
- Control burning may need to be followed near the agricultural zones.
- Restrict the materials that can cause forest fires and provide concerned staff with necessary assistance for control burning.

D. Control Invasive Species

- Regularly monitoring and eradication of invasive alien species like *Lantana camara*, *Prosopis juliflora*, *Senna*, and others as they restrict the availability of a variety of food resources for wildlife.
- Assist regeneration of indigenous plant species to retain the native plants and also maintain the ecological balance.

E. Anti-Poaching Management

- Regular patrolling in the protected area and four-horned antelope preferred habitats in the division will prevent poaching.
- Engage local people to inform the forest department against illegal activities within the division.

F. Conduct Scientific Research

- Conduct research surveys to estimate the current population trend and threats to the preferred habitat of the four-horned antelope within the Hosur division.
- Collaborate with universities, research institutions, and governmental organizations to get support in various ways to conduct research.

G. Regulate the Eco-Tourism

- Educate the local people about the importance of forest habitats and the necessity of conserving the Four-horned antelope. They should also be involved in monitoring eco-tourism activities.

2. SALEM FOREST DIVISION

2.1. BENGAL FOX

Domain : Eukaryota
Kingdom : Animalia
Phylum : Chordata
Class : Mammalia
Order : Carnivora
Family : Canidae
Genus : *Vulpes*
Species : *V. bengalensis*

Binomial Name : *Vulpes bengalensis* (Shaw, 1800)

Common Name : Bengal fox

Tamil Name : வங்காள நரி

IUCN Category : Least concern

WPA, 1972 : Schedule – I; Part – A of WPA 1972 Act



Figure 5: Pup of Bengal Fox

BACKGROUND

The Bengal Fox, *Vulpes bengalensis* (Shaw, 1800), also known as Indian Fox (Gompper *et al.*, 2006), and is called “Vangala Nari” in Tamil. This species is endemic to the Indian subcontinent and distributed across India, Nepal, Bhutan, Bangladesh, and Pakistan (Akter *et al.*, 2023; Gompper *et al.*, 2006). It was considered a habitat generalist (Vanak & Gompper, 2010), but it preferred dry deciduous forests, scrublands, grasslands, barren lands and agricultural fields (Vanak, 2005). These foxes avoid dense forests, tall grasslands, or high-altitude regions for their habitat (Gompper & Vanak, 2006). In India, the Bengal fox is widely distributed across states such as Gujarat, Rajasthan, Madhya Pradesh, Maharashtra, Andhra Pradesh, Tamil Nadu, and Karnataka (Vanak & Gompper, 2009; Forester, 2012). Specifically in Tamil Nadu, this species is commonly found in the Western and Eastern Ghats (Gompper & Vanak, 2006).

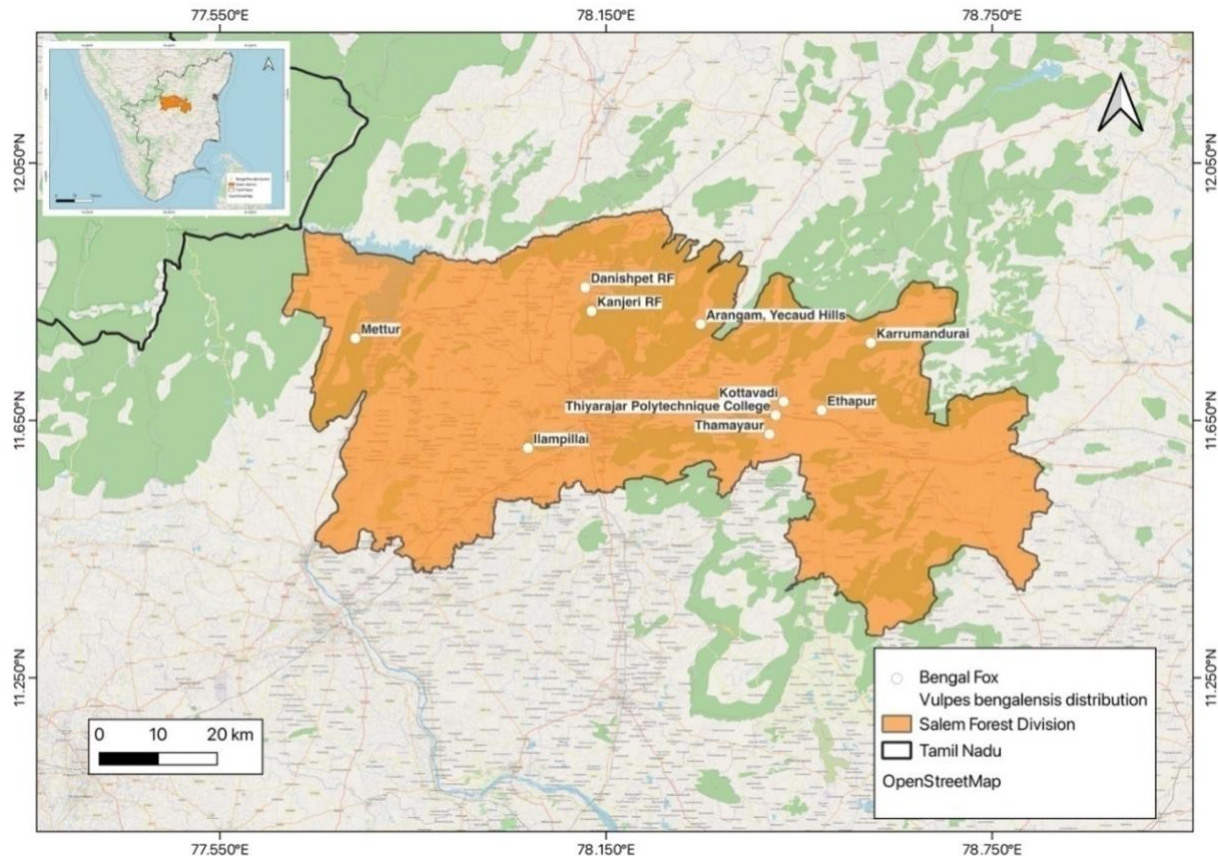


Figure 6: Distribution of Bengal fox in Salem Forest division (The species distribution was provided by the research team of the forest division).

Bengal foxes have a small body of 50–60 cm in length. Moreover, pointed ears and a long, distinctive, bushy tail (25–35 cm) are tipped in black (Gompper & Vanak, 2006). The overall body pelage appearance is silver-grey with a grizzled effect, and the body weight is 2-4 kg (Menon, 2014). The dorsal pelage is predominantly greyish and paler ventrally. The legs tend to be brownish or rufous, and the underparts are light, a pale sand to ginger shade (Gompper & Vanak, 2006). It is considered nocturnal and crepuscular, and this fox is primarily active in the calm periods of daytime, like dawn and dusk, and typically spends warmer daylight hours under vegetation or in dens (Gompper & Vanak, 2006). They used to build three distinct types of dens based on their requirements. It is solitary or in pairs and constructs burrows in sandy or loose soils for shelter (Vanak, 2005). Bengal foxes are not especially suspicious of humans and can be found near human settlements (JungleDragon, 2025). Bengal foxes exhibit strong territorial behaviour and an omnivorous diet (Johnsingh, 1978). The preferred food is rodents, birds, reptiles, insects, fruits, and carrion (Vanak & Gompper, 2009). The breeding season is from December to February (Meadors, 2007). After completing a gestation period (50–60 days), the females give birth to two to four pups, and both parents care for the young ones (Johnsingh, 1978).

The Bengal fox is considered a key species for its ecological roles by acting as a scavenger (Ramasamy *et al.*, 2020), controlling the population of rodents, Indian peafowl and insect species (Wang *et al.*, 2022), and mainly contributing to plant regeneration through seed dispersal (Kamler *et al.*, 2020). Furthermore, it is recognised as an indicator species for healthy grassland ecosystems (Sial, 2024). This species is listed as ‘Least Concern’ by the IUCN and protected under Schedule I, Part A of the Wildlife (Protection) Act of India 1972, but currently, the Bengal fox population size is declining due to increasing threats. The threats are primarily due to agricultural expansion, urbanization, deforestation, and encroachment (Sharma *et al.*, 2024)

CURRENT THREATS IN SALEM DIVISION

The survival of the Bengal fox in the Salem division is highly challenging due to multiple threats driven by human-altered environmental changes. The primary critical issues are habitat loss and fragmentation, agricultural expansion, urbanization, revenue infrastructure development, and deforestation. Human-mediated developmental activities constitute a significant concern for the species. One of the impacts of habitat loss is the reduction in the denning and foraging spaces and an increase in foraging behaviour into the agricultural landscape, creating human-wildlife conflicts. Roadkills are a result of such a scenario.

Another major threat is poaching for its body parts including the skull, canine, tail, and meat for medicinal and magical properties believed by local communities. In particular, some villages in Salem still celebrate the harvest festival with the belief that a fox on the doorstep would bring higher crop yield and prosperity. The population decline caused by these illegal activities leads to ecological imbalances especially in the prey-predator relationships. Due to this, the population of prey species of the Bengal fox, like Indian peafowl and rodents is increasing in the Salem division. Moreover, increasing invasive alien plant species alter the ecosystem and reduce the denning areas. With the loss of open barren lands, grasslands are diminishing in the landscape. Additionally, transmission of diseases such as canine distemper and rabies from domestic and stray dogs poses an emerging threat to the health of the Bengal fox population.

CONSERVATION PLAN

A. Habitat Conservation

- Identify, protect and expand the boundaries of potential fox habitats such as grasslands, barren lands and scrublands around the division.

- Ensure the presence of denning and foraging sites and water availability within the habitat. Restrict the expansion of revenue land area by agriculture and industries near the fox habitat to minimize habitat fragmentation. Likewise, the wildlife corridors should be expanded to allow species to move safely within the greater habitat of the fox.

B. Controlling Poaching

- Strengthen the enforcement of the Wildlife (Protection) Act 1972 to prevent illegal hunting, trapping, and local cultural activities associated with the Bengal fox hunting through regular monitoring and patrolling in the division.
- Conduct an awareness campaign to dispel myths regarding the superstitions and medicinal properties of the body parts of fox, with an aim to reduce illegal hunting practices.

C. Reduce Road Accidents

- Incorporate the wildlife warning signboards near the fox habitat zones to alert drivers and monitor speed regulations in protected areas.
- Construct culverts and underground passages in identified key habitats of Bengal foxes to ensure safe animal movement and reduce road kills.
- Educate local communities and transport authorities about Article 51-A (g), which states that it is the fundamental duty of every Indian citizen to protect and improve the natural environment.

D. Disease Prevention

- Regularly organize vaccination camps for domestic animals in the division to prevent the spread of diseases, particularly rabies and canine distemper.
- Encourage cattle owners to take necessary precautions to avoid disease transmission to wildlife and foxes.

E. Maintain Prey Availability

- Promote eco-friendly agricultural methods to prevent pesticide-induced declines in prey populations, especially insects and rodents.
- Use digital media to create public awareness about the ecological importance of the Bengal fox and other wildlife species for their conservation.

F. Scientific Research

- Conduct long-term monitoring studies to track changes in the distribution and behaviour changes due to human threats and population dynamics.
- Assess the transmission mode of spreading diseases and find innovative disease prevention methods from wild and domestic prey species.

3. VILLUPURAM FOREST DIVISION

3.1. SPOT BILLED PELICAN

Domain : Eukaryota
Kingdom : Animalia
Phylum : Chordata
Class : Aves
Order : Pelecaniformes
Family : Pelecanidae
Genus : *Pelecanus*
Species : *P. philippensis*

Binomial Name : *Pelecanus philippensis* (J. F. Gmelin, 1789)

Common Name : Spot-billed Pelican

Tamil Name : புள்ளிஅலகுக் கழைக்கடா

IUCN Category : Near Threatened

WPA, 1972 : Schedule – II; Part – B of WPA 1972 Act



Figure 7: Spot-billed Pelican

BACKGROUND

The Spot-billed Pelican, *Pelecanus philippensis* (J. F. Gmelin, 1789), is also called the Grey Pelican (Raj, 2010). It is a large and heavily built water bird distributed across South and Southeast Asia (Leo & Velayutham, 2019). Black spots on its bill easily identify this species (Stidham & Gang, 2019). Taxonomically, it belongs to the family Pelecanidae within the order Pelecaniformes (Nelson, 2006). Once, this species was considered a subspecies of the Pink-backed Pelican but is now categorized as a distinct species (Allen, 2019). It predominantly prefers habitats such as freshwater lakes, reservoirs, large rivers, and wetlands (Gokula, 2011; Ravishankara *et al.*, 2022) and was also majorly distributed in the regions of India, Sri Lanka, Nepal, Bangladesh, Cambodia, Thailand, Vietnam, Myanmar, and Indonesia (Bandyopadhyay *et al.*, 2014; Mundkur *et al.*, 2017). It is widely distributed in the districts of Tamil Nadu, including Chengalpattu, Tirunelveli, Ariyalur, Tiruvarur, Villupuram, Ramanathapuram, Nagapattinam, Thiruvallur, Chennai, and Erode district (Guptha *et al.*, 2011; Durairajan *et al.*, 2023; Kannan *et al.*, 2005; Gokula, 2011).

The overall body length of the spot-billed pelican is 125-152 cm, the wingspan is 210-250 cm, and the total weight is approximately 4-6 kg (Elliott *et al.*, 2020). Its plumage appearance is predominantly greyish-white, with a pale grey head and a large, deeply expandable throat pouch for catching fish and other prey (Farnsworth, 2024). It is categorized under carnivorous species and mainly feeds on fish and small aquatic species (Ebrahim & Mahmad, 2023). Breeding behaviour occurs between the period of September and May (Ravishankar *et al.*, 2022). The clutch size varies by the presence of two to three eggs and the expected incubation period from 25 to 36 days. The males and females are involved in the incubation and chick-rearing (Gokula, 2011). It is currently classified as Near Threatened by the IUCN Red List for its low population, approximately 8,700 to 12,000 mature individuals (IUCN, 2017).

