LARGE CARNIVORES IN SHARED SPACES

An Assessment of Wild Canids and Hyenas in Surendranagar's Mixed-Use Grasslands.



sahjeevan

THE HABITATS TRUST

FOREST DEPARTMENT GOVT. OF GUJARAT

Rainmatter Foundation

Team
Compiled and edited by: Malaika Mathew Chawla and Abhinav Rajan
Designed by: Sejal Rastogi

Sahjeevan,
175 - Jalaram Society, Vijay Nagar,
Bhuj - Kachchh, Gujarat, India 370001
P: +91 2832 251814
E-mail: sahjeevan@gmail.com
Website: sahjeevan.org

Field offices

Chotila – Cluster Office
Asopalav Residency,
Haridham Society,
Sangani Highway Road,

Dayapar – Cluster Office
Uma Shiv Adarsh Nagar,
Bhuj–Narayan Sarovar Road,
Dayapar, Kutch, Gujarat

RAMBLE – Field Station
Banni Research Centre, Hodko
Village, Bhuj, Kutch, Gujarat
– 370510

Ladakh
Bomb Guard Road, Housing
Colony, Leh, 194101
Union Territory of Ladakh

Regd. Society no. Guj/245/Kutch
Reg. Public Charitable Trust no. F-421/Kutch

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CHAPTER 1

INTRODUCTION





Grasslands in India

Open Natural Ecosystems (ONEs) are **non-forested terrestrial habitats** that encompass a wide range of ecosystems, including arid and semi-arid grasslands, as well as hot and cold deserts. (Madhusudan & Vanak, 2023). These landscapes harbour a diversity of globally threatened and endemic wildlife species while simultaneously forming the backbone of livestock-keeping communities, including agro-pastoralists, semi-nomadic, and nomadic pastoralists. Despite their ecological and socio-cultural importance, ONEs in India are often misclassified as “wastelands”—a legacy of colonial land-use policies—leading to their systematic neglect and mismanagement. (Lahiri et al., 2023).

Semi-arid ONEs, such as savanna grasslands and deserts, constitute more than **10% of India’s geographical area.** They are distributed across the drier parts of western, central, and southern Indian states such as Gujarat, Rajasthan, Maharashtra, Karnataka, Tamil Nadu, Madhya Pradesh, Andhra Pradesh, and Telangana. These ecosystems support natural resource-based livelihoods, contribute to the national economy and cultural heritage, and hold significant potential for below-ground carbon sequestration while sustaining rich and unique biodiversity. (Sengupta & Vanak, n.d.).

However, ONEs are increasingly under threat. India’s arid and semi-arid grasslands are rapidly undergoing loss and degradation due to multiple pressures, including the diversion of land for large-scale renewable energy projects, infrastructure development, and emerging industrial setups (Singh, 2022). In addition, these ecosystems are being impacted by woody plant invasions (Arandhara et al., 2021; Nerlekar et al., 2022), large-scale tree-based afforestation drives (Nerlekar et al., 2024; Ramprasad et al., 2020), and expanding agricultural activities (Arasumani et al., 2018). Alarmingly, nearly 70% of ONEs in India are still classified as ‘wastelands’, making them highly vulnerable to land-use conversions. This misclassification undervalues their immense ecological, cultural, and socio-economic roles in sustaining biodiversity, enabling climate adaptation, supporting pastoral livelihoods, and contributing to carbon sequestration.

The absence of a scientific and equitable national grassland policy further exacerbates this crisis, threatening the ecological integrity and cultural continuity of ONEs (Lahiri et al., 2023). If managed appropriately, these ecosystems represent a latent cornucopia that can help India achieve its climate, biodiversity conservation, and rural development goals simultaneously.

Grasslands as Community-Conserved Areas

Grasslands have been historically maintained and conserved through livestock grazing, herbivory, and other environmental drivers. While less than 5% of grasslands fall under India’s Protected Area (PA) network (Madhusudan & Vanak, 2023) . Researchers recommend alternate protection regimes for grasslands instead of traditional PA models that are a part of the ‘fortress conservation’ paradigm. Lahiri et al., 2023 stress that the management of grasslands must include “a protection and restoration regime that recognises their unique values and relationships to livelihoods – prioritising the rights and livelihood needs of pastoralists whose lives are threatened by the loss of grassland ecosystems.” This is echoed by Sheth et al., 2025, who emphasise the need to view grasslands and pastoralism as integrated systems, rather than separate entities. There have also been concerted international efforts to encourage inclusive and equitable models of PAs. Target 3 of the Kunming-Montreal Global Biodiversity Framework states that by the year 2030, at least 30% of all terrestrial, inland water, coastal, and marine areas are to be brought under protection using PAs or other effective area-



based conservation measures (OECMs). The target particularly emphasises the equitable governance of these protected areas, while recognising and respecting the rights of local communities. (CBD, 2022) . Scientists emphasise that the implementation of Target 3 in India should include recognising grasslands as functional ecosystems that support endemic and threatened species. (Sengupta et al., 2024) .

Surendranagar's Grasslands as refuges for Wild Canids and Hyenas

The Surendranagar landscape, situated within the broader arid and semi-arid grasslands of Gujarat, serves as a critical habitat for a wide diversity of carnivores and functions as an important shared space for both wildlife and pastoral communities. The region features a distinct mosaic of savanna grasslands and thorn forest, forming a complex ecological matrix that supports a variety of species. According to a 2020 study, only about 5% of the district's total area (9271 sq. km.)—approximately 42 square kilometres—was under grass cover, highlighting the scarcity and ecological importance of these habitats (Forest Area Information | Principal Chief Conservator of Forest & Head of the Forest Force (HoFF), n.d.; JICA, 2020) . Surendranagar's grasslands span multiple landownership and management systems, including privately owned vidis, Village Panchayat–managed grazing lands (gauchar), revenue lands, and Reserved Forests overseen by the Forest Department. Together, these form a patchwork of interconnected yet differently managed grassland types, shaping the ecological character of the study area and influencing patterns of wildlife use across the landscape.

Vidis are ecologically rich and biodiverse grasslands that were historically owned by the Kathi Darbars during the princely state era. Although these lands are now legally under state government ownership, many of them remain under the informal, customary possession of the Kathi Darbars. This reflects long-standing traditional use and social recognition rather than formal legal rights. These grasslands provide critical habitat for several grassland specialist species and other wildlife such as the Indian Grey Wolf, Striped Hyena, Golden Jackal, Indian Fox and many other grassland specialist species. Rapid industrial growth and changes in land use for mining and green energy projects, illegal expansion of agricultural activities on commons, and the infestation of invasive plant species in the region have created significant habitat fragmentation, negatively impacting native biodiversity as well as pastoral livelihoods.
Large carnivores like the Indian grey wolf have undergone significant population declines in the state of Gujarat over the past 15 years. In 1991, the wolf population in Kutch was estimated to be 40–48 individuals (Jhala & Giles, 1991) .

Carnivore Ecology and Conservation in Western Indian Grasslands

The grasslands of western India, particularly within the contiguous landscape of Saurashtra, Kachchh, and Thar, support a diverse and ecologically significant community of carnivores. This region is considered the largest habitat for the endangered Indian Grey Wolf and also sustains populations of the Striped Hyena, Golden Jackal, and Indian Fox. (Jhala et al., 2022) .The persistence of these species in this multiple-use landscape is critically influenced by factors like food availability, habitat loss, and human-wildlife conflict.

Indian Grey Wolf *(Canis lupus pallipes)*
The Indian Grey Wolf is recognised as the world's oldest wolf lineage (Hennelly et al., 2021) . The species has recently undergone a critical conservation reassessment, being re-classified from Least Concern; to ;Vulnerable; on the International Union for Conservation of Nature and Natural Resources (IUCN) Red List. (Hennelly et al., 2025) . The most recent assessment estimates a population of approximately 3,293 individuals across both India and Pakistan. (Hennelly et al., 2025) .

- **Diet and Conflict:** The wolfs diet in this region heavily relies on sheep and goat (Hennelly et al., 2021; Khan et al., 2019; Mahajan et al., 2021) . This reliance on domestic livestock, which also serves as a critical food resource, is a major driver of retaliation from pastoralists and subsequent population decline. (Hennelly et al., 2021) .
- **Habitat and Threat:** The Indian grey wolf population faces a drastic decline, also due to habitat loss (Hennelly et al., 2021). A substantial portion of the population resides outside Protected Areas (PAs), making them highly susceptible to anthropogenic pressures. The availability of secure breeding sites is paramount for their long-term persistence (Jhala et al., 2022) .

Striped Hyena *(Hyaena hyaena)*

The Striped Hyena, another large carnivore in these grasslands, is fundamentally a scavenger. Their diet predominantly consists of the carcasses of domestic ungulates. (Panda et al., 2022; Singh et al., 2014) .

- **Role of Livestock:** Similar to the wolf, the presence of pastoral livestock carcasses plays a significant role in provisioning food for the hyena population (Panda et al., 2022) .
- **Conservation Need:** Beyond food, the survival of hyenas is strongly linked to the presence of secure breeding sites in the mixed-use grasslands (Jhala et al., 2022; Singh et al., 2014) .

Mesocarnivores: Golden Jackal and Indian Fox

The grasslands also provide habitat for several mesocarnivores, including the Golden Jackal and the Indian Fox. Both species demonstrate opportunistic foraging behaviours and consume a varied diet of small mammals, birds, insects, and fruits. (Alam et al., 2015; Home & Jhala, 2009) .