Habitat loss, human disturbances, and changing public perceptions are critical threats in Southern India (Nautiyal *et al.*, 2020; Kannan, 2019). Additionally, their study highlighted the decline in the traditional nesting zones and the conservation actions needed by the local community to protect this species (Nautiyal *et al.*, 2020; Kannan, 2019). Research has highlighted that conservation is particularly needed for the potential habitats of this species in the Vedanthangal and Koonthankulam Bird Sanctuary in India for its long-term survival (Frank *et al.*, 2021). Spot-billed pelicans in the semi-urban landscapes of wetlands of Coimbatore, Tamil Nadu, highlights the importance of wetlands for their survival and the need for proper management strategies to reduce hazards (Leo & Velayutham, 2019). Ecologically, it is important for various ecosystems as it regulates fish populations, nutrient recycling, and determines wetland quality, and it also has significant cultural value (Nazneen *et al.*, 2021). However, the survival challenges require proper conservation measures focused on habitat protection, sustainable fishing, and community engagement, which are considered very important to confirm the survival of this spot-billed pelican.

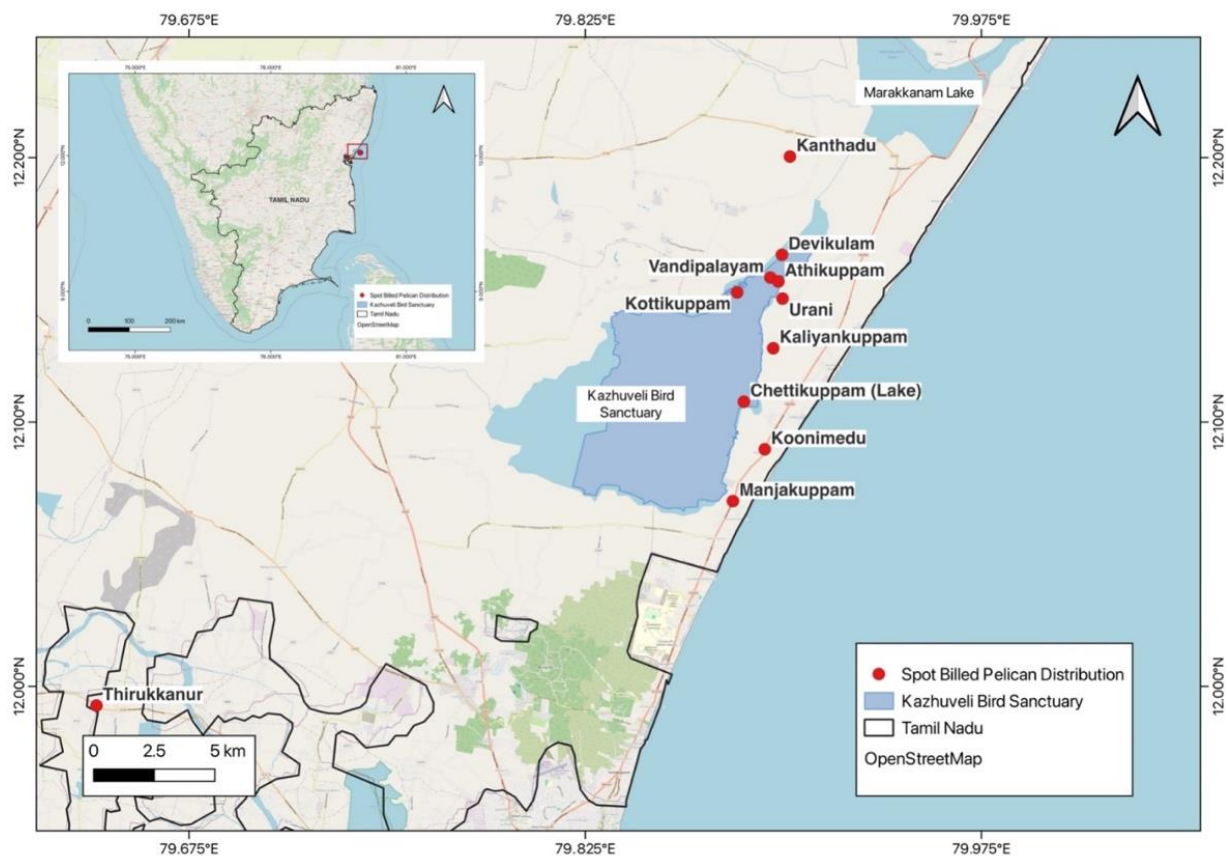


Figure 8: Geographical Distribution Map of Spot-billed Pelican in Kazhuveli Bird Sanctuary (The species distribution data was provided by the research team of the forest division).

KAZHUVELI BIRD SANCTUARY

Kazhuveli Bird Sanctuary (12.16643 - 12.072351 N to 79.912297 - 79.827553 E), is located in the Villupuram district of Tamil Nadu, India. This sanctuary covers an area of approximately 5,151.6 hectares and is considered one of the important wetland ecosystems (Ramsar Sites Information Service, 2024). It was declared the 16th bird sanctuary of Tamil Nadu in 2021. In 2024, Kazhuveli Bird Sanctuary gained international recognition as a Ramsar site (Ramsar Convention Secretariat 2024). It is considered one of the largest brackish lakes in South India. It is connected to the Bay of Bengal in the north via Uppukalli Creek and receives seawater during high tides or cyclones (Kazhuveli Bird Sanctuary, 2025). This lake provides nesting areas for over 2,000 colonial nesting birds each breeding season, particularly for the spot-billed pelican (*Pelecanus philippensis*).

The Kazhuveli bird sanctuary act as a suitable habitat for over 750 species of flora and fauna, including 229 bird species, 85 fish species, 72 butterfly species, 39 reptile species, 14 mammal species, and 13 amphibian species (Ramsar Sites Information Service, 2024). It serves as a critical stopover along the Central Asian Flyway, supporting both resident and migratory birds, and provides habitat for vulnerable species such as the Indian flap-shelled turtle (*Lissemys punctata*) and the Indian star tortoise (*Geochelone elegans*) (Ramsar Sites Information Service, 2024; Officer, 2023). Ecologically, this sanctuary plays a significant role in groundwater restoration, prevention of soil erosion, and regulation of climate conditions, and is also involved in nutrient cycling and pollination. Given the rich biodiversity and ecological importance of this sanctuary, it is necessary to have continuous conservation initiatives and research to retain its richness in the long term.

CURRENT THREATS IN VILLUPURAM DIVISION

The Spot-billed Pelican in the Villupuram division faces several threats to its survival, such as sewage pollution, poaching, extensive fishing, invasive species, check dam construction and tidal shifts. However, some commercial activities, i.e., shrimp farming industries and recently developed industries near the lake, threaten the ecosystem quality. The Kazhuveli is a typical lake, where the influence of fresh water is higher during the monsoons while the impact of seawater intrusion is higher during non-monsoon season. Due to that, the local bodies build check dams to store and make fresh water useful for irrigation purposes.

So, there are attempts to convert it into a freshwater lake. Due to these constructions, the tidal shifts are changing near the wetland. Also, contaminated water from this industry affects the fish population size and reduces the availability of the pelican's primary food source. The water quality is also majorly degraded by sewage pollution. Due to this pollution, several modifications are happening within the sanctuary, including algal blooms, bioaccumulation of toxins, and increased invasive species growth. In the breeding season, the maximum number of nesting failures is caused by human disturbances such as tourism, fishing, and recreational activities in this sanctuary. The secondary main threat is poaching activities for its meat and eggs. The meat and eggs are believed to be used as traditional medicine by local communities. These myths are increasing the illegal activities and the tilting the balance towards its population decline.

CONSERVATION PLAN

A. Habitat Protection

- Implement wastewater treatment plants to control and prevent direct sewage pollution in/near the sanctuary.
- Reducing the dam height to maintain the flow of the tidal sea waters and retain its nature as a brackish lake.
- Keep records of shrimp farms and recent industries to control further expansion near the sanctuary.

- Ensuring minimal human interference at the traditional nesting sites to prevent nesting mortality within the sanctuary.
- Regularly monitor the industrial and shrimp farm activities. And enforce strict regulations against industries that pollute the wetland.

B. Maintain food sources

- Promote traditional fishing methods to reduce overfishing and maintain the availability of various fish stocks.
- *Prosopis juliflora* is a significant threat to the ecosystem. Therefore, the periodic removal of invasive alien species will be crucial to creating diverse trees and enhancing the habitats for pelican roosting and nesting sites.
- Promote organic farming in and around the sanctuary buffer zones to reduce and prevent pesticide and fertilizer contamination. This activity enhances the healthy fish population.

C. Protection during breeding season

- Establish nesting protection zones and restrict tourism and recreation activities during the breeding season.
- Educate local residents in the buffer zone about the importance of nesting conservation and provide guidelines to minimise noise and movement near the breeding zones.
- Conduct awareness programs for the tourists, fishermen, and local communities around the sanctuary about the importance of pelicans and biodiversity conservation.

D. Anti-Poaching operations

- Depute sufficient staff to regularly monitor against poaching activities and implement the protection rules strictly against these kinds of activities.
- Introduce alternative sustainable income opportunities like eco-tourism and organic farming to locals involved in poaching activities.

E. Research monitoring

- Assess the water quality parameters regularly. Collaborate periodically with research institutions to maintain the ecological balance of the sanctuary lakes.
- Conduct long-term systematic surveys to monitor behaviours, population trends, breeding success and migration patterns.
- Study the effects of climate change on wetland ecosystems in the sanctuary and develop adaptive management strategies.

4. SATHYAMANGALAM FOREST DIVISION, STR

4.1. VULTURE SPECIES

Binomial Name : *Neophron percnopterus*(Linnaeus, 1758)
Common Name : Egyptian vulture
Tamil Name : மஞ்சள்முகப் பாறு கழுகு
IUCN Category : Endangered
WPA, 1972 : Schedule – I; Part – B of WPA 1972 Act

Binomial Name : *Gyps bengalensis* (Gmelin, JF, 1788)
Common Name : White-rumped Vulture
Tamil Name : வெண்முதுகுப் பாறு கழுகு
IUCN Category : Critically Endangered
WPA, 1972 : Schedule – I; Part – B of WPA 1972 Act

Binomial Name : *Gyps indicus* (Scopoli, 1786)
Common Name : Indian Vulture
Tamil Name : கருங்கழுத்துப் பாறு கழுகு
IUCN Category : Critically Endangered
WPA, 1972 : Schedule – I; Part – B of WPA 1972 Act

Binomial Name : *Sarcogyps calvus* (Scopoli, 1786)
Common Name : Red-headed Vulture
Tamil Name : செந்தலை பாறு கழுகு
IUCN Category : Critically Endangered
WPA, 1972 : Schedule – I; Part – B of WPA 1972 Act



Figure 9: White-rumped Vulture



Figure 10: White-rumped Vulture & Red-headed Vulture

BACKGROUND

Vulture species are important avian scavengers that play a crucial ecological role by consuming carcasses and preventing the spread of disease in the environment (Vicente & Vercauteren, 2019; Navarro & Castillo-Contreras, 2025). There are 23 vulture species distributed worldwide (Ogada et al., 2012), with nine in India, and six recorded in southern India (Jha, 2015). In Tamil Nadu, four species are observed: the White-rumped, Indian, Red-headed, and Egyptian vultures (Recovery Plan for Vultures in Tamil Nadu, 2015). These species are categorized as Critically Endangered and Endangered by the IUCN, and are also listed under Schedule I of the Wild Life (Protection) Act 1972.

The Egyptian Vulture *Neophron percnopterus* (Linnaeus, 1758) is a small to medium-sized vulture primarily distributed in southern Europe, North Africa, the Middle East, and South Asia (Arkumarev *et al.*, 2014). Its white plumage, black flight feathers, and distinctive yellow easily identify it. Juveniles are dark brown and gradually turn light once they mature (Bildstein, 2017). Egyptian Vultures are commonly known for their unique behaviour, which uses stones to break open eggs (Tong, 2020).

The White-rumped vulture, *Gyps bengalensis* (Gmelin, JF, 1788), was one of the most common vultures in the South Asia region (Harris, 2013). However, its population has drastically declined, mainly due to certain veterinary drugs which harm vultures, when they feed on treated livestock carcasses (Plaza *et al.*, 2022). It is a large vulture with dark brown to black plumage and a unique white patch on its lower back (Rodríguez & Elorriaga, 2016).

The Indian Vulture *Gyps indicus* (Scopoli, 1786) is another large vulture native to India (Manigandan *et al.*, 2024), primarily distributed in open landscapes and cliffs (Campbell & Radhika, 2020). It has pale brown or buff-coloured plumage and a darker, bare head and neck, similar to other *Gyps* vultures (Campbell, 2015).

The Red-headed Vulture *Sarcogyps calvus* (Scopoli, 1786) is also called the Indian Black Vulture (Sah *et al.*, 2017). This species is easily identified by its dark body and bright red, featherless head (Bildstein, 2017). Compared to *Gyps* vultures, which feed in large groups, the red-headed vulture is solitary or found in small numbers (Sah *et al.*, 2017). It was once a common sight across South and Southeast Asia (Clements *et al.*, 2013), but it has become rare due to food scarcity, habitat loss, and poisoning (Jha & Jha, 2024).

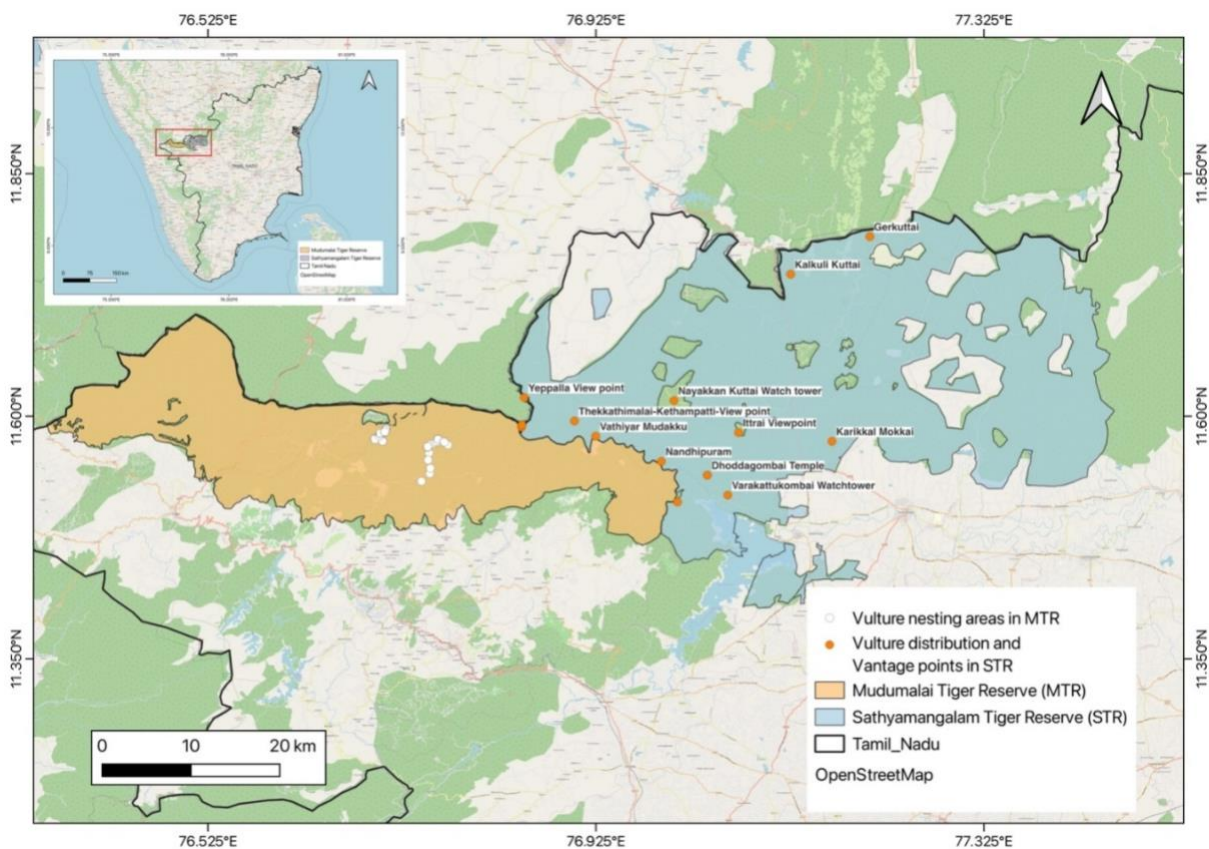


Figure 11: Geographical Distribution Map of Vulture Species in STR and MTR (The species distribution data was provided by the research team of the forest division).

The ecological importance of vultures is significantly impacted by the continued use of the drug Diclofenac, which causes kidney failure when vultures ingest it from the livestock carcasses treated with this drug (Cook *et al.*, 2024; Vajdi *et al.*, 2024). However, in 2006, these drugs (like diclofenac, ketoprofen, and aceclofenac) were banned in India (Cook *et al.*, 2024). Recently, in 2025, the

Government of Tamil Nadu banned the distribution of all Nimesulide formulation drugs exclusively to protect vultures. However, the illegal usage of these drugs continues to various extents.

In Tamil Nadu, vulture species are sighted in Mudumalai and Sathyamangalam Tiger Reserves (Samson *et al.*, 2018), Chennai, Chengalpattu, Thanjavur, Coimbatore, Tirunelveli, Madurai, Sivagangai, and Ramanathapuram districts (Recovery Plan for Vultures in Tamil Nadu, 2015). The seemingly viable vulture populations found in the Nilgiri Biosphere Reserve are considered one of the key populations in India, spanning the landscapes of Mysore, Nilgiri, Wayanad, and Sathyamangalam (Sashikumar & Vishnudas, 2013). Moyar Valley is one of the prime habitats for Vultures in Southern India.

Sathyamangalam Tiger Reserve (STR) recorded the presence of multiple vulture species, including the Red-headed vulture, White-rumped vulture, Indian vulture, Himalayan vulture (*Gyps himalayensis*), and Egyptian vulture (Chandrasekaran & Kannan, 2021). The Indian Vulture, *Gyps indicus* population has increased from 13 in 2016 to 28 individuals in 2021 according to research, with a notable nesting success rate observed in Mudumalai Tiger Reserve (Samson *et al.*, 2024). Their population has increased in the Moyar Valley, while it remains scattered in the other adjoining areas. Notably, 56 vulture nests of endangered vultures in Moyar Valley are recorded from the *Terminalia arjuna* tree (Iyanar *et al.*, 2025). The Moyar Valley in STR and MTR is considered as a potential prime habitat for these critically endangered vulture species.

These vultures are almost always found and preferred in regions with livestock carcasses, such as open scrub forests, riverine habitats, and nearby water bodies (Campbell, 2015). This habitat is primarily suitable for their nesting and other behaviours (Moran-Lopez *et al.*, 2006), also supported by providing a variety of food sources within it. In 2010, the rediscovery of a small population of Indian vultures in

the Moyar River valley was reported, with 20 nests and 40 adult individuals, highlighting the STR's importance in vulture conservation (Oppili, 2010).

Research conducted by the Tamil Nadu Forest Department along with the Bombay Natural History Society in 2021 has identified STR as a critical habitat for vulture conservation and pointed out the need to protect these habitats from threats like habitat degradation, poisoning, and human disturbance (Samson & Ramakrishnan, 2020). Between January and October 2018, researchers documented four vulture species in MTR: White-rumped, Indian, Red-headed, and Egyptian vultures. Researchers counted 1,602 individual vultures around 1,220 kilometres of road transects (Manigandan *et al.*, 2021). A total of 320 vultures were recorded across Tamil Nadu, Karnataka, and Kerala during the synchronized vulture census program conducted in December 2022 (Govind Tekale, 2025). This census report highlighted that the number of vulture individuals has increased compared to the previous year's report, with Tamil Nadu recorded the highest number of nesting sites. However, the vulture populations in STR and MTR remain critically low, requiring continuous monitoring and sustained conservation efforts to protect these scavengers.

CURRENT THREATS IN SATHYAMANGALAM DIVISION

In areas around Sathyamangalam Tiger Reserve, the usage of NSAIDs (non-steroidal anti-inflammatory drugs) and poisoning of livestock during human-wildlife conflict has affected the vulture population. The primary threat to scavenging vultures is the continuous use of NSAIDs like diclofenac, ketoprofen, and aceclofenac in veterinary care. These drugs are administered to livestock and are present in the carcasses found in the villages surrounding the STR and MTR protected areas. The poisoning of livestock cattle to protect against predators (e.g., tiger and leopard) indirectly affects the vulture population. Contaminated or poisoned carcasses are often disposed of / discarded in open areas, leading to mass mortality events in vultures. The NSAIDs in these treated livestock affect vultures' health, finally causing fatal conditions. Even though, the vultures have incredible digestive systems with

highly acidic stomachs that allow them to process a wide range of substances, the indirect consumption of these drugs is eventually detrimental to the vultures.

Another major threat is the increasing unavailability of food resources in the forest area. In some areas, the locals remove the meat from the carcasses hunted by the predators. The lack of awareness about wildlife along with developmental activities have further threatened the vulture population in STR. Additionally, the disposal of livestock carcasses in the open areas had reduced, with alternative methods now being used. The reduction in available carcasses, food scarcity and habitat loss due to declining traditional cattle farming and agricultural expansion in the buffer areas of STR poses a significant challenge. Another threat is electrocution due to the expansion of high-voltage power lines inside the Protected Area.

CONSERVATION PLANS

A. Habitat Protection

- Protecting the large old trees in the Moyar river valley will be crucial for vulture conservation as the vultures nest and roost on large trees such as *Ficus*, *Terminalia*, *Maduca*, *Spondias pinnata*, and *Mangifera sp.*
- Identify nesting and roosting sites, and then implement strict protection to prevent disturbance from human activities.
- Activities such as deforestation and land conversion should be restricted near wildlife corridors, especially in areas favoured by vultures for their survival.
- The land near the protected area of STR is susceptible to encroachment, so strong measures are necessary to protect this habitat.
- The scrub jungles and barren lands serve as essential food resource areas for vultures.

B. Control Poisoning and Toxic Exposure

- Conduct frequent visits to cattle farms to ensure the non-use of NSAID drugs and recommend safer alternatives like meloxicam. Strengthen laws and enforcement against illegal wildlife poisoning.
- Educate the local communities about the impact of poisoned livestock carcasses on the food chain and human health, highlighting the necessity of conservation actions for vulture species.
- Introduce environmentally safe fertilizers and pesticides to the local farmers to reduce and prevent secondary poisoning. Also, educate them on the safe disposal of livestock carcasses without using harmful chemicals.

C. Vulture Zone

- Identify potential habitats for vulture nesting and other behaviours, then designate these areas as vulture zones. Implement strong protection measures within these declared zones.
- Ensure that harmful materials, such as plastics, glasses, or fire hazards are removed from these vulture conservation zones.
- Installing acoustic monitoring stations in sensitive areas and review weekly logs to identify and address noise spikes. This can be implemented in nearby villages and areas where temple festivals take place.
- Enforcing restrictions on the use of flash flood lights in the surrounding hamlets and villages.

D. Research Monitoring

- Investigate new threats to vultures from various sources, including climate change, modernization, advanced medicine, and emerging diseases.

- Conduct regular population assessments to study the trend in population size in the division.
- Assess and promote the study of vultures' behaviours, identifying the reason behind their preferred habitat.

E. Carcass Disposal Methods

- Promote the practice of disposing of livestock carcasses in open land areas where vulture species can easily access them for feeding.
- Regularly conduct awareness programs within local communities highlighting the benefits of traditional carcass disposal methods and the negative impacts of altering these practices.

Sathyamangalam Tiger Reserve needs additional scientific research to monitor conservation efforts, and community participation is essential for ensuring the long-term survival of vulture species. Collaboration with local NGOs and other organisations for community engagement can positively impact the survival of species.

5. SRIVILLIPUTHUR WILDLIFE DIVISION, SMTR

5.1. GRIZZLED GIANT SQUIRREL

Domain : Eukaryota
Kingdom : Animalia
Phylum : Chordata
Class : Mammalia
Order : Rodentia
Family : Sciuridae
Genus : *Ratufa*
Species : *R. macroura*

Binomial Name : *Ratufa macroura* (Pennant, 1769)

Common Name : Grizzled Giant Squirrel

Tamil Name : பழுப்புமலை அணில்

IUCN Category : Near Threatened

WPA, 1972 : Schedule – I; Part – A of WPA 1972 Act



Figure 12: Grizzled Giant Squirrel

BACKGROUND

Brief Introduction about the species

The Grizzled Giant Squirrel (GGS) is a threatened species that is found in only a few spots in India and Sri Lanka. There are three different subspecies, and is the smallest of the Indian Giant Squirrels. Grizzled Giant Squirrels are named for the white flecks of hair that cover their greyish-brown bodies, giving them a grizzled appearance (Prater, 1971). They also have very long tails that can constitute over half their total body length, and small round ears with tufts.

Ellerman (1961) listed three subspecies that were accepted later by Moore and Tate (1965), Phillips (1981) and Corbet and Hill (1992). *Ratufa macroura macroura* & *Ratufa macroura melanochra* occur exclusively in Sri Lanka, while *Ratufa macroura dandolena* occurs in both Sri Lanka and India (Ellerman, 1961).

The GGS is typically a solitary animal, pairing only during courtship/breeding. Each individual has a home range that extends between 0.197 and 0.611 ha (Rao *et al.*, 2015). The species are diurnal and common behavioural patterns include feeding, moving, exploring, grooming, chasing, freezing, and resting. Some other related patterns include: playing, calling, urinating, defecating, nesting, mating, cleaning, swinging, and yawning. Considerable time was spent on feeding and resting (the latter happen during mid-day hours). The exploratory behaviour ranged from 7 to 9% of total time-activity budget.

Feeding activity encompasses as many as 37 tree species, and include several floral parts, viz. leaves (38%), fruit (24%), bark (15%), flower (12%), pith (6%), flower buds (3%), and seeds (2%) (Rao *et al.*, 2015). In GGS food composition 48% were trees, 43% climbers and 9% shrubs. Mango and tamarind leaves were frequently utilized, in addition to barks of several species: *Mallotus philippensis*, *Mangifera indica*, *Phyllanthus emblica*, *Tamarindus indica* and *Terminalia arjuna*; fruits include:

Tamarind and Mango (including flowers). Flowers of *Albizia lebbeck* are also fed at times. Pith utilization species include mango and *Tinospora cordifolia*. Other floral parts consumed include flower buds of *Adansonia digitata*, and seeds of *Ziziphus eoenoplia*. Broadly, the consumption of mango and tamarind floral parts was comparatively greater than other tree species. Mango plantations and fruit trees lure GGS.

Studies from Grizzled giant Squirrel Sanctuary reported a total of 24 tree species used for building nests, such as *Lannea coromandelica*, *Mangifera indica*, *Sterculia chelonoides*, *Cullenia exarillata*, *Eriodendron pentandrum*, *Tamarindus indica*, *Terminalia arjuna*, *Terminalia bellirica*, *Terminalia chebula*, *Terminalia tomentosa*, *Azadirachta indica*, *Melia azadirachta*, *Albizia amara*, *Albizia lebbeck*, *Ficus benghalensis*, *Ficus racemosa*, *Ficus religiosa*, *Syzygium cumini*, *Dalbergia latifolia*, *Pterocarpus marsupium*, *Sapindus emarginatus*, *Schleichera oleosa*, *Grewia tiliaefolia*, *Gmelina arborea*, and *Tectona grandis* (Vanitharani and Bharathi, 2011).