- **Golden Jackal (***Canis aureus***):** The jackal is considered a habitat generalist, capable of persisting across various land uses (Katna et al., 2022) .
- **Indian Fox** *(Vulpes bengalensis)***:** In contrast to the jackal, the Indian Fox exhibits a preference for native savanna grasslands over other forms of land use (Katna et al., 2022; Punjabi et al., 2013) .



Indian Grey Wolf



Striped Hyena

Project Rationale

An ecological assessment of wild canids and hyenas found that the Indian grey wolves occupy only 33% of all their potential habitats in India, while striped hyenas occupy 41%, Indian foxes 38% and jackals 73%, suggesting that Indian grey wolves and Indian Foxes have undergone the greatest declines amongst the canids (Srivathsa et al., 2020) . The study aims to understand the occurrence, distribution, and species diversity of wild canids and striped hyenas in the mixed-use grasslands of Gujarat's Surendranagar district. A national-level conservation prioritisation assessment identified Surendranagar as a 'high priority' district, emphasising its importance for both biodiversity conservation and human wellbeing (Srivathsa et al., 2020) . Through our camera trapping study, we seek to highlight the ecological significance of these shared landscapes that support diverse grassland carnivores. Based on the findings, the study recommends the creation of Community Conserved Areas such as Conservation Reserves and Community Reserves to safeguard the habitats of wild canids and hyenas that predominantly occupy human-dominated landscapes overlapping with open habitats like grasslands (Srivathsa et al., 2020) . The overarching purpose is to build scientific evidence to promote the long-term conservation and protection of Surendranagar's grasslands as Community Conserved Areas (CCAs).

Project Objectives

- To document the presence of all mammal species (baseline) that frequent the Surendranagar's Grazing Lands through camera trapping surveys.
- To specifically understand the occupancy and distribution of wild carnivores such as the Golden Jackal, the Indian Fox, the Indian Grey Wolf and the Striped Hyena in these open habitats.
- To come up with science-based recommendations for conservation of wild carnivores in Surendranagar's Grazing Lands.



Golden Jackal



Indian Fox

CHAPTER 2

DISTRICT PROFILE





ખડ પાણી અને ખાખરા પથ્થરનો નથી પાર,
વગર દીવે વાળું કરે મારો ભોમકો પાંચાલ.[1]

Grass, water, the flame of the forest trees, and rocks that are limitless, where we live with little means, this is Panchal, my land.

Named after King Surendrasinhji, Surendranagar was the former capital of the princely state of the Wadhwan Dynasty and is situated at the base of the Kathiawar peninsula, in the western part of India.

The district is also the gateway to Saurashtra, which covers five districts of southwest Gujarat. The district has ten Tehsils, including Wadhwan, Muli, Sayla, Limbdi, Chotila, Chuda, Lakhtar, Dasada, Thangadh, and Dhrangadhra.

[1] *A traditional couplet that describes the ecology and culture of the ancient Panchal region in Surendranagar district.*

Geography

The biogeographical zone comprises salt flats, scrublands, grasslands, and the Little Rann of Kutch. The region shows a semi-arid feature with precipitation as low as 400 mm per year. Rainfall varies widely within the district; for example, the eastern boundary receives high rainfall and contributes to the formation of a popular wetland called Nalsarovar. Nalsarovar is considered a haven for birds and was declared a RAMSAR Site in 2012, with a total of 222 species recorded, of which 122 species (57%) are waterbirds (Nalsarovar | Ramsar Sites Information Service, n.d. 2025). On the northern end, the Little Rann of Kutch, a saline flat, transforms into a brackish wetland post-monsoon, with freshwater from the Banas and Rupen rivers and seawater from the Gulf of Kutch. The diversity of the eco-regions allows high-nutritive grasses to grow, thus contributing to the erstwhile contiguous grasslands of Surendranagar district **(Figure 1).**



Figure 1. Surendranagar District, Talukas, and adjoining Protected Areas, illustrating spatial patterns of biodiversity in relation to administrative and conservation boundaries.

Ecology

The grasslands of Surendranagar create a unique mosaic of savanna and thorn forest. According to a 2006 study, only about 8% of the district's total area had grass cover, which is about 44 square kilometres. These grasslands are interspersed with other land uses, including village grazing lands (gauchar), revenue wastelands, privately managed vidis, and Forest Department-managed Reserved Forests. Together, these areas form a continuous habitat that supports biodiversity and the livelihoods of local pastoralists

Flora

Surendranagar's grasslands host over 105 plant species, including trees, grasses, sedges, climbers, herbs, and shrubs (Thakkar et al., 2023). Three main grass communities exist in the area:

- *Aeluropus, Halopyrum, Urochondra*
- *Dicanthium annulatum*
- *Cenchrus, Eragrostis, Aristida*

In addition to grasses, thorny tree species are common. These include Vachellia nilotica, *Senegalia senegal, Vachellia leucophloea, Zizyphus nummularia, Commiphora wightii, Maytenus emarginata, Balanites aegyptiaca,* and *Euphorbia spp.* The grasses serve as the first trophic level, acting as the primary producers.

Land Use- Land Cover (LULC) Map of Surendranagar District

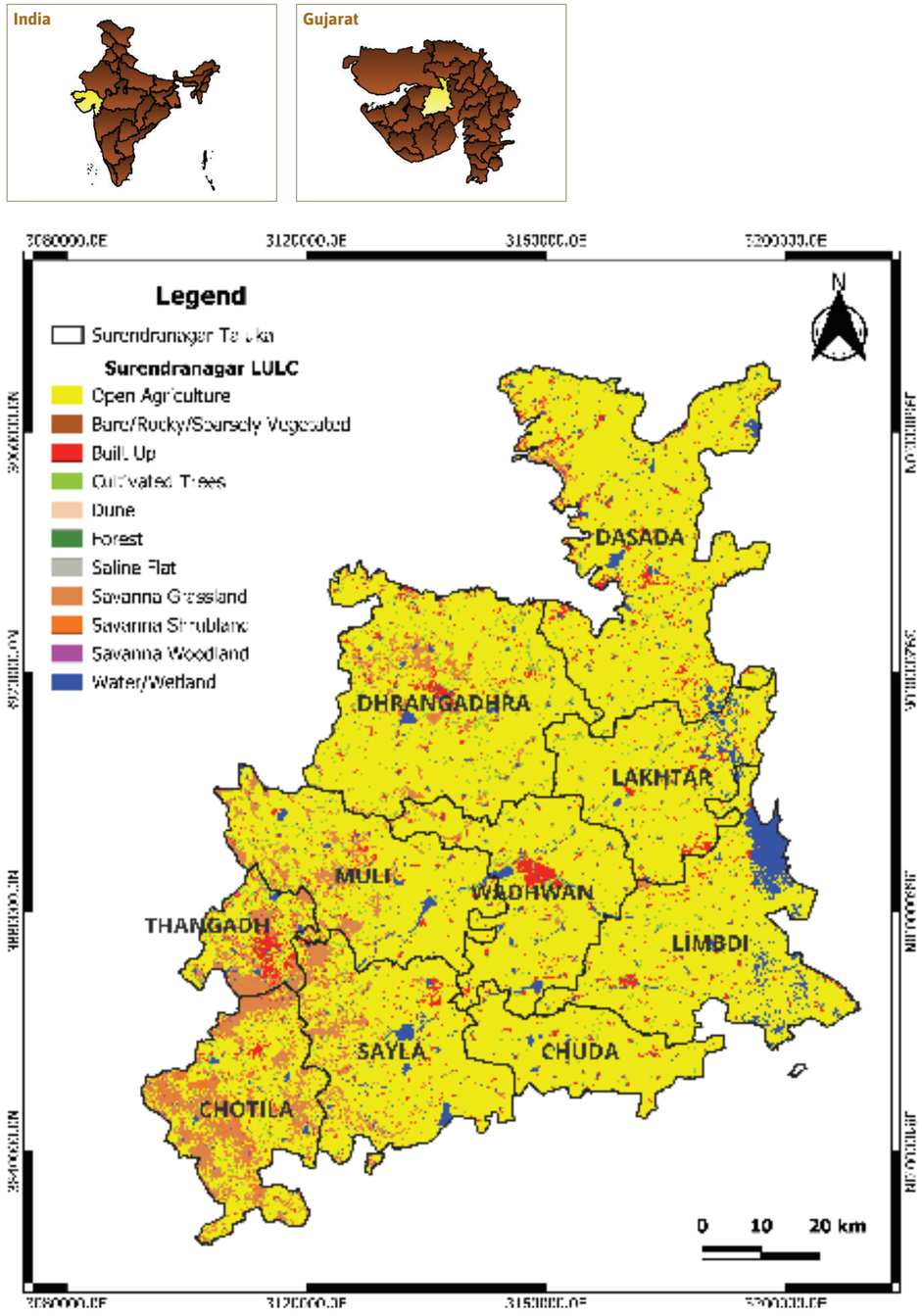


Figure 2. A Land Use and Land Cover (LULC) map of the Surendranagar district provides a visual breakdown of how its 9,271 sq. km of geographical area is utilized. The district's landscape is characterized by a mix of intensive agriculture, significant ONEs and unique wetlands.



Halopyrum mucronatum



Urochondra setulosa



Eragrostis atrovirens



Aristida cetacea



Dicanthium annulatum



Aeluropus lagopoides

Figure 3. Photographic plate showing the dominant grass species recorded in the Surendranagar landscape. These species are characteristic of the region's arid and semi-arid grassland ecosystems.

Fauna and Trophic Structure

Table 1. Trophic levels and representative species of the Surendranagar grassland–thorn forest ecosystem.

Trophic Level	Role	Key Species/Examples
Primary Producers	Grasses, shrubs, trees (First Trophic Level)	*Vachellia nilotica, Zizyphus nummularia, Dicanthium annulatum*, and other flora species
Primary Consumers	Herbivores and Omnivores (Second Trophic Level)	Wild: Chinkara, Nilgai, Wild pig, Indian hare, Rodents Domestic: Cows, Buffaloes, Sheep, Goats, Donkeys, Camels Avifauna: Larks, Quails, Partridges, Parakeets, Sunbirds
Secondary Consumers	Small Carnivores (Third Trophic Level)	Jackals, Foxes, Small Indian Civets, Jungle cats, Grey mongoose
Tertiary Consumers	Large Carnivores (Fourth Trophic Level)	Leopards, Indian Wolves
Scavengers	Apex Scavengers (Last Link)	Striped hyenas (feed on dead animals and carcasses, recycling nutrients)

Ecological Dynamics

The presence and distribution of Surendranagar's plants and animals have changed a lot over time, mainly due to human activities like changes in land use, habitat loss, and overgrazing. Despite these challenges, the grassland mosaic continues to support a diverse array of life while also providing for the pastoralist communities that rely on it.

Social and Economic Structure

The district is inhabited by a mixed group of people, with a majority population residing in the rural setting, with only two urban conglomerations in Wadhwan and Surendranagar city. There are several small towns like Chotila that are growing at a rapid scale. The total rural land in the district is 10,00,124.70 hectares, and forest land is 29,120.35 hectares.

In the district, 2.91% of the area is covered under forest, 20.36% is irrigated, and 47.35% is unirrigated. As per the Census 2011, it was noted that almost 63.04 per cent of the total working population of the district was engaged in agriculture. High-quality cotton and groundnut, besides jowar and bajra, are the main crops for subsistence. Livestock keeping and animal husbandry are the secondary important means of production and income in the region. Other than agriculture and pastoralism,

Surendranagar is popular for its textiles, chemicals, ceramics, and food processing industries. Among the registered establishments in 2010-11, the four most important are related to the manufacture of (1) Machinery and parts except electrical, (2) Non-metallic mineral Products, (3) Basic Metal Industries, and (4) Rubber & Plastic Products. The district has seen a rapid expansion in the industrial sector and has fast-growing towns and cities.

Pastoralism in the Landscape

Many communities in the Surendranagar district practice livestock keeping; however, only a few communities maintain pastoralism as a traditional occupation. The pastoralists found in this region are the **Rabaris, the Bharwads,** and the **Charan Gadhvis.** Pastoral communities from Surendranagar and beyond consider themselves part of a shared historical tradition of livestock husbandry, known as the **Maldharis.**

The livestock breeds native to Surendranagar district are the Panchali dumma sheep, the Zalavadi goat, and the Gohilwadi goat **(Figure 3)**. Other breeds found in the region are the Gir cow, the Kankrej cow, the Jaffarabadi buffalo, the Halari donkey, the Kutchi camel, and the Kathiawadi horse.



Figure 4. Traditional Rabari and Bhadwad pastoralists of Surendranagar district engaged in daily grazing practices, with herds of goats and women carrying out routine household and livestock-related activities—reflecting the deep cultural and ecological ties between community and grassland landscapes.

Spread of Invasive Flora and Habitat Alteration

A major factor driving ecological change in the region is the rapid growth of invasive plant species, mainly *Senna uniflora* (locally known as Kuvadiya), *Lantana camara* (locally known as Abhagani), and *Neltuma juliflora* (locally known as Gando Baval). This aggressive invasion has led to a significant decline in the cover and variety of native plants, especially outcompeting the local grass species that used to shape the landscape.

This ecological change has two main effects. First, it has changed the habitat structure for local wildlife. Open grasslands and scrublands are increasingly turning into dense, woody thickets that do not support many open-country species. Second, this invasion has caused a reduction in important grazing resources. As desirable native grasses are replaced by undesirable invasive plants, the land's capacity to support livestock decreases. This puts serious pressure on the livelihoods of local pastoralist communities that depend on livestock.



Lantana camara



Neltuma juliflora



Senna uniflora

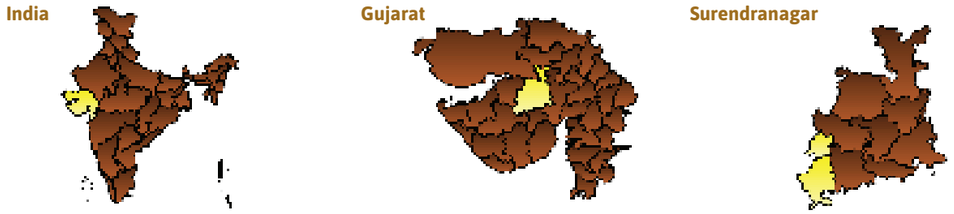
Figure 5. Invasive plant species dominating the landscape—Neltuma juliflora, Lantana camara, and Senna uniflora—are rapidly spreading across Surendranagar's grasslands, altering native vegetation structure and reducing habitat quality for wildlife.

CHAPTER 3

STUDY AREA



Village Locations for Camera Trapping Study in Surendranagar District



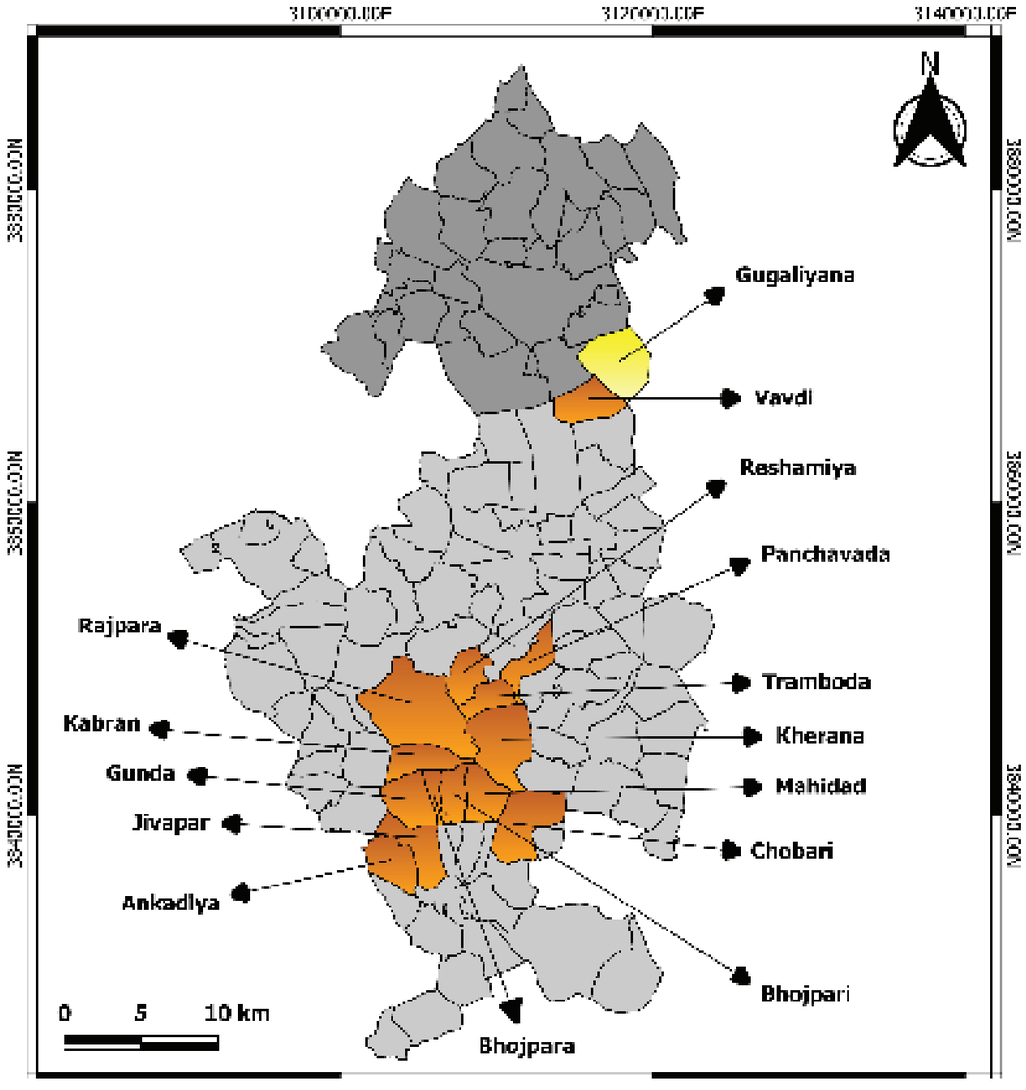


Figure 6. Study area map showing the hierarchical location of the camera-trapping survey sites.

Location

Our camera trapping project was conducted in two specific administrative blocks: Thangadh and Chotila talukas, located in the Surendranagar district of Saurashtra, Gujarat **(Figure 6).**
The survey sites were strategically chosen across various land-use types:

- **Chotila Taluka:** Cameras were deployed in the Vavdi Reserved Forest and in villages across the central parts of the taluka.
- **Thangadh Taluka:** Camera traps were deployed primarily in the Gugaliyana Reserved Forest.