In Chinnar Wildlife Sanctuary, GGS used 12 tree species for nest building, with nest heights varying from 2.5 to 35 meters Veeramani et al. (2018), Thomas and Nameer (2021) identified 36 tree species for drey construction, with 11 nests found in *Mangifera indica*, *Terminalia arjuna*, *Ficus microcarpa*, *Diospyros ebenum*, and *Pongamia pinnata*.

The Srivilliputhur Grizzled Squirrel Sanctuary supports the largest population of Grizzled Squirrel Sanctuary followed by Chinnar Wildlife Sanctuary. Srivilliputhur Grizzled Squirrel Wildlife Sanctuary spans over 476.65 sq.km in the Southern Western Ghats of Tamil Nadu. The sanctuary's geographical coordinates range from 09°23'38" N to 09°49'51" N latitude and from 77°21'51" E to 77°47'20" E longitude.

The area was declared as a sanctuary in G.O.Ms.No.399, Environment and Forests (FR.II) dated 26.12.1988 and comprise the Reserved forests of erstwhile

Kamarajar Forest Division and Saptur R.F. of Madurai Forest Division. These areas were brought under the system of working areas from 1891.

It predominantly lies within the Srivilliputhur and Rajapalayam taluks of Virudhunagar district and the Peraiyur taluk of Madurai district. This sanctuary is contiguous to the Periyar Tiger Reserve on the southwestern side and the Megamalai Reserve Forest on the western side. Its southern limit adjoins the Sivagiri Reserved Forest of Nellai Wildlife Sanctuary, and its northern limit borders the Sulapuram Reserved Forest of Megamalai Wildlife Sanctuary. In 2021, this sanctuary was designated as the 51st Tiger Reserve in India by combining it with the Megamalai Wildlife Sanctuary, forming the Srivilliputhur-Megamalai Tiger Reserve. This initiative aims to establish a continuous corridor for big cats by connecting adjacent protected areas. Additionally, this sanctuary is part of the Agasthiyarmalai landscape in the Western Ghats.

Species habitat and distribution

Habitat

Endemic to South Asia. Tamil Nadu and Kerala in India and many localities in Sri Lanka, the habitat of the GGS is narrow and located along major rivers and their tributaries, within mixed deciduous forests in distinct patches (Ramachandran, 1993). Arboreal dwellers, including the GGS, generally favour habitats with dense canopy cover and taller canopy heights (Baskaran et al., 2011).

Distribution

Distribution is shown in fig.1. In India it is known to occur in Srivilliputhur GGS Sanctuary, Tamil Nadu (Joshua, 1992), Chinnar Wildlife Sanctuary, Kerala (Ramachandran, 1993), Anamalai Tiger Reserve, Tamil Nadu (Kumar et al., 2007), Theni Forest Division (Babu et al. 2013), Sirumalai (Sathasivam et al., 2008), Tiruvannamalai forest division (Babu & Kalaimani, 2014), Pakkamalai Reserve Forest,

Gingee (Vimalraj et al., 2018) Palani Hills (Davidar, 1989). Kanakapura Forest Division, in southern Karnataka (Kumara and Singh, 2006; Baskaran et al., 2011),

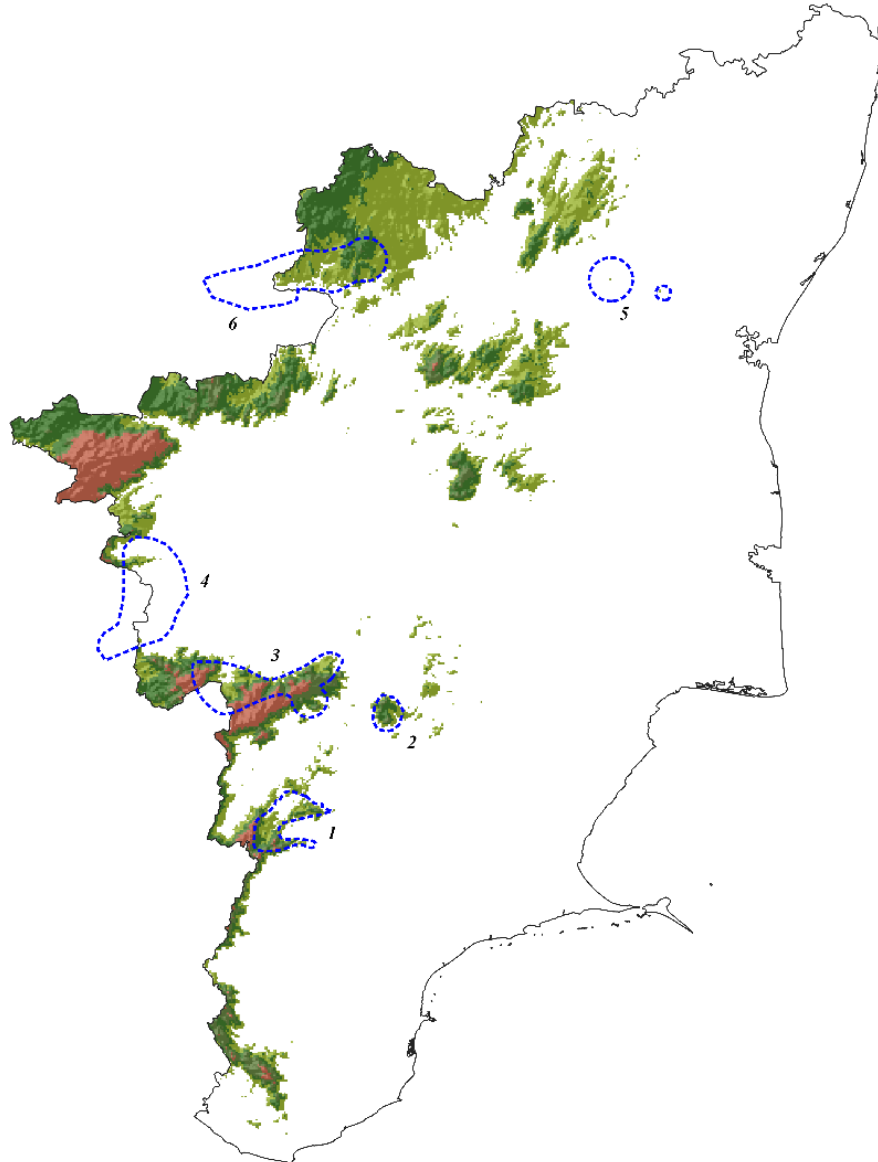


Figure 13: Distribution map of Grizzled giant Squirrel

A study conducted in different forest/plantation types in 2024 by Shilpa Beevar observed that extensive transect replications recorded only 8 squirrels and 2 dreys in riparian Forest (which is the habitat type believed to be the key indicator habitat of GGS) but 11 squirrels and 51 dreys were recorded in deciduous forests. In the

Protected Area, deciduous forests had an estimated density of 14.31 ± 9 squirrels per sq. km, which slightly reduced to 10.59 ± 6 squirrels per sq. km in case of Riparian forests (Shilpa, 2024).

Figure 14: Geographical Distribution Map of Grizzled giant squirrel in Srivilliputhur Forest division (GGS Distribution data was provided by researchers of Srivilliputhur Forest Division)

When different forest types are considered, mixed moist deciduous are found to be more suitable followed by secondary dry deciduous. This inference added support to the study conducted by Shilpa (2024). In the same study (Shilpa 2024), four replications of 67 transects walked outside the Protected Area (into the plantations), in Mixed plantation and a total of 55 Squirrels and 47 Dreys were observed and in Coconut plantation 29 Squirrels and 23 dreys were sighted. In contrast, in Mango orchards only 6 squirrels and 2 dreys were sighted. The density value is also following the same pattern with the highest density in (72.95 ± 22) in mixed plantation followed

by coconut plantations (57.28 ± 19) and Mango Plantations (5.21 ± 6). The species is highly restricted to the densely wooded habitats between 200 to 700 meter elevation.

3. Current threats in the division

The GGS is listed as the Near Threatened in the IUCN Red List (IUCN, 2018). This species is listed under Schedule I (Part I) of the Indian Wildlife (Protection) Act (1972), and is listed in CITES Appendix II thereby regulating international trade in this species. The population of GGS has declined in the last 25 years to about 30% of its early distribution due to habitat loss and hunting (Rao *et al.*, 2015). There is high relative abundance of GGS populations in man-made plantations (tamarind groves, mango, coconut) and private forests. Such areas are also subjected to the use of pesticides, which undoubtedly is a threat to the endangered GGS.

A. Habitat Fragmentation

Fragmentation leads to habitat loss. Habitat loss remains a significant threat to the GGS throughout its range (Joshua, 1992; Joshua & Johnsingh, 1994; Molur *et al.*, 2005). The primary cause of habitat loss is fragmentation resulting from the felling of forest trees to meet various human needs (Joshua & Johnsingh, 1994; Datta & Goyal, 2008; Harlekar, 2010). Therefore, protecting the habitats of the GGS is crucial for the conservation of this species.

B. Pesticides

There is high relative abundance of GGS populations in man-made plantations (tamarind groves, mango, coconut) and private forests. Heavy pesticide usage in the farmlands, especially in the fruiting season of Mango, indirectly affects the population of GGS, which feeds on the plant parts. At the same time, most of the mango plantations are situated along the boundary of the Protected Area. Farmers in

the region apply pesticides and fertilizers before flower setting to enhance flowering. The bio-accumulation of large doses of these pesticides or insecticides may also affect predatory species of GGS.

C. Conflict

Human-Wildlife conflict can often result in the disruption of the social, economic, or cultural lives of humans and wildlife (Roy, 2017). When these squirrels venture into farmlands, they cause significant damage to the economic crop. The movement and ranging patterns of wildlife are primarily influenced by the availability of food, water, and mates. These squirrels exhibit the behaviour, where they particularly chew on specific parts of plants, often causing more destruction than consumption (Govind & Jayson, 2018).



Figure 15: Grizzled giant squirrel accessing coconut trees in plantations

4. Management action plans for survival

A. Regulating Pilgrim movement in Srivilliputtur Forest Division

- Create specific pathways for pilgrims up to the end of the temple and restricting movement into core zones of squirrel habitats.
- Conduct awareness programs to the devotees about the importance squirrel and biodiversity conservation.

B. Compensation and Incentives for Patta Land Owners

- Offer financial-based compensation to farmers who maintain crop lands near sanctuary corridors to avoid conflicts.
- Restrict or reduce the use of banned pesticides and insecticides in eco-sensitive zones, and educate the farmers about the impact of chemical fertilizers on wildlife and human health.

C. Undertake the temple land

- Conduct research based land surveys to assess current potential habitat of squirrel for conservation.
- Follow the strict wildlife protection regulations against encroachment in Reserve forest and ensure that converted lands are restored with native vegetation.

Involving local communities via eco-tourism and indigenous cultural integration and local awareness can help conservation. The long-term monitoring of the species using camera traps and radio telemetry can track habitat use and hazards (Sheppard *et al.*, 2022). Genetic studies highlighted that isolated populations have extremely little genetic variety, alarming the necessity for genetic rescue measures for Grizzled Giant Squirrels (Baskaran *et al.*, 2011). Implementing anti-poaching rules, monitoring illegal wildlife trade, and campaigning for forest conservation policies are significant innovations toward species protection. These multidisciplinary conservation strategy such as genetic studies and satellite tracking, are critical to grizzled giant squirrel long-term existence.

Continuous monitoring and awareness programmes are necessary to conserve this species. Management of Plantations at edge of the forest can reduce the threat to the species. Establishing buffer zones between plantations and natural forests and promoting biodiversity-friendly practices in monoculture plantations will also be helpful. Community-based conservation efforts and adaptive management strategies are essential for mitigating human-wildlife conflicts and ensuring the sustainable coexistence of GGS and agricultural livelihoods in this biodiversity hotspot.

This species faces a significant threat from poisoning and hence continuous monitoring of such factors across different seasons is crucial to understanding and mitigating this risk. This will allow us to track exposure trends, identify high-risk periods, and develop timely intervention strategies to protect the species.

6. TIRUNELVELI FOREST DIVISION

6.1. INDIAN SPOTTED EAGLE

Domain : Eukaryota

Kingdom : Animalia

Phylum : Chordata

Class : Aves

Order : Accipitriformes

Family : Accipitridae

Genus : *Clanga*

Species : *C. hastata*

Binomial Name : *Clanga hastata* (Lesson, 1831)

Common Name : Indian Spotted Eagle

Tamil Name : இந்தியபுள்ளிகமுகு

IUCN Category : Vulnerable

WPA, 1972 : Schedule – I; Part – B of WPA 1972 Act



Figure 16: Indian Spotted Eagle in Tirunelveli

BACKGROUND

The Indian Spotted Eagle *Clanga hastata* (Lesson, 1831) is a medium-sized eagle native to the Indian subcontinent. Its geographic distribution covers the Indian subcontinent, with occurrences in India, Nepal, and parts of Bangladesh and Myanmar. It is identified by its broad wings, pale nape patches, and distinctive spotted plumage on its wings (BirdLife International, 2023; Ali & Ripley, 1987). This species has been identified as very important due to its distinct characteristics, specific habitat preferences, and conservation needs. Historically, the Indian Spotted Eagle is a subspecies of the Lesser Spotted Eagle. Parry *et al.* (2002) provided significant insights into the classification of the species as a distinct entity. The study clearly explained the difference between the species based on their plumage, morphology, and behaviour.

Additionally, evidence from molecular analysis by Vali (2006) reveals the mitochondrial DNA sequence of the species. Based on the scientific reports, the Indian Spotted Eagle, along with the Greater and Lesser Spotted Eagles, has been reclassified under the genus *Clanga*. Compared to its related species, the Greater Spotted Eagle, which prefers wetlands, *C. hastata*, is usually found outside the wetland habitat. The species has been recorded in Nepal's protected zones, notably the Chitwan National Park and the Koshi Tappu Wildlife Sanctuary (Grimmett *et al.*, 2017).