These sites are hierarchically located within the semi-arid grassland mosaic of the region, which is historically part of the ancient land of Panchal.

Geography and Ecology

The study area is ecologically, culturally, and economically significant. The topography of Thangadh and Chotila serves as a critical catchment, as five major rivers originate from this area: **Wadhwan Bhogavo, Limbdi Bhogavo, Sukhbhadar, Machchhu, and Bhadar.**

The ecology is characterised by the thorny-scrub savanna and grassland tracts, providing vital habitat for a wide range of flora and fauna, including endangered species like the Chinkara, Indian Grey Wolf and Leopard. The ecosystem is intrinsically linked to local livelihoods, as it supports highly dependent livestock-keeping communities.





Figure 7. Habitat view of Gugaliyana Reserved Forest in Thangadh Taluka, depicting the characteristic vegetation and landscape features of this protected ecosystem.

Anthropogenic Threats to the Grassland Ecosystem

The open natural ecosystems in the study area face serious and growing threats from rapid industrial growth, especially large-scale renewable energy projects and changes in land use. These developments put native plants and animals, as well as local farming livelihoods, at risk. The main threats include the large-scale conversion of land for renewable infrastructure, habitat fragmentation, and increased conflict between humans and wildlife due to changes in traditional grazing and wildlife movement areas

Land Diversion for Industrial Projects

The biggest threat comes from the large-scale takeover of common and grazing lands for industrial use.
This often happens under the pretext of increasing productivity or promoting green energy.

- **Sandstone Mining (Thangadh):** The grasslands of Thangadh face intense pressure because of their valuable sandstone geology. This has led to many mining and stone blasting operations. Surendranagar serves as a major hub for the ceramic industries. The high demand for raw materials drives extensive unregulated quarrying, which permanently destroys habitats and pollutes nearby areas.

- **Renewable Energy Infrastructure (Chotila):** In the past fifteen years, the open grazing lands of Chotila have seen extensive development of wind power projects and, more recently, solar farms. These green energy projects take up large areas of land, causing significant habitat fragmentation and destroying native vegetation. These projects often move forward without effective ecological restoration plans, leaving the land damaged and unusable for native plants, animals, and traditional grazing.



Figure 8. Habitat view of Vavdi Reserved Forest in Chotila Taluka, depicting the characteristic vegetation and landscape features of this protected ecosystem.

- **Major Infrastructure Impact:** The building of the international airport in nearby Hirasar village (Rajkot district) represents another major loss of common land. This further worsens habitat reduction and fragmentation across the region.

Conservation and Grazing Conflicts

Pastoralists, who play a key role in maintaining the grassland ecosystem through controlled grazing, deal with ongoing disputes with the Forest Department over traditional grazing rights, especially in Reserved Forest areas. The integrity of the ecosystem also faces threats from invasive species, which harm the quality of native grass cover and make the land less suitable for wildlife and livestock.

Human-Wildlife Conflict (HWC)

The loss and fragmentation of natural habitats, along with the concentration of livestock, lead to more human-wildlife conflicts. Large predators, including the Indian wolf and leopard, often use these mixed-use grasslands. Conflicts frequently result in the loss of livestock and, in some cases, damage to crops from herbivores like nilgai and wild boar. This human-wildlife conflict creates negative attitudes toward conservation among local communities and often leads to retaliation against wildlife.

CHAPTER 4

METHODOLOGY





Landscape Reconnaissance and Area Estimation

To define the scope of our study, we first conducted a reconnaissance survey across the landscape. This initial step was critical to:

Identification and delineation of survey sites: To delineate the study area, we carried out physical reconnaissance surveys and ground truthing in the **Gugaliyana Reserved Forest (Thangadh Taluka)** and the **Vavdi Reserved Forest (Chotila Taluka)**. These sites were selected based on inputs from the Forest Department and local communities, who identified them as important habitats supporting wild canids, leopards, and other wildlife species. In Chotila Taluka, we expanded our reconnaissance to multiple villages, capturing larger landscape patterns. To maintain consistency and spatial accuracy, we used Survey of India maps to outline village boundaries and overlaid a 2 × 2 km^2 grid across the selected villages. This grid helped us plan our survey coverage and identify potential locations for camera traps.

Habitat mapping: The reconnaissance survey helped to understand the ecological makeup of the region. It includes Reserved Forests, vidis (privately managed grasslands), gauchar (village grazing lands), and revenue wastelands.

Documenting community dependency: We recorded the status and ownership of vidis. We assessed how much maldhari households depend on these grasslands for grazing, which includes both Reserved Forests and privately managed vidis. Table 2 shows a detailed breakdown of grazing lands, their size, and household reliance.

These efforts enabled the development of a spatial framework for systematic sampling while ensuring a comprehensive understanding of the social and ecological dynamics of grassland use. The Gugaliyana and Vavdi Reserved Forests were selected based on reports from pastoralists and the Forest Department regarding the presence of wild canids and leopards. Similarly, villages across Chotila Taluka were chosen due to the suitability of their habitats for these species and the high ecological biodiversity they

Table 2. Village-wise details of important grazing lands in Chotila and Thangadh talukas, including their size and the extent of maldhari community dependence on each site.

Village	Taluka	Important Grazing Land	Size (in sq.km)	Dependencies of the Maldhari Community (Households)	Reason for Dependency on Reserve Forests
Gugaliyana	Thangadh	Reserved Forest	4.62	50 HH	Nomadic pastoralists depend on the Reserved Forests during the monsoon season, particularly those who do not migrate.
Vavdi	Chotila	Reserved Forest	0.70	–	
Kherana	Chotila	Vidi	12.54	7 HH	Due to loss of land under gauchar and risks during cattle migration to other parts of Gujarat, pastoralists prefer vidis with native grasses beneficial for cattle gut health, which supports the production of highly nutritious milk.shrubs, trees (First Trophic Level)
Rajapara	Chotila	Vidi	12.54	165 HH	
Reshamiya	Chotila	Vidi	0.40	55 HH	
Tramboda	Chotila	Vidi	1.244	17 HH	
Soniyadhar	Chotila	Vidi	0.32	8 HH	
Kabran	Chotila	Vidi	12.95	175 HH	
Gunda	Chotila	Vidi	1.41	24 HH	
Mahidad	Chotila	Vidi	2.63	62 HH	
Bhojapari	Chotila	Vidi	1.61	27 HH	
Chobari	Chotila	Vidi	2.83	65 HH	
Jivapar	Chotila	Vidi	4.04	75 HH	
Aakadiya	Chotila	Vidi	1.61	22 HH	

support, as well as their significance for livestock grazing. Collectively, these factors made these areas appropriate sites for conducting a mammalian survey.

Community Interaction

Engaging with local communities was crucial for designing a survey that fits the social and ecological context of the study area. We had both structured and informal discussions with pastoralists, farmers, and landowners to gather insights on several key aspects:

- **Wildlife presence and movement:** Local knowledge helped identify areas that wolves, foxes, hyenas, and leopards frequently used. We also conducted indirect sign surveys across the Gugaliyana Reserved Forest and the vidis of Chotila. Pastoralists who know these grasslands shared their traditional ecological knowledge. This helped us identify indirect signs, such as scat, pugmarks, and other indicators of wildlife presence.
- **Conflict dynamics:** Pastoralists shared their experiences with predator attacks on livestock. This provided valuable insights into human-wildlife interactions. During field surveys in the Reserved Forests for camera trap setup, we found an injured calf with claw marks around its neck and puncture wounds near its ears and neck. This strongly indicated a leopard attack.
- **Cultural knowledge and attitudes:** Our discussions showed community-specific livestock management practices and views on wild canids and leopards. This offered a historical and current understanding of their interactions with wildlife.

These interactions not only helped us improve our field methods but also built trust between researchers and local communities. This cooperation made it easier to access survey sites and enhanced collaboration throughout the study.



Figure 9. Ongoing interaction with the Maldhari community in Chotila, engaging in dialogue on grazing land challenges, human–wildlife conflict, and incorporating local perspectives to better understand and conserve the region's biodiversity.

Categorisation of Grasslands

The grasslands in Surendranagar are varied. Differences in ownership and management affect both the ecological conditions and the dependency of the community. For this study, they were classified as follows:

- **Gauchar (Village Grazing Commons):** These are public lands managed by the Village Panchayat and legally set aside for grazing. However, despite this protected status, gauchars are decreasing in size and are heavily overrun by *Neltuma juliflora* and *Lantana camara,* which lowers their value for grazing.
- **Vidis (Privately Managed Grasslands):** These lands are mainly owned by the Kathi Darbar community and are leased to pastoralists for an annual fee. vidis are usually better cared for, with fewer invasive plants and more native grasses. This is especially good for livestock health and milk production.
- **Reserved Forests:** Managed by the Forest Department, Reserved Forests are valuable for the environment but can cause social issues. In Thangadh, turning key grazing areas into Reserved Forests has caused conflicts, as pastoralists face fines for grazing in afforestation areas. In Chotila, these forests are also heavily invaded by *Neltuma juliflora,* which limits their grazing usefulness.
- **Revenue Grasslands (Classified as "Wastelands"):** These lands are officially marked in the Wasteland Atlas of India but crucial grazing. They are very susceptible to degradation due to industrial activity, agricultural encroachment, and the spread of invasive species.