The breeding habits of the Indian Spotted Eagle provide insights into its reproductive characteristics. Gurung *et al.* (2019) recorded that during the chick-rearing period, the nestlings' diet consisted mainly of frogs, small mammals, birds, and lizards. The male was primarily responsible for offering prey to the nest, while females usually feed the chicks (Gurung *et al.*, 2019). Also, feeding times were recorded between 08:00 to 09:00 and 16:00 to 17:00 hours. Nesting was typically constructed in tall trees; the preferred trees included *Dalbergia sissoo*. Both males and females are involved in nest building, with males contributing more to collecting

nesting materials and females mainly focusing on nest maintenance during the nesting (Gurung *et al.*, 2019).

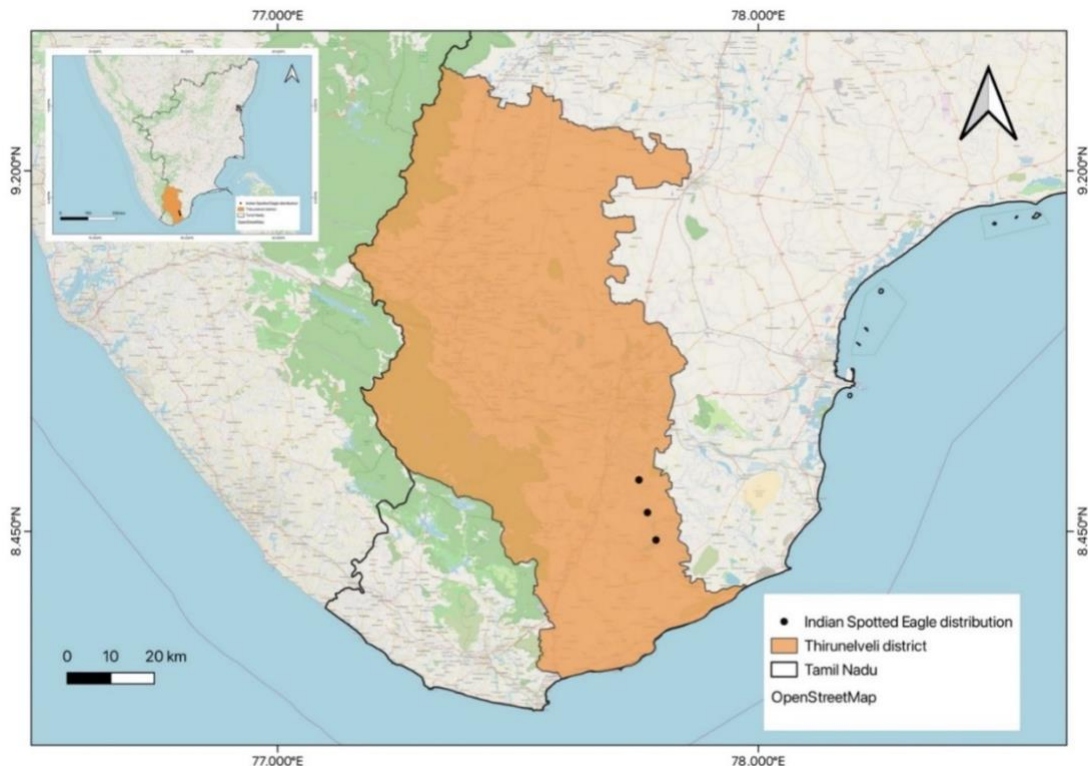


Figure 17: Geographical Distribution Map of Indian Spotted Eagle in Tirunelveli Forest division (The species distribution data was provided by the research team of the forest division).

The most preferred habitat of the Indian spotted eagle includes wetlands, open grasslands, and isolated trees for their foraging and nesting purposes (Rasmussen & Anderton, 2012). Because of habitat losses, decreased prey populations, and human disturbances, the Indian Spotted Eagle is considered as ‘Vulnerable’ by the IUCN, 2023. Its distribution in some regions of Tirunelveli Forest Division is recorded and factors like prey availability and minimal human disturbance lay an important role. . Koonthankulam Bird Sanctuary is a preferred habitat for the eagle. Based on field surveys conducted by the Tamil Nadu Forest Department in 2023 and 2024, the presence of three individuals in this location indicate it as a foraging and potential breeding site for the Indian spotted eagle in the Nellai division (Gopi & Pandav, 2011). Also, the same species was studied in Vijayanarayanamin, the agricultural fields, by researchers from the Forest Department and Advanced Institute for Wildlife Conservation.

Similarly, in Nellaiyapapuram, two individuals were sighted at the farmlands and perched on isolated trees, likely in search of prey (Rahmani, 2012). These observations indicate the fragmented distribution of the species in the Nellai Forest Division. The Koonthankulam Bird Sanctuary is known for its rich food source, low human disturbance and provides an essential hunting and roosting habitat for the species. There is a need for long-term monitoring and conservation management of this species in Nellai Forest Division. Habitat preservation, minimizing human disturbance, and managing prey availability are significantly important to ensuring the survival of this significant species in the Nellai Forest division.

CURRENT THREATS IN TIRUNELVELI DIVISION

In Koonthankulam Bird Sanctuary (KBS), tree density is rapidly decreasing, making it difficult for these eagles to build nests in their preferred area. However, the Koonthankulam pond is a critical bird habitat for bird species, including the Indian Spotted Eagle. In KBS and adjacent areas, eagles were spotted nesting on the *Acacia nilotica* and *Borrassus flabellifer* trees, but they were disturbed as some of the trees were felled due to development and construction. Due to the disturbance, the birds shifted to adjacent locations in Nagalkulam, a revenue land area. The revenue village Nagalkulam wetland is one of the prime habitats for water birds and spotted eagles. It is necessary to initiate a conservation plan for Nagalkulam to promote it as a protected area for bird conservation. The second major problem for this species is habitat destruction caused by nearby agriculture, illegal wood harvesting for commercial purposes, and changes in land-use patterns. Use of toxic compounds, such as rat poison, insecticides, and weedicides, indirectly threatens and affects prey species, which in turn affects the eagle's food chain. Moreover, it has been recorded that electric power in the Nellai division causes accidental deaths. Additionally, changes in feeding behaviour have been observed due to habitat loss and insufficient prey availability in the Nellai division. The lack of baseline population data and scientific research on this species highlights the risk to its conservation. Poaching of

the Indian Spotted Eagle is not reported within the division, but poaching of other species, such as the Black-naped Hare and Spotted Deer, has been reported in the region and this needs to be curbed.

CONSERVATION PLAN

A. Habitat Conservation

- Restrict tree cutting activities and promote the plantation of the preferred native trees, particularly species like *Borrassus flabellifer* and *Acacia sp.*
- Protect against encroachment and strengthen the conservation efforts of Koonthankulam Bird Sanctuary.
- Build artificial nesting structures in unpreferred areas of the species to provide temporary breeding sites.
- Water Body Restoration: Ensure continuous water availability in wetlands and ponds to maintain prey population density.
- Implement modifications to power lines to prevent accidental electrocutions.

B. Increase prey availability management

- Enhance the conservation efforts of prey populations like frogs, small mammals, and birds.
- Monitoring and regular patrolling in prime habitats like Nagalkulam land to prevent illegal activities that may affect the species.
- Minimise the use of pesticides among local farmers and promote eco-friendly pest management practices such as integrated pest management (IPM).

C. Scientific Research

- Conduct research to assess the population size, behaviour, habitat status, and prey-predator availability.
- GPS tagging through telemetry studies to track movement patterns and habitat preferences.

- Developing scientific solutions to understand and protect active nesting sites across divisions, for creating effective management strategies.
- Collaborate with academic institutions to promote research on the species' ecology and conservation needs

D. Legal Framework

- Designate Nagalkulam as a protected area for bird conservation, as it provides potential nesting sites during the migratory season and also located close to the Koonthankulam Bird Sanctuary.
- Collaborate with local authorities to designate revenue lands with eagle sightings as Community Conservation Areas and establish revenue land conservation agreements.

E. Community Involvement and Awareness

- Organise innovative awareness programs and workshops in local schools and colleges to educate students about the importance of the Indian Spotted Eagle.
- Form a conservation committee comprising local people in Koonthankulam village to conserve this species and obtain regular updates on activities regarding this species from the committee.
- Provide alternative livelihood opportunities to reduce high-level dependence on wood harvesting and agricultural encroachments.

6.2. EGYPTIAN VULTURE

Domain : Eukaryota
Kingdom : Animalia
Phylum : Chordata
Class : Aves
Order : Accipitriformes
Family : Accipitridae
Genus : *Neophron*
Species : *N. percnopterus*

Binomial Name : *Neophron percnopterus*(Linnaeus, 1758)

Common Name : Egyptian vulture

Tamil Name : மஞ்சள்முகப்பாறுக்கமுகு

IUCN Category : Endangered

WPA, 1972 : Schedule – I; Part – B of WPA 1972 Act



Figure 18: The Egyptian Vulture *Neophron percnopterus* in the open grassland habitat in Nellai forest division

BACKGROUND

The Egyptian Vulture *Neophron percnopterus* (Linnaeus, 1758) is commonly called as the white scavenger vulture. It is a medium-sized scavenger belonging to the family Accipitridae (Campbell, 2015). The overall body length of the Egyptian vulture ranges from 47–65 centimetres. The wingspan ranges from 1.0 to 1.5 m (Campbell, 2015; Vulture Conservation Foundation, 2025). It is considered one of the smallest true Old-World vultures (Mundy *et al.*, 1992). Egyptian vultures are widely distributed throughout the world including Europe, Africa, and Asia (Margalida & Ogada, 2018). This species survives in its preferred open landscapes, such as savannahs, shrublands, grasslands, wetlands, and rocky cliffs (Schneck *et al.*, 2023). This vulture serves as a scavenger by engulfing and digesting carcasses, animal waste, and organic refuse. Over the last few decades, Egyptian Vulture populations have significantly declined due to habitat destruction, food scarcity, poisoning from veterinary drugs (such as diclofenac) (Bean *et al.*, 2024), and electrocution from power lines (Shobrak *et al.*, 2020). In 2025, two juvenile Egyptian Vultures foraging were observed by the Nellai forest department in Nellayappapuram, which is located approximately 7.5 km from Koonthankulam Bird Sanctuary.

Nellai Forest Division predominantly provides potential open dry landscapes, agricultural fields, and rocky cliffs for the foraging and roosting of Egyptian vultures. Also, these habitats support the species' scavenging behaviour (Bhusal, 2011). Research has been conducted on the potential habitats in the Nellai division and surrounding regions, such as Koonthankulam Bird Sanctuary, Nellaiyappapuram, Vijayanarayanam, Sivakalaipuram, Perungulam, Vallanadu Blackbuck Sanctuary, Vagaikulam, Kootampuli, and Mudivaithanendal. The most preferred habitat in the Nellai division is rocky cliffs at Pothayadi Hillock, which provides potential roosting and perching sites for vultures. These habitats also provide livestock carcasses, which are essential food sources for this species.

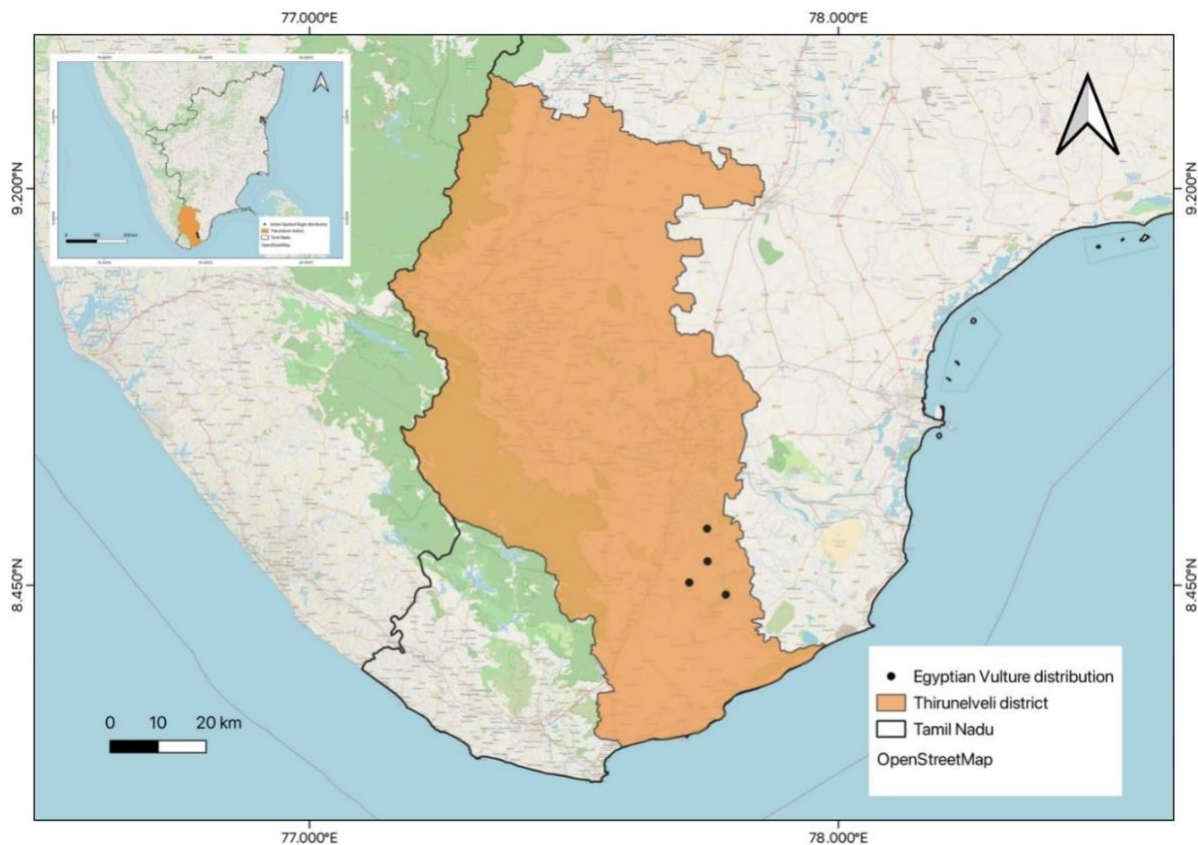


Figure 19: Geographical Distribution Map of Egyptian Vulture in Tirunelveli Forest division (The species distribution data was provided by the research team of the forest division).

Frequent sightings of Egyptian vultures in the Nellai forest division, indicate their presence either as solitary or in small groups, along with juveniles and sub-adults. Byju & Raveendran (2022) observed and documented 37 Egyptian vultures in 16 districts of Tamil Nadu, with the highest number of individuals sighted in Tirunelveli District.

In 2011, two juvenile Egyptian Vultures were observed during the scavenging process on a cow carcass in Nelayapapuram, which is located near 7.5 km from Koonthankulam Bird Sanctuary. In 2013, two juveniles were seen feeding on a carcass in Koonthankulam Bird Sanctuary. Also, a juvenile vulture roosting in Kaspas Tank in 2015 was confirmed in the division.

CURRENT THREATS IN TIRUNELVELI DIVISION

The Nellai Forest Division, in Tamil Nadu, provides suitable habitats for the foraging and roosting behaviours of Egyptian vultures. Research observations and species sightings have documented several potential locations in Nellai forest division. The main reason behind the presence of this species in these locations is the availability of livestock carcasses in Vijayanarayanam, which serves as a primary food source. Local communities commonly dispose the livestock carcasses in open lands which attracts vultures. Additionally, pig farms in these regions play a vital role in vulture presence as these farms collect animal wastes from various sources to feed the pigs. and often discard excess animal waste and pig excreta in open land areas, a supplementary food resource for vultures. Diclofenac drug is banned in India, but some of the cattle farms continue to use it illegally for several therapeutic procedures. Likewise, the pig farms also use diclofenac and other healing drugs for livestock. Carcasses treated with diclofenac and other drugs cause kidney failure and visceral gout when vultures consume contaminated carcasses (Herrero-Villar *et al.*, 2020). Another observation recorded in Nellayappapuram is the destruction of tall trees for furniture and other commercial activities, which disrupts the nesting sites of vultures. Using chemical pesticides and rodenticides in agriculture leads to secondary poisoning, while human activities affect the nesting and roosting sites.

CONSERVATION PLAN

A. Drug Regulation and Awareness Programs

- Regular visits to the veterinary clinics, cattle farms, and pig farms to ensure that diclofenac and other harmful drugs are not being used illegally.
- Promote the use of wildlife-friendly veterinary drugs that do not pose a threat to scavenging vultures.
- Conduct regular awareness programs for veterinarians, farmers and pig and cattle farm owners to educate them about the negative/ harmful effects of

drugs, which have a high impact on vultures and encourage the adoption of safer alternatives.

B. Promote Carcass Disposal Methods

- Encourage the local communities to dispose of livestock carcasses in an open area like Vijayanarayanam, ensuring they are away from human settlements but accessible to feeding by vultures.
- Conduct regular discussions with local people to raise awareness about the importance of carcass disposal methods.
- Develop and implement the standardised protocols for carcass disposal to avoid spreading of new diseases



Figure 20: Egyptian Vulture roosting on Palmyra tree *Borassus flabellifer*, state tree of Tamil Nadu

C. Protection of nesting trees and sites

- Prevent the destruction of tall trees by the landowners and introduce some compensation schemes to the landowners who protect trees with vulture nests.

- Restoring the native tree species by planting tall trees in vulture-preferred habitats to support nesting and roosting
- Native species such as *Borassus flabellifer*, *Ficus* sp., *Acacia* sp., *Terminalia* sp., and grass species of open grassland need to be conserved for the habitat of this unique Egyptian Vulture.
- Identify more potential rocky cliffs like Pothayadi Hillock and declare that region as a protected area for vultures with minimal human disturbance. Also, restrict commercial activities like quarrying and mining in these areas to protect vulture populations.

D. Scientific Research

- Conduct regular vulture population assessments in the Nellai forest division.
- Record the current behaviour and threats within the division through field observation, drones, and GPS tagging.
- Collaborate with research institutions and NGOs for successful conservation initiatives.

E. Involvement of Local Communities

- Encourage local residents to protect nesting sites by providing incentives and ensure that they report regular updates to the department authorities.
- Change the perception of barren lands (Porambokku) by educating communities that these so-called "wastelands" serve as critical habitats for Egyptian Vultures and other wildlife.
- Educate local communities about the importance of the species and the provisions of the Wildlife (Protection) Act, 1972 to safeguard vultures and their habitats.

F. Control Pesticide and Rodenticide Poisoning

- Promote organic farming techniques for eco-friendly management to reduce pesticide use. Additionally, educate the public about the effects of deliberate poisoning and its impact on wildlife.

- Encourage farmers by providing organic pesticides to minimize the excessive use of harmful chemicals that impact vulture species.

7. THOOTHUKUDI FOREST DIVISION

7.1. BLACKBUCK

Domain : Eukaryota
Kingdom : Animalia
Phylum : Chordata
Class : Mammalia
Order : Artiodactyla
Family : Bovidae
Subfamily : Antilopinae
Genus : *Antilope*
Species : *A. cervicapra*

Binomial Name : *Antilope cervicapra* (Linnaeus, 1758)

Common Name : Black Buck

Tamil Name : வெளிமான், கலைமான்

IUCN Category : Least concern

WPA, 1972 : Schedule – I; Part – A of WPA 1972 Act

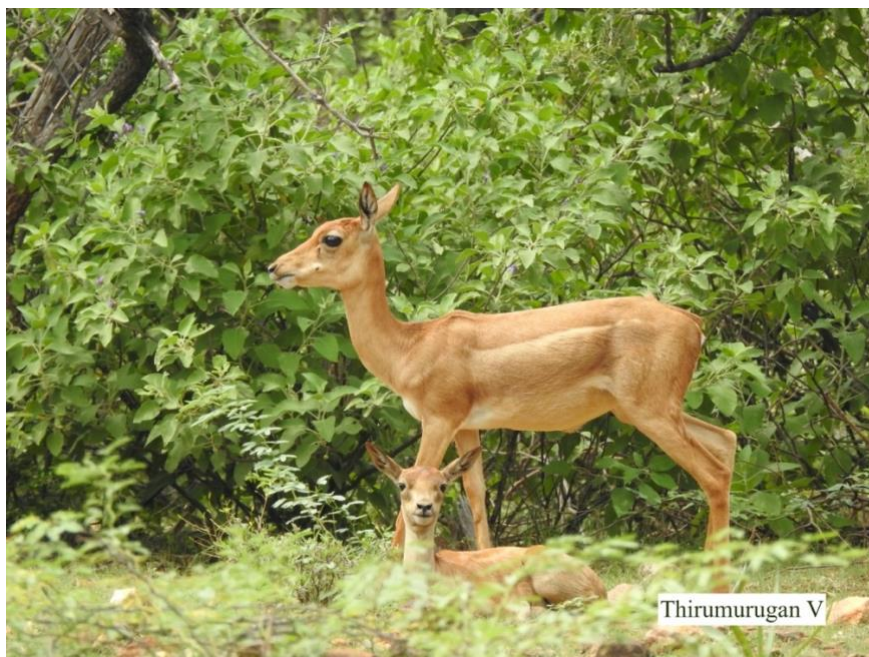


Figure 21: Blackbuck fawns resting under a bush

BACKGROUND

The Blackbuck *Antilope cervicapra* (Linnaeus, 1758) is a medium-sized antelope native to the Indian subcontinent (Menon, 2023). It is distributed throughout the Indian subcontinent, with a notable population in Rajasthan, Punjab, Haryana, Uttar Pradesh, Bihar, Madhya Pradesh, Odisha, West Bengal, Andhra Pradesh, Karnataka, Tamil Nadu, and Gujarat (Menon, 2023; Adhikari *et al.*, 2025). *A. cervicapra* is distinct for its striking nature, with males possessing a unique dark brown to black coat with white underparts (Bell, 2024). The Blackbuck is mainly found in grasslands, open scrublands, and dry deciduous forests, thriving in areas with minimal tree cover across India (Kumar *et al.*, 2024). They mostly avoid densely forested areas, favouring short grasslands for protection against predators (Jhala, 1993). They prefer open habitats, and habitat fragmentation has critically impacted their population structure (Rahmani, 1991). Blackbucks play a crucial role in maintaining grassland ecosystems and supporting predator-prey dynamics (Arandhara *et al.*, 2021).

Blackbucks are grazers, primarily feeding on grasses; seasonal shifts in their diet show increased browsing behaviour during dry periods (Jhala, 1997). However, dietary overlaps with livestock create competition for food resources in shared habitats (Baskaran *et al.*, 2016). Faecal analysis studies confirm that high-protein grasses are critical for reproductive success during the breeding season (Leslie *et al.*, 2008). Blackbucks possess a lekking reproductive system, where dominant males create territories that attract females (Isvaran, 2005). Male dominance is consistently determined by body size and stamina; however, reproductive success is significantly influenced by the habitat quality (Jhala & Isvaran, 2016). Seasonal variations highlight that peak reproductive activity occurs post-monsoon (Delu & Singh, 2023). Population studies showed decreasing trends due to habitat loss, poaching, and human-wildlife conflict (Rahmani & Sankaran, 1991). Declines in certain regions due to poaching and agricultural expansion (Rahmani & Sankaran, 1991) have been further exacerbated by increasing roadkill mortality linked to expanding

infrastructure. Genetic studies show that habitat fragmentation has reduced genetic variation in isolated populations, raising concerns over genetic bottlenecks (Gaur *et al.*, 2012; Parida *et al.*, 2022).

In India, the blackbuck is legally protected under Schedule I of the Wildlife (Protection) Act, 1972. Community-based conservation efforts by the Bishnoi community in Rajasthan have played a crucial conservation role in protecting blackbucks from hunting (Vijayan, 2023). However, human-blackbuck conflict is rising, particularly in agricultural zones where blackbucks damage crops. Studies suggest using solar fencing, bio-fencing, and translocation strategies to mitigate these conflicts (Kumar & Kumara, 2022). More importantly, climate change has presented another significant challenge to the species due to changes in temperature and physical characteristics (Prakash, 2022).

In Tamil Nadu, Blackbuck is distributed along the open grassland habitats of Point Calimere Wildlife Sanctuary, Guindy National Park, Moyar Valley of Mudumalai and Sathyamangalam Tiger Reserve, and Thoothukudi Forest divisions (Prashanth *et al.*, 2016; Rathore, 2017; Arandhara *et al.*, 2021). The Thoothukudi Forest Division, particularly the Vallanadu Blackbuck Sanctuary, serves as a significant conservation area for the blackbuck population. The Vallanadu Blackbuck Sanctuary, covering 1641.21 hectares, is a protected Reserved Forest located between 8°39'45'' N to 8°39'45''N latitude and 77°54'45'' E to 77°57'10'' E longitude. Tropical scrub woods and grass areas with seasonal water availability occupy this sanctuary. In this location, blackbucks graze on open landscapes, mainly on grasses, herbs, and crops (Jha & Isvaran, 2022).

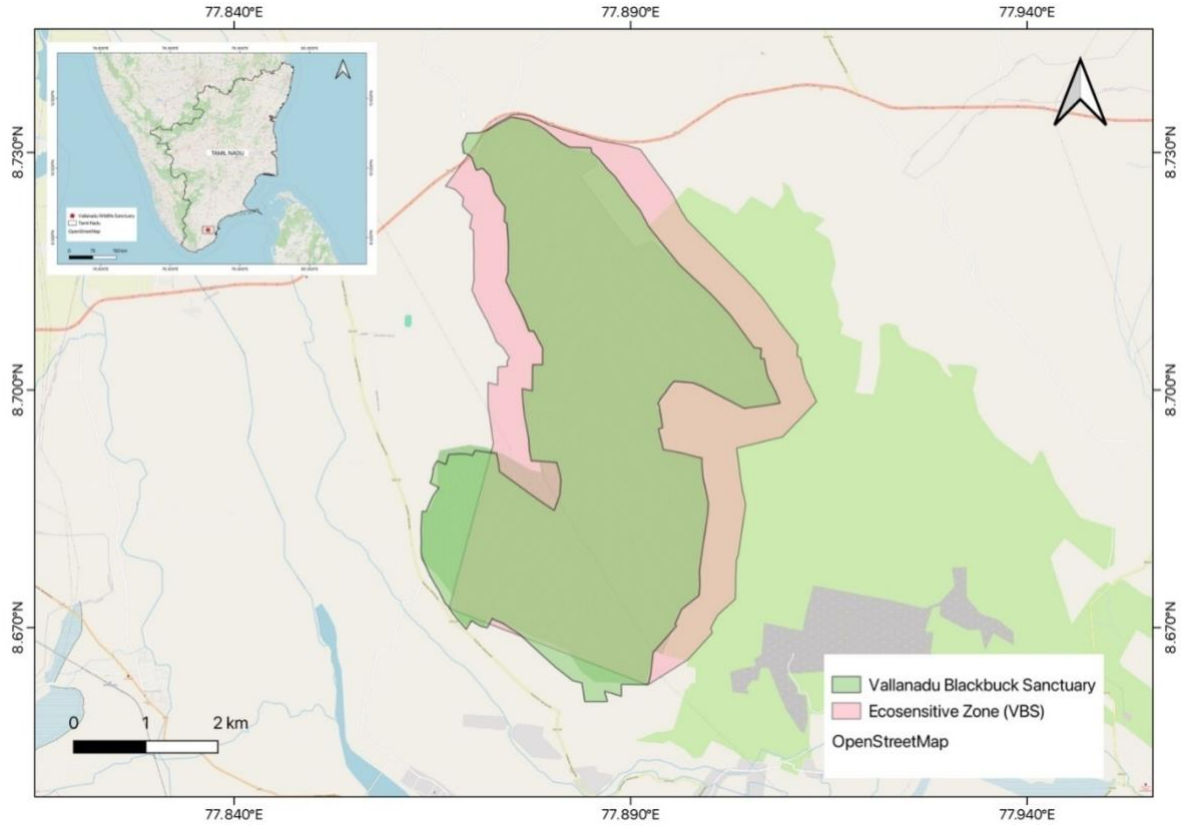


Figure 22: Geographical Map of Vallanadu Blackbuck Sanctuary in Thoothukudi.