This classification provided the ecological and socio-economic backdrop against which the mammalian survey was conducted, as it highlighted both the quality of habitats and the dependence of maldhari households on different land types.



Figure 10. Representative habitats of Chotila Taluka: (A) gauchar (village grazing lands), (B) vidis (community protected grasslands), (C) Reserved forests, and (D) Revenue wastelands, illustrating the distinct ecosystems and the mosaic of ecological niches within the landscape.

Youth Engagement

Recognizing the importance of local participation during the reconnaissance surveys, we actively involved youth from the study area in the project. Ten young individuals from pastoral and farming communities received training in:

- Camera trapping techniques, including installation and retrieval.
- Data collection methods using KoboCollect and KoboToolbox.
- Basic field ecology, wildlife identification, and survey ethics.

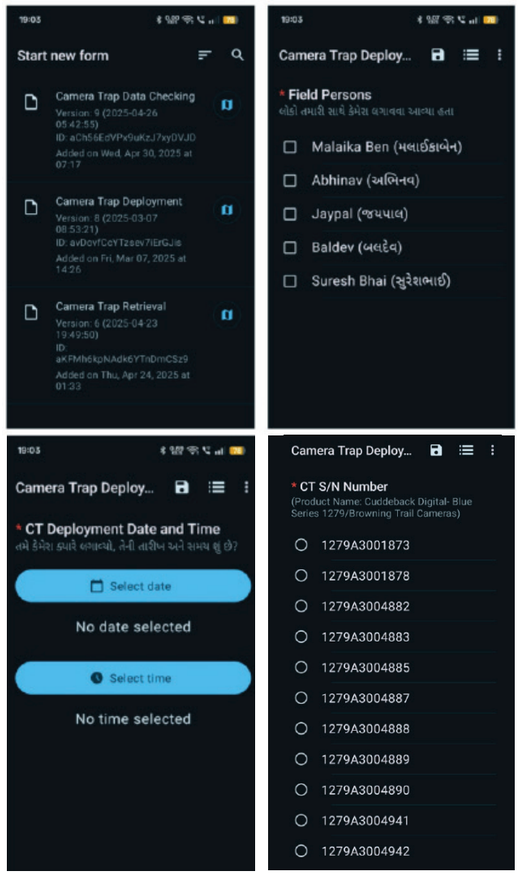


Figure 11. KoboCollect form developed for standardized field data collection, with trained local youth recording ecological and habitat information during surveys. This participatory approach strengthened data accuracy while building local capacity in biodiversity monitoring and citizen science.

Two youth were formally hired as field assistants to support the project:

- **Mr. Baldev Khodabhai Sasla** from Gugaliyana village assisted with surveys in the Gugaliyana and Vavdi Reserved Forests.
- **Mr. Jaypal Hirabhai Tramta** from Kherana village supported surveys across multiple villages in Chotila taluka.

Their involvement was essential for field logistics, community awareness, and long-term conservation engagement. This ensured the research was rooted in local stewardship.

Survey Design and Camera Trap Deployment

Systematic camera-trapping surveys were conducted with prior research approval from the Gujarat Forest Department **(Approval no: WLP/RTC/TE-1/C/768-70/2023-24).** The sampling strategy integrated both grid-based deployments and opportunistic sampling informed by traditional ecological knowledge (TEK) from pastoralist communities. Deployments were strategically extended in areas where pastoralists reported frequent sightings of wild canids and other carnivores to maximize detection probability.

The surveys were carried out across two talukas of Surendranagar district:

- **Thangadh Taluka:** Camera traps were deployed in the Gugaliyana Reserved Forest between December 2024 and February 2025 **(Figure 14).**
- **Chotila Taluka:** Deployments occurred in the Vavdi Reserved Forest during February 2025 **(Figure 15)** followed by a grid-based sampling effort across the central villages from March to May 2025 **(Figure 16).**

Each camera trap was positioned strategically and left in the field for a minimum of 21 days. Detailed deployment information is provided in the Camera Trapping Schedule (Annexure III).



Figure 12. Camera-trapping training session with local youth, focusing on field techniques, equipment handling, and biodiversity monitoring.



Figure 13. Camera-trapping fieldwork with Mr. Baldev Khodabai Sasla and Mr. Jaypal Hirabhai Tramta, documenting local collaboration with pastoral youth in biodiversity monitoring.

Camera Trap Equipment and Settings

Two models of infrared-sensor camera traps were used: the Cuddeback Digital Blue Series (Model No. 1279) and the Browning Strike Force Pro DCL (Model No. BTC-5DCLN).All devices were configured with standardized settings to ensure data consistency:

- **IR Mode:** Field
- **Aspect:** Wide / Centred (depending on location)
- **Zone:** Wide
- **Image Size:** 20 MP
- **Lapse Size:** 1 MP
- **Delay (Day/Night):** FAP (Fast as Possible)
- **Image Burst (Day/Night):** 2 images
- **Video (Day/Night):** Off
- **Lapse (Day/Night):** Off

Camera Trap Locations in Gugaliyana Reserve Forest

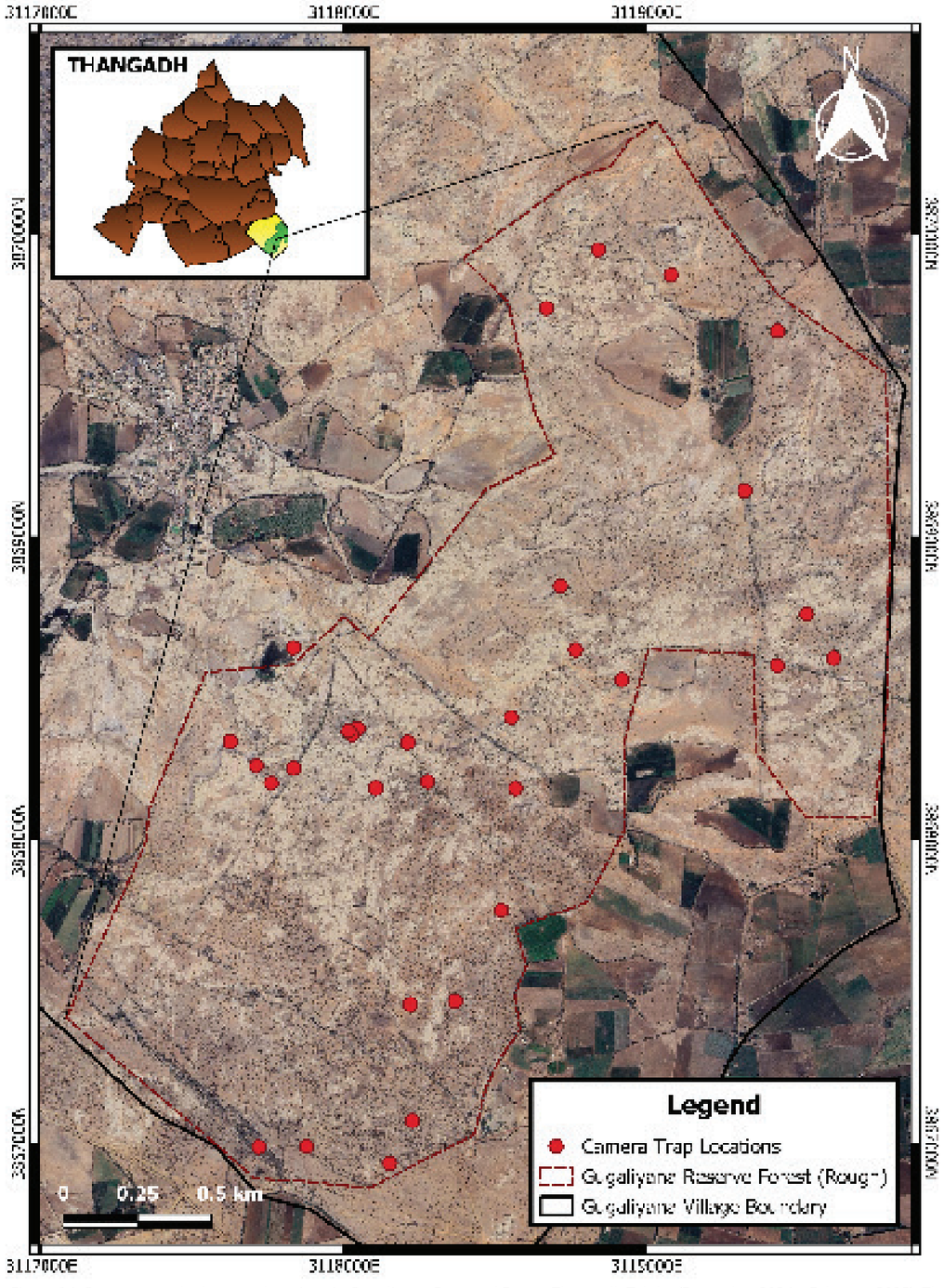


Figure 14. Camera trap deployment locations in Gugaliyana Reserved Forest, Thangadh Taluka (December 2024 – February 2025). The total surveyed area was 4.62 km².

Camera Trap Locations in Vavdi Reserve Forest

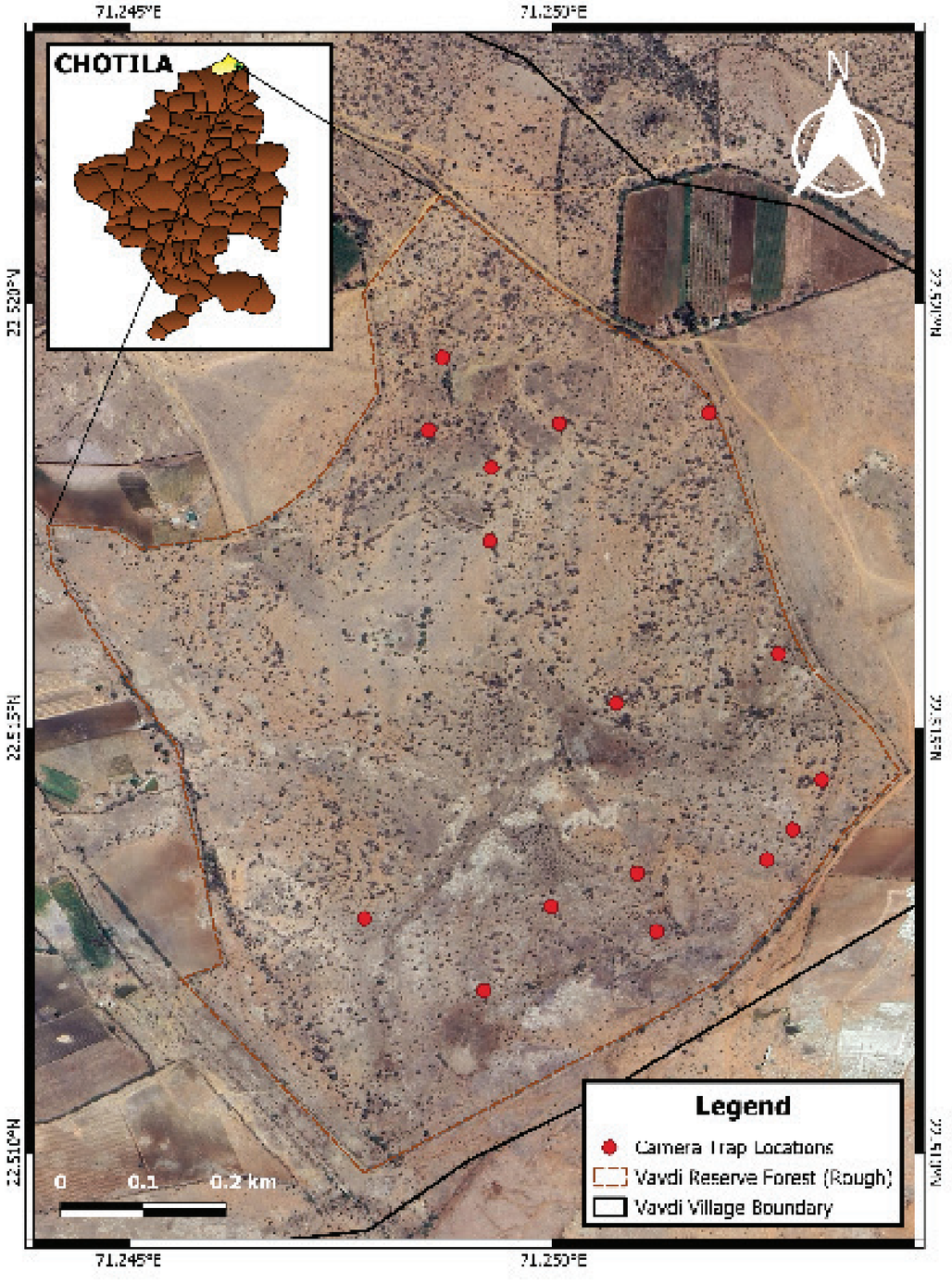


Figure 15. Camera trap deployment locations in Vavdi Reserved Forest, Chotila Taluka (February 2025), covering a 0.70 km² survey area.

Camera Trap Locations across Commons of Chotila

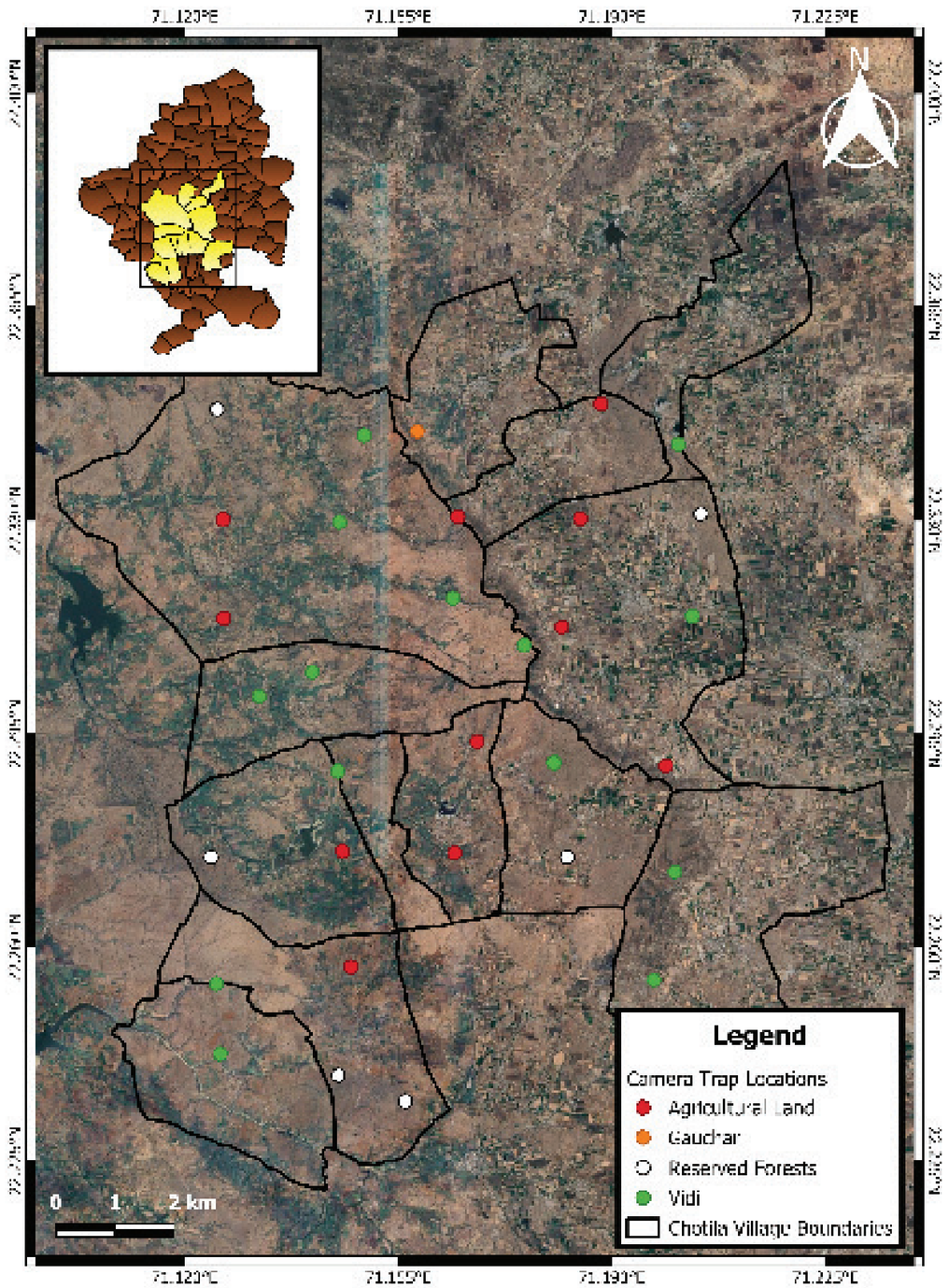


Figure 16. Grid-based camera trap deployment locations across the central villages of Chotila Taluka (March – May 2025), covering a survey area of 44 km².

Data Curation and Management

The process for data collection and curation was designed to be systematic and robust.

1. Data Curation: Upon retrieval from the field, memory card contents were transferred to an external hard drive and organised into location-specific folders under the main directory CT_Images. Images were then processed in a two-phase approach. First, we used **Camtrap Detector v0.4.0,** a machine learning-based application powered by the MegaDetector model. (Fennell et al., 2022). This offline tool provided an initial automated classification, sorting images into two primary folders: Animals and Others (e.g., humans, vehicles, false triggers).
Second, all images classified under Animals were manually reviewed and verified. This manual step served to identify all captures to the species level and to cross-check and validate the accuracy of the MegaDetector classifications. Verified images were then sorted into species-specific folders.

2. Data Entry: Following manual categorisation, detection data were entered into a Google Sheets database. A standardised set of fields was used to ensure consistency:

- **CT Location:** Name of the camera trap site (e.g., RAJ005).
- **CT ID or S/N Number:** Unique identifier for the camera trap device.
- **Latitude and Longitude:** Geographic coordinates of the deployment.
- **Habitat/Village:** Description of habitat type or associated village name.
- **Landuse/Ownership Type:** Classification (e.g., Vidi, gauchar, reserved forest, agricultural land).
- **Date of Deployment:** Installation date.
- **Species Name** and **Scientific Name.**
- **Date of Detection** and **Time of Detection.**
- **Count:** Number of individuals recorded in the capture.
- **Remarks:** Type of media (Photo/Video).