Habitat fragmentation and competition with cattle pose a serious challenge to the blackbuck population (Meena *et al.*, 2017). Therefore, increasing/stabilising the population trend of blackbucks in the Thoothukudi Forest Division is essential for blackbuck conservation. Focused habitat restoration, anti-poaching efforts, and community-based conservation are essential to conserving this species in the long-term in the division. Conservationists recommend incorporating climate adaptation strategies into wildlife management to ensure the long-term survival of blackbuck (Nikhil, 2020). It is also suggested that creating habitat corridors can help maintain gene flow and enhance genetic diversity (Sharma *et al.*, 2013). Additionally, conservationists emphasize the importance of preserving grassland corridors to prevent population isolation within their territory (Kumar & Rahmani, 2008).

CURRENT THREATS IN VALLANADU BLACKBUCK SANCTUARY

The Vallanadu Blackbuck Sanctuary faces multiple ecological threats, including habitat encroachment, water management, and infrastructure challenges. The sanctuary's sloping landscape in some regions causes rainwater to flow towards the revenue lands under the Eco-Sensitive Zone (ESZ), where blackbucks frequently cross in search of food-rich grasslands and natural water sources like Puliyanikulam pond, even though there is availability of man-made water tanks inside the sanctuary. The provision of a separate management plan for the ESZ and not including the sanctuary officers except for the District Forest Officer in the zonal committee, makes it challenging to regulate activities. At the same time, bore wells in the ESZ are depleting groundwater rapidly.

Cultivation of high water-consuming crops on patta lands near the sanctuary boundary reduces water availability within the sanctuary, which forces the blackbucks to depend on areas outside the PA for grazing. A large population of feral cattle, possibly numbering around 1,000 individuals, compete with blackbucks for food and habitat, further stressing the sanctuary habitat. Infrastructure development, including highways near the sanctuary, fragmented habitats, disrupts natural movement and increases the risk of roadkill. In contrast, ongoing habitat fragmentation raises inbreeding concerns, which may lead to genetic isolation and health issues.

CONSERVATION PLAN

A. Habitat Restoration and Management

- Better management of the revenue patta lands adjoining the sanctuary will ensure that blackbucks are not harmed or negatively affected. Speedy and adequate compensation to be disbursed for conflicts

- Instead of planting Eucalyptus in the eco-sensitive zone (revenue lands), it is necessary to remove the non-native Eucalyptus plantation and replace it with native grass species. This shift would enhance food availability within the sanctuary, thereby reducing the need for the blackbucks to venture outside Protected Areas for grazing.
- Implement and maintain the drip irrigation method to improve moisture retention and enhance natural grass growth inside the sanctuary.

B. Water Resource Management

- ***Conservation of natural water sources:*** Natural ponds such as Puliyankulam, Nainarkulam, Tholappankulam, Vallakulam, and Killikulam are crucial water resources for blackbucks. Conservation efforts should focus on maintaining and protecting the pond to ensure year-round water availability.
- To safeguard groundwater levels within the sanctuary, the use of borewells for commercial purposes and the installation of new borewells in the Eco-Sensitive Zone should be restricted.

C. Disease Prevention and Health Monitoring

- Conduct vaccination programs to protect domestic livestock cattle around the sanctuary villages and also to prevent the spread of infectious diseases to blackbucks.
- Organise disease surveillance awareness programs to monitor and prevent the spread of ectoparasites from domestic cattle to blackbucks, which can cause serious health problems in the wild population.

D. Controlling Feral Animal Populations

- Eliminate the feral cattle and pigs from the sanctuary to prevent them from competing with blackbucks for food, resources and habitat.

- Conduct awareness programs to encourage local communities to feed their cattle by adopting stall-feeding methods.

8. KANYAKUMARI FOREST DIVISION

8.1. GREAT PIED HORNBILL

Domain : Eukaryota
Kingdom : Animalia
Phylum : Chordata
Class : Aves
Order : Bucerotiformes
Family : Bucerotidae
Genus : *Buceros*
Species : *B. bicornis*

Binomial Name : *Buceros bicornis* (Linnaeus, 1758)

Common Name : Great pied hornbill

Tamil Name : மலை இருவாட்சி

IUCN Category : Vulnerable

WPA, 1972 : Schedule – I; Part – B of WPA 1972 Act



Figure 23: Great Pied hornbill

BACKGROUND

The Great Pied Hornbill *Buceros bicornis* (Linnaeus, 1758) is a large and prominent bird species belonging to the Hornbill family, and its major distribution is the dense woods of South and Southeast Asia (Teampanpong, 2014). It primarily inhabits tropical and subtropical forests, particularly in habitats with tall, mature trees with holes for bird nesting (Corlett, 2017). Their preferred habitat is evergreen and moist deciduous woods with fruit-bearing trees, riparian forests along riverbanks, and even human-altered landscapes such as rubber and clove plantation fields (Auger, 2013). This species has a wide but fragmented distribution across India, Nepal, Bhutan, Bangladesh (Baral & Huettmann, 2020), Myanmar, Thailand, Laos (Kinnaird & O'Brien, 2007), Cambodia, Vietnam (Setha, 2004), Malaysia, and Indonesia (Datta & Naniwadekar, 2015; Poudyal, 2010).

In India, the Great Pied Hornbill prefer tropical and subtropical forests (Mudappa & Raman 2009). They are predominantly found in the Western Ghats, Northeastern states including Arunachal Pradesh, Assam, Nagaland, and Manipur (Grewal, 2022), as well as in the Himalayan foothills from Uttarakhand to Arunachal Pradesh (Vishwakarma *et al.*, 2022). In Tamil Nadu, their populations are recorded in the Southern Western Ghats, including the Kalakkad-Mundanthurai Tiger Reserve, Kanyakumari Wildlife Sanctuary, and Anamalai Tiger Reserve (Datta, 2014; Govindaraj, 2009). Within the Kanyakumari Wildlife Sanctuary, they are likely to be found in moist deciduous forests of Asambu Hills, Kalikesam, and Keeriparai, as well as the wet evergreen forests in Kulasekaram, Kaliyal, and Alagiapandiapuram, which provide nesting and fruiting trees essential for their survival.

The great Pied Hornbill is categorised as a 'vulnerable' species by the IUCN and is distributed in the hills of India and Southeast Asia. This large-bodied frugivorous bird performs an essential function in tropical forest ecosystems as a seed disperser (Naniwadekar *et al.* 2019), especially large seeds that may not be consumed by small

avian frugivores (Sethi and Howe 2009), and hence are called ‘farmers of the forest’. Hornbills are mainly designated as forest keystone species because they are essential in seed dispersal behaviour (Franco & Minggu, 2019).

Additionally, similar behavioural research observed by Naniwadekar *et al.* (2019) in the Western Ghats showed that the Great Pied Hornbill mainly feeds on fruits of *Ficus* species, wild nutmeg, and other large-seeded fruits, making it a critically needed species for forest diversity. In the Pillur Valley, Western Ghats, the preferred nesting tree species for the Great pied hornbill are *Madhuca longifolia* (J. Koenig ex L.) J.F. Macbr., *Spondias pinnata* (L. f.) Kurz, *Terminalia bellirica* (Gaertn.) Roxb, *Syzygium cumini* (L.) Skeels, and *Dysoxylum binectariferum* (Roxb.) Hook. f. ex Bedd. and some tall hardwood tree species with heights ranging from 7 – 34 meters (Prabakaran *et al.* 2019). The unique nesting behaviour of the Great Pied Hornbill has been extensively recorded by Kemp (1995), and their research describes the unique nesting characteristics, where the female seals herself inside a tree cavity with mud and regurgitates food while the male provides food until the chicks are ready to fledge.

Mudappa *et al.* (2014) noted the need for large and old trees for nesting and underlined that habitat degradation highly affects breeding success. Raman *et al.* (2016) found that deforestation and selective logging limited nesting site availability in the Anamalai Hills, leading to population decline. Deforestation, hunting activities, and habitat fragmentation are the major threats to the survival of Great Pied Hornbill. The Hornbill Nest Adoption Conservation Program in Arunachal Pradesh (Datta *et al.*, 2017) proved that conservation efforts by local communities to protect nesting trees for hornbill's survival was effective. In the Western Ghats, focused efforts on habitat restoration and effective protected area management (Sundararaj *et al.*, 2020) have contributed to conserving hornbill populations in that region.

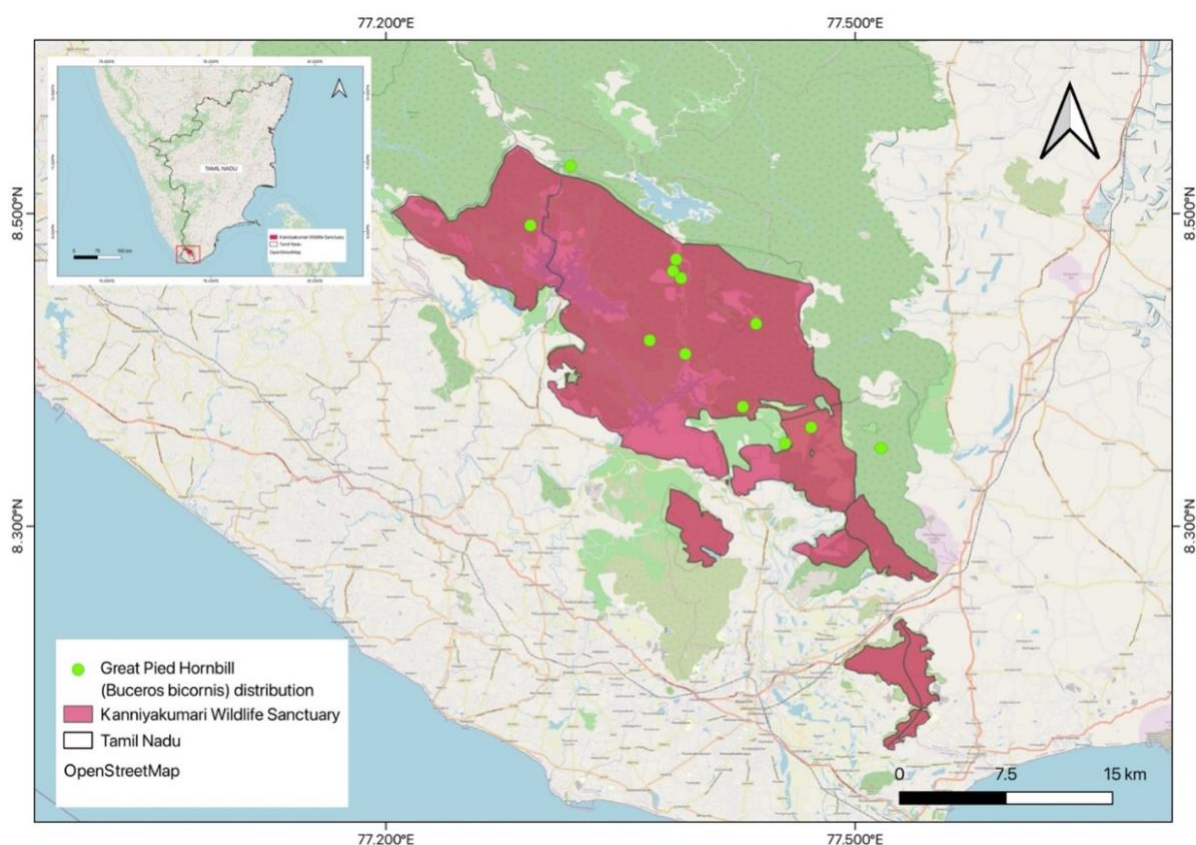


Figure 24: Geographical Distribution Map of Great Pied Hornbill in Kanyakumari Forest Division (The species distribution data was provided by the research team of the forest division).

CURRENT THREATS IN KANYAKUMARI DIVISION

In the Kanyakumari Division, the Great Pied Hornbill faces minor threats due to habitat loss, human disturbances, and environmental changes. Commonly, habitat loss and fragmentation are significant issues, but there are no direct threats to the hornbill in this division. However, converting forest lands into agricultural land for cultivating rubber and clove plantations reduces the availability of mature rainforest trees, which are essential for nesting and roosting. Deforestation due to road expansion, urbanization, and agricultural encroachment are activities that indirectly affect the hornbill habitat. This species primarily depends on large and old-aged trees for nesting. Food resource depletion is another minor issue, as forest degradation and climate change have led to the loss of fruiting trees like *Maduca*, *Spondias*, *Terminalia*, *Syzygium*, *Dysoxylum*, *Ficus*, *Mootupazha*, *Eethal*, *Pendantra macrocarpa*, *Oklandra*,

Mallatous, vattakanni, *Myristica*, *Eleocarpus* species, forcing hornbills to move to fragmented landscapes.

Human-hornbill conflict also happens when hornbills feed on cultivated fruits, resulting in conflict with farmers. Increased tourism in some regions of Reserved Forest corridors may disrupt their nesting and feeding routines. Climate change has further impacted their routine behaviour, disrupting tree fruiting cycles and contributing to food shortages. At the same time, extreme weather events like storms and droughts impact nesting success.

CONSERVATION PLAN

A. Habitat Conservation

- Enhance the conservation efforts to protect the moist deciduous and wet evergreen forests, particularly in Kanyakumari Wildlife Sanctuary and Kalakkad Mundanthurai Tiger Reserve.
- Prioritise the planting of native fruit-bearing trees like *Maduca*, *Spondias*, *Terminalia*, *Syzygium*, *Dysoxylum*, *Ficus* species and other native trees for their essential survival.
- Prohibit the selective logging of native tall trees for household construction and furniture, as these trees are crucial for hornbill nesting.