To maintain consistency, two images of the same species were treated as separate capture events if recorded one minute or more apart. The Count was based on the number of individuals visible in a single capture event, not an aggregation from consecutive frames.

Data Analysis

The curated dataset was used to evaluate mammalian diversity, species distribution, and relative abundance. **The Relative Abundance Index (RAI)** was calculated for all species based on the total number of photographs and the total camera trap nights.
This systematic data entry and analysis process allowed for the creation of a complete species checklist for all mammals recorded within the study area. This dataset provided a strong basis for understanding wildlife persistence in human-dominated landscapes. (Athreya et al., 2013; Karanth et al., 2004; Odadi et al., 2009) And for examining species diversity across different habitat types (vidis, gauchars, agricultural fields, and Reserved Forests).

CHAPTER 5

RESULTS & KEY FINDINGS



Our camera-trap surveys across the mixed-use grasslands of Surendranagar district documented **18 mammal species,** including **large carnivores, meso-carnivores, ungulates, and small mammals**, confirming that these multi-use grasslands support a **functioning and biodiverse semi-arid ecosystem**. Species records revealed that **Vidis and Reserved Forests are the richest habitats**, supporting over 60% of all documented species, while agricultural lands and Gauchars hosted more adaptable fauna. Notably, **the Indian Grey Wolf was confirmed only in Thangadh**, underscoring the area's role as a key refuge for this endangered carnivore. Spatial analyses further identified **distinct wildlife hotspots, movement corridors**, and areas where **pastoral activity overlaps with wildlife use**, highlighting the ecological significance of these community-managed landscapes. Together, these findings establish a strong **baseline for monitoring ecological change**, informing management decisions, and guiding future conservation planning across Surendranagar's grazing ecosystems. A detailed analysis of these results is presented below.

Species Documentation

Camera-trap surveys in Surendranagar's Chotila and Thangadh talukas established a baseline inventory. This documented 18 mammal species using the district's semi-arid grazing lands. The inventory includes representatives from various trophic levels, including herbivores, omnivores, carnivores and scavengers.

This indicates a diverse and functioning grassland ecosystem. **Table 3** below provides a comprehensive checklist of all species documented, their conservation status as per the IUCN Red List and the Wildlife Protection Act (WPA), and their presence in each of the study areas.

Table 3. Baseline checklist of mammalian species recorded in Chotila and Thangadh talukas, indicating their IUCN Red List status, Wildlife (Protection) Act schedules, and presence–absence across the two study sites.

S.No	Common Name	Scientific Name	IUCN Red List	WPA Schedule	Thangadh Taluka	Chotila Taluka
1	Indian Grey Wolf	*Canis lupus pallipes*	Endangered	Schedule I	☑	☒
2	Striped Hyena	*Hyaena hyaena*	Near Threatened	Schedule I	☑	☑
3	Golden Jackal	*Canis aureus*	Least Concern	Schedule I	☑	☑
4	Indian Fox	*Vulpes bengalensis*	Least Concern	Schedule I	☑	☑
5	Indian Leopard	*Panthera pardus*	Vulnerable	Schedule I	☑	☑
6	Jungle Cat	*Felis chaus*	Least Concern	Schedule I	☑	☑
7	Asiatic Wild Cat Hybrid	*Felis lybica ornata* × *Felis catus*	Least Concern	Schedule I	☑	☑
8	Wild Boar	*Sus scrofa*	Least Concern	Schedule II (Part A)	☑	☑
9	Small Indian Civet	*Viverricula indica*	Least Concern	Schedule I	☑	☑
10	Indian Grey Mongoose	*Urva edwardsii*	Least Concern	Schedule I	☑	☑
11	Indian Gazelle	*Gazella bennettii*	Least Concern	Schedule I	☒	☑
12	Nilgai	*Boselaphus tragocamelus*	Least Concern	Schedule II (Part A)	☑	☑
13	Indian Crested Porcupine	*Hystrix indica*	Least Concern	Schedule I	☑	☑
14	Indian Hare	*Lepus nigricollis*	Least Concern	Schedule II (Part A)	☑	☑
15	Indian Hedgehog	*Paraechinus micropus*	Least Concern	Schedule II (Part A)	☑	☑
16	Gerbil	*Tatera sp.*	Least Concern	Schedule II (Part A)	☒	☑
17	Rodent	*Rattus spp.*	Least Concern	Not Listed	☑	☒
18	Five-Striped Squirrel	*Funambulus pennantii*	Least Concern	Not Listed	☑	☑

Large herbivores such as Nilgai *(Boselaphus tragocamelus)* and Wild Boar *(Sus scrofa)* were consistently recorded in both Chotila and Thangadh talukas. This indicates that these grasslands across both talukas provide important habitats for these ungulates, supporting prey populations vital for sustaining the local carnivore communities. However, the Chinkara/Indian Gazelle *(Gazella bennettii)* was recorded only in Chotila Taluka, suggesting a more restricted distribution for this species within the landscape. This may indicate habitat preferences or pressures limiting the Chinkara's presence to Chotila, which should be considered in targeted conservation planning for this species in Surendranagar.

Mesocarnivores such as Golden Jackal *(Canis aureus)*, Indian Grey Mongoose *(Urva edwardsii)*, Jungle Cat *(Felis chaus)*, Small Indian Civet *(Viverricula indica)*, and Indian Fox *(Vulpes bengalensis)* were detected at multiple sites. This shows that these grazing systems can sustain mid-ranking predators as well as less noticeable nocturnal carnivores.

Smaller mammals, including Indian Hedgehog *(Paraechinus micropus)*, Five-striped Squirrel *(Funambulus pennantii)*, Indian Hare *(Lepus nigricollis)*, and Gerbil *(Tatera sp.)*, were commonly captured on camera. This highlights the presence of grassland-adapted and generalist small mammals.

The species composition and spatial patterns were largely similar in both talukas. This indicates that the landscape is suitable for a variety of grassland mammals. It suggests that Chotila and Thangadh still have the necessary features for the survival of both generalist and specialist species.

Notably, the Indian Grey Wolf *(Canis lupus pallipes)* was confirmed only in Thangadh taluka (Figure 17). This emphasises Thangadh grasslands as a key area for this endangered and Schedule I species. Although cameras did not document the Indian Wolf in Chotila, community knowledge confirms its occasional presence in some open grassland areas. However, these reports need physical verification.
Several Schedule I species under the Wildlife (Protection) Act, 1972, including Leopard, Striped Hyena, Golden Jackal, and Jungle Cat, were recorded. This confirms the conservation importance of these grazing lands for threatened mammals.

These findings together establish the Surendranagar grazing landscapes as vital reservoirs of mammalian diversity. The records of apex and mesocarnivores, strong herbivore populations, and grassland specialists provide a baseline for measuring future ecological changes, management interventions, and conservation impacts.

Spatial Analysis of Camera

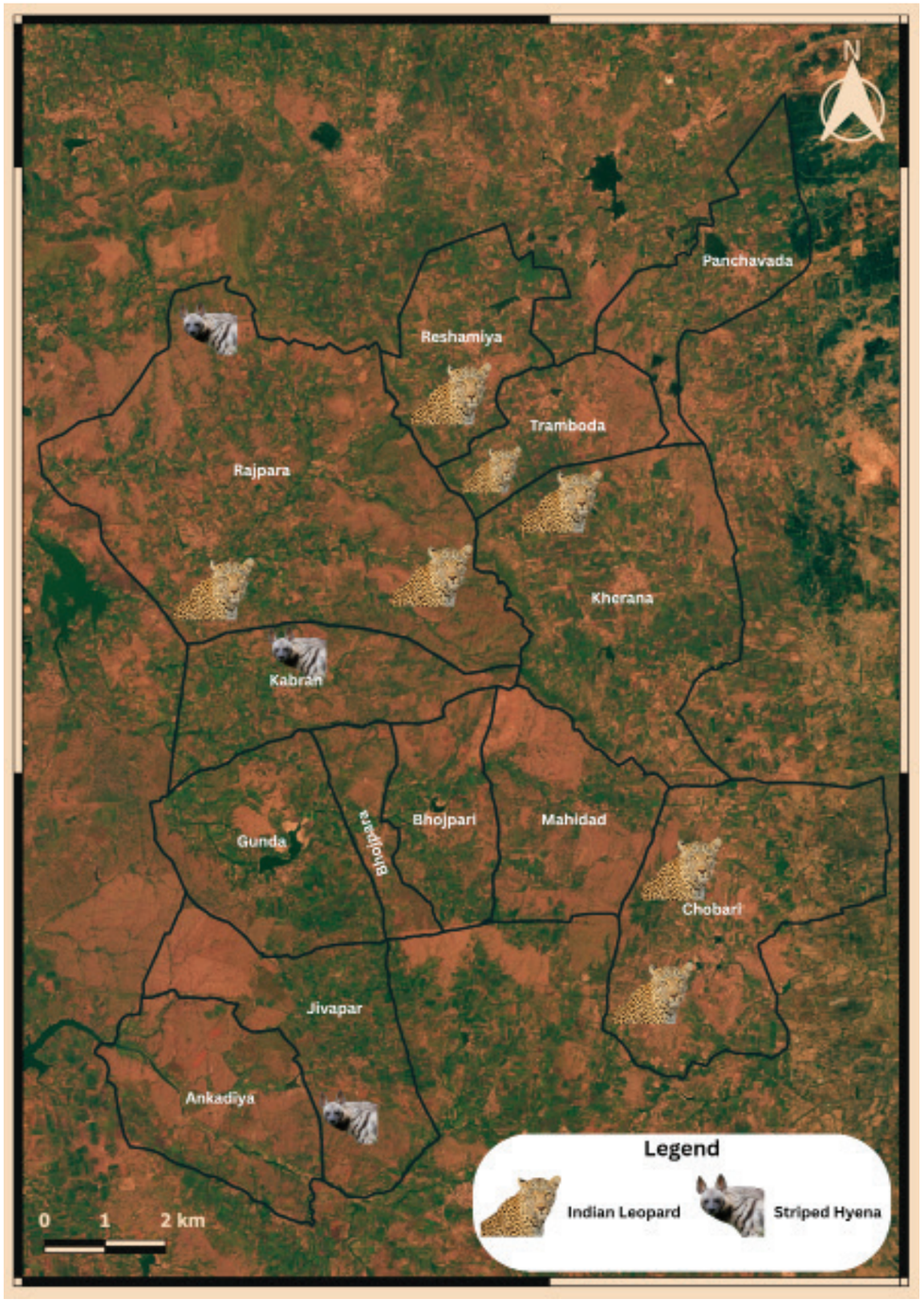
The grid-based camera trap survey conducted in Chotila revealed several notable spatial patterns. Using QGIS software, all photographic detections from the dataset were geo-referenced and mapped to visualize species distribution across the study landscape. The resulting maps illustrated the spatial occurrence of large carnivores, mesocarnivores, and their prey species. This spatial analysis further enabled the identification of distinct wildlife hotspots—areas characterized by a high concentration of detections or frequent animal activity.

These spatial distribution maps provided helpful insights into how species use Chotila's diverse grassland habitats. The analysis pointed out key activity zones for species such as Striped Hyenas and Leopards. It also showed the wider, more dispersed presence of adaptable species like Jackals and Foxes. Additionally, this spatial approach helped in identifying movement corridors, areas where pastoral activities overlap, and the interconnected roles of vidis, gauchars, and Reserved Forests, each contributing in different ways to sustaining wildlife across the landscape.



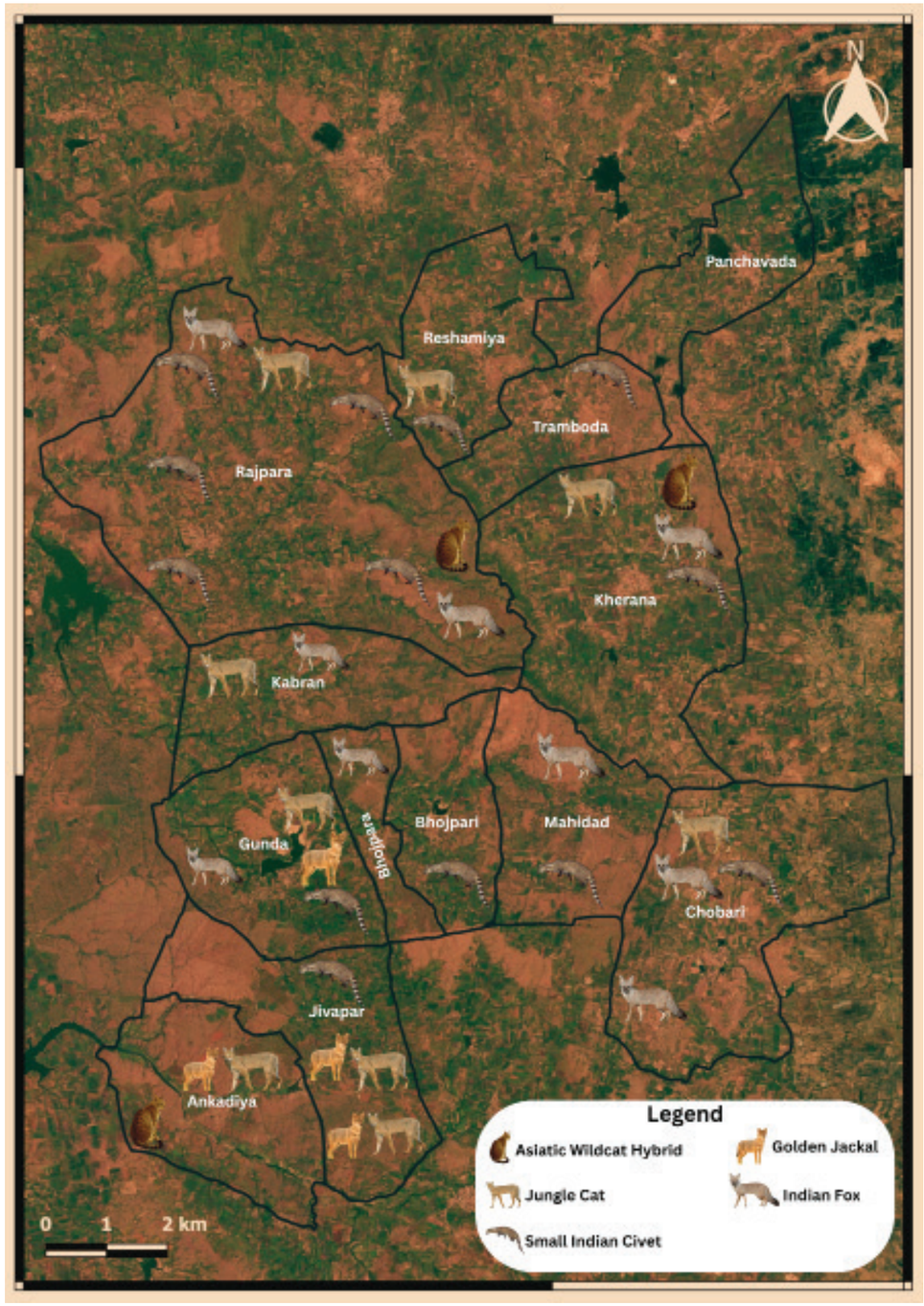
Figure 17. Camera trap captures from Gugaliyana documenting two records of Indian Grey Wolf alongside other elusive carnivores, including Indian Fox, Golden Jackal, Indian Leopard, and Striped Hyena, highlighting the area's significance for grassland predator diversity.

Distribution of Carnivores in Sampled Villages of Chotila



(A) Carnivores

Distribution of Meso-Carnivores in Sampled Villages of Chotila



(B) Mesocarnivores

Distribution of Ungulates in Sampled Villages of Chotila



(C) Ungulates

Figure 18. Spatial distribution maps showing the village-wise occurrence and concentration of mammalian species groups—(A) Carnivores, (B) Mesocarnivores, and (C) Ungulates—detected through camera-trapping in the villages of Chotila Taluka. The maps illustrate species distribution patterns across sampled sites, highlighting key wildlife activity zones and habitat-use gradients within the landscape.

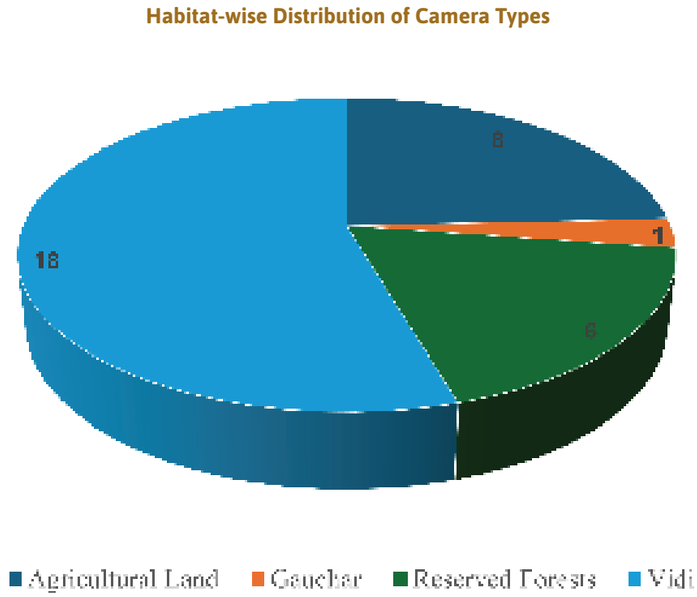


Figure 19. Distribution of camera-trap deployments across different landscapes in Chotila Taluka.

The widespread presence of mesocarnivores—including the jungle cat, golden jackal, Indian fox, Asiatic wildcat hybrid, and small Indian civet—suggests a rich variety of habitats, strong landscape connectivity, and a variety of smaller prey species. Similarly, the frequent sightings of ungulates like nilgai, chinkara, and wild boar in almost all surveyed villages indicate productive habitats with adequate food, water, and vegetation cover.

Villages such as Rajpara, Kabran, Chobari, and Tramboda, which have populations of carnivores, mesocarnivores, and ungulates, emerge as significant biodiversity hotspots. A notable finding from this study is the absence of the Indian Grey Wolf (Canis lupus pallipes) at all camera-trapping sites, confirming that this species was not present in the landscape during the observational period. Overall, these findings suggest that the Chotila landscape consists of a rich and interconnected mix of habitats that support a diverse array of wildlife. The observed patterns highlight the ecological significance of these multi-use areas and underscore the importance of maintaining habitat connections and protecting natural corridors to ensure long-term coexistence and stability.

The distribution of camera traps **(Figure 18)** by habitat shows the grid-based sampling method used in the study area. Most