B. Nest Protection

- Identifying and marking the large nesting trees to prevent destruction.
- Create artificial nesting boxes in potential sites where natural tree cavities are unavailable, following successful models from Northeast India to support hornbill breeding.
- Involve the local communities in nest monitoring programs and educate them to prevent poaching and disturbances.

C. Legal action

- Impose strict poaching and habitat destruction penalties under the Wildlife (Protection) Act of 1972. Regular patrolling in hornbill habitats by the forest department officials.
- Conduct regular programs to educate local communities on the importance of hornbills in the ecosystem.

D. Food Management

- Encouraging division farmers to cultivate native fruiting trees in their plantation fields (rubber, clove) to support food resources for the hornbill.

E. Community Involvement and Eco-Tourism

- Adopting hornbill nests by local tribal people and also paying them remuneration to protect the hornbill nests.
- Identifying local people to take responsibility for ensuring minimal disturbance from tourism.

F. Scientific Research

- Conduct immediate & long-term monitoring to assess population trends and threats.
- Track hornbill movements by radio telemetry studies to identify key feeding and nesting areas.
- Investigate the effects of changing climate patterns and temperature shifts on hornbill survival.

8.2. NILGIRI LANGUR

Domain : Eukaryota
Kingdom : Animalia
Phylum : Chordata
Class : Mammalia
Order : Primates
Family : Cercopithecidae
Genus : *Semnopithecus*
Species : *S. johnii*

Binomial Name : *Semnopithecus johnii* (J. Fischer, 1829)

Common Name : Nilgiri Langur

Tamil Name : நீலகிரிமந்தி

IUCN Category : Vulnerable

WPA, 1972 : Schedule – I; Part – A of WPA 1972 Act



Figure 25: Nilgiri Langur

BACKGROUND

The Nilgiri Langur, *Semnopithecus johnii* (J. Fischer, 1829) belongs to the family Cercopithecidae and is classified under the genus *Semnopithecus*. It was categorised as a member of the *Presbytis* genus, but taxonomic research named it within *Semnopithecus* (Napier & Napier, 1967). The species is endemic and primarily distributed across the Western Ghats, from southern Karnataka to Kerala and Tamil Nadu, with occasional sightings in adjoining areas (Sunderraj & Johnsingh, 2001; Radhakrishna *et al.*, 2010; Chetan *et al.*, 2014). Its range extends from the Bramhagiri hills in Karnataka to the Kanyakumari Wildlife Sanctuary in southern Tamil Nadu, with notable populations in Nilgiri-Brahmagiri, Siruvani, Anamalai Parambikulam, Cardamom Hills, and Periyar-Agasthyamalai, each with many fragmented sub-populations (Menon, 2008; Kumara *et al.*, 2024). The species is currently distributed in three distinct landscape units in the Western Ghats (Sunita Ram, 2007). The northern unit includes Bramhagiri hills and southwards up to Silent Valley. The second unit includes Anamalai Hills, Nelliampathy and surrounding areas, Parambikulam Wildlife Sanctuary and Palani Hills. The southernmost unit includes the Periyar-Agasthyamalai landscape southwards to the Kanyakumari Wildlife Sanctuary. However, their habitat fragmentation continues to be a pressing issue (Menon, 2008).

Nilgiri Langur is listed as vulnerable by the IUCN. The population size is between 9500-10000 mature individuals (Singh *et al.*, 2020). Nilgiri Langurs are primarily found in tropical evergreen and montane forests, and they prefer regions with dense canopy cover. Studies have shown that they are highly arboreal and depend on undisturbed forest patches (Kumar *et al.*, 2000). They are always found at higher elevations between 300 and 2000 meters (Singh *et al.*, 2013) in areas with high rainfall and humidity. However, they have also been recorded in lower elevations. Habitat suitability analysis shows that the Nilgiri Langur occupies just 16% of its

geographical range in the Western Ghats, both in Protected Areas and outside PA, and is negatively dependent on human activity (Sunita Ram, 2007). Unfortunately, more than 50% of this area lies outside the Protected Area network.

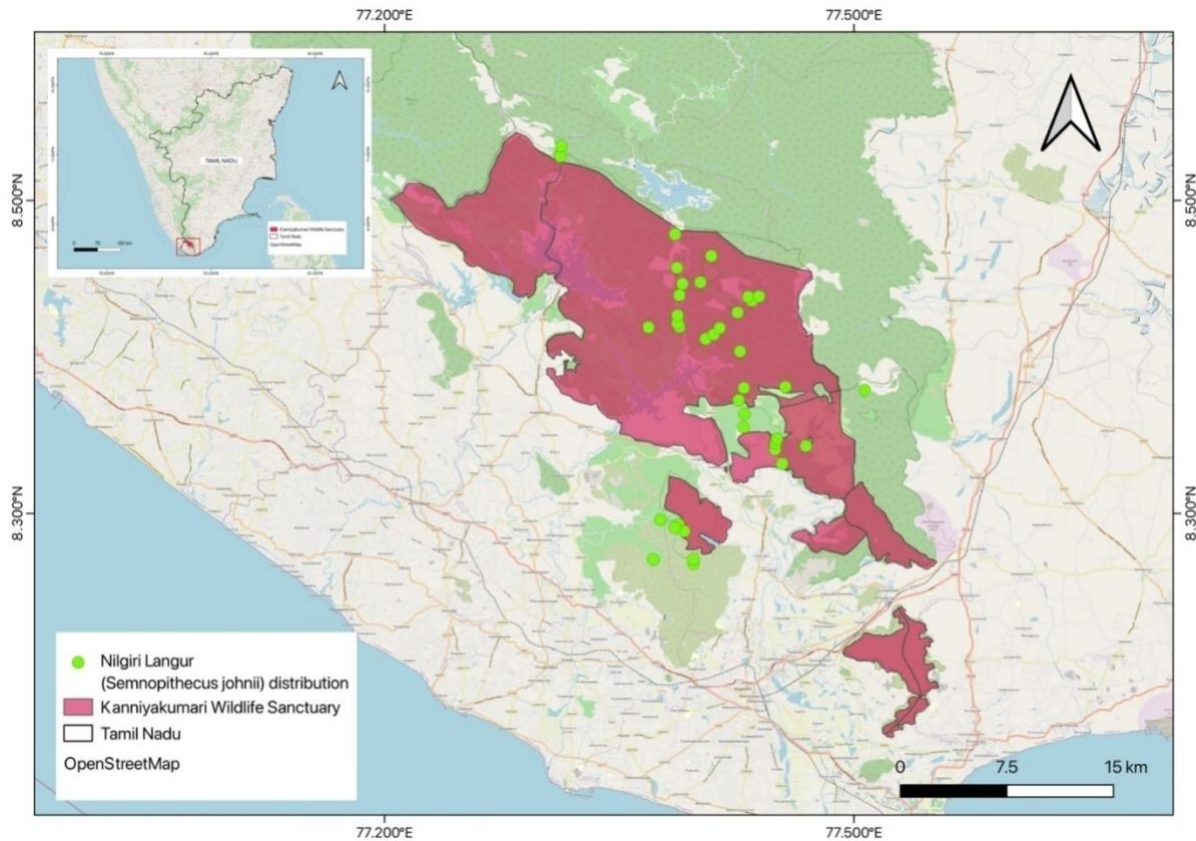


Figure 26: Geographical Distribution Map of Nilgiri langur in Kanyakumari Forest Division (The species distribution data has been provided the research team of the forest division).

Nilgiri Langur is primarily folivorous, with a diet consisting mainly of preferred young leaves, fruits, flowers, and seeds. Research has highlighted their adaptability to seasonal variations in food availability (Umapathy & Kumar, 2000). The Nilgiri Langur has also been recorded for its unique feeding behaviour on bark and mineral-rich soil, which is beneficial for their digestion and detoxification (Krishnamani & Mahaney, 2000). Nilgiri Langur possesses a multi-male, multi-female social structure, with population group sizes ranging approximately from 8 to 20 individuals (Mahato *et al.*, 2024). Communal interactions include participating in grooming, playing behaviour among juveniles, and vocal communication for territory marking and

warning against predators (Ramachandran *et al.*, 2015). Male dispersal patterns suggest a hierarchical dominance system within groups (Singh & Kaumanns, 2005). Although the IUCN categorised the species as vulnerable, it faces serious threats from habitat fragmentation, hunting, and human-wildlife conflict (Molure *et al.*, 2003). Poaching for their fur and body parts, used in traditional medicine, poses a critical conservation concern (Kumar & Umapathy, 2002). Additionally, the loss of tree species and fragmented rainforest habitats due to land clearing pose significant threats to the long-term survival of the Nilgiri Langur (Sunderraj & Johnsingh, 2001; Kumara *et al.*, 2024).

Kanyakumari Wildlife Sanctuary

The Kanyakumari Wildlife Sanctuary (KWS) is the southernmost Protected Area in the Western Ghats, occupying an area of 407 sq.km. It lies approximately between 77°10'-77°35' east longitude and 80°5'-80°35' North latitude (KWS management plan 2023-2024 to 2032-2033). It was officially declared a wildlife sanctuary in 2007. The sanctuary is a catchment for eleven reservoirs, which meet the irrigation and drinking needs of the district.

Dry deciduous and dense scrub jungles occur on the eastern side in Panakudi beat; moist deciduous forests occur in the Asambu hills, Kalikesam-Balamore, Keeriparai-Maramalai and Keeriparai-Samikuchi. The upper reaches of Kulasekaram, Kaliyal and Alagiapandiapuram ranges contain wet evergreen forests. In addition to the natural forest, vast areas are under cultivation for rubber, clove and nutmeg. While rubber plantations are state-owned, clove and nutmeg plantations are managed by private entities. The Nilgiri langur appears to be fairly distributed throughout the Reserve and occupy natural forests within private plantations and the Reserved Forests.

CURRENT THREATS IN KANYAKUMARI DIVISION

The fragmented rain forest in the Kanyakumari Division impacts the Nigiri langur population. The fragmentation has led to the loss of significant fruiting trees in the division. In some areas, the langurs were hunted for their body parts and blood. They were used for medicinal purposes as part of some traditional therapies. The main concern is habitat loss as a result of agricultural expansion and increased human activities in nearby corridors. Encroachment in some regions of Reserved forest areas has led to increased interactions between humans and langurs, affecting their natural behaviour and changing their feeding habits. Climate change variations include rainfall patterns and temperature, which impact the availability of food and water sources.

CONSERVATION PLAN

A. Assess and Monitor Population

- Conduct the assessment for population estimation and its distribution.
- Establish a permanent species monitoring system with scientific collaboration.

B. Habitat Protection

- Determine and strictly protect the potential habitats, including the fragmented rainforest areas and adjoining Reserved forest habitats.
- Implement restoration projects with native trees to restore degraded habitats.
- Designate sensitive zones in adjoining corridors to connect fragmented forest patches and reduce genetic isolation.
- Native tree species can be planted to establish connections between corridors as mammalian species are reported to have been successfully conserved in the restored rainforests (Mudappa *et al.*, 2007).

C. Law Enforcement

- Strengthen enforcement of the Wildlife (Protection) Act of 1972 to prevent and control illegal anthropogenic activities.

- Enhance patrolling in Reserved forests by the department and update the surveillance systems in highly conflicted regions.
- Introduce community-based anti-poaching squads with incentives for participation.

D. Community Involvement in Conservation

- Involve local youth in conservation through eco-tourism and sustainable forest management.
- Reduce dependency on forest resources by supporting sustainable practices such as beekeeping, handicrafts, and sustainable agriculture.

E. Promote Research Studies

- Enhance scientific research on the Nilgiri langur habitat, behaviour, and dietary patterns with a focus on climate change impacts on this species. Conduct regular disease monitoring programs to find and prevent health threats in its population.

F. Funding Support

- Increase Government support action for Nilgiri langur conservation in the division.
- Encourage public-private collaboration to enhance conservation efforts.
- Incorporate Nilgiri Langur conservation into regional and national biodiversity management plans.

CONCLUSION

The species conservation action plan has identified critical threats such as habitat destruction, human-wildlife conflict, increased invasive species, and illegal anthropogenic activities, which pose significant challenges to the survival of key species across the Northern (Hosur, Villupuram, Salem, and Sathyamangalam) and Southern (Srivilliputhur, Tirunelveli, Thoothukudi, and Kanyakumari) forest divisions of Tamil Nadu. The plan provided mitigation measures of long-term sustainable survival for precisely thirteen targeted species such as Four-horned antelope, Smooth-coated otter, Bengal fox, Spot-billed pelican, Vulture species (Egyptian, Indian, white-rumped, and red-headed), Grizzled giant squirrel, Indian Spotted eagle, Blackbuck, Great pied hornbill, and Nilgiri langur. Species-specific and site-specific implementation measures were addressed in the conservation plan. Implementing these conservation action plans is essential for ensuring the future survival of these targeted species, preserving global biodiversity hotspots in Tamil Nadu and sustainably maintaining ecosystem balance. The proposed conservation initiatives may help safeguard designated target species in Tamil Nadu. Successful implementation can serve as a model for biodiversity management across India.

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The conservation action plan provided the key challenges and threats impacting 13 target species in eight forest divisions of Tamil Nadu. The plan includes an outline of the mitigation measures for the long-term survival of Four-horned antelope, Smooth-coated otter, Bengal fox, Spot-billed pelican, Vulture species (Egyptian, Indian, White-rumped, and Red-headed), Grizzled giant squirrel, Indian spotted eagle, Blackbuck, Great pied hornbill, and Nilgiri langur. Species-specific and site-specific implementation were addressed in the conservation plan. Implementing and considering these conservation action plans is essential for ensuring the future survival of these targeted species, preserving global biodiversity hotspots in Tamil Nadu, and sustainably maintaining ecosystem balance. The proposed conservation initiatives may help safeguard designated target species in Tamil Nadu.

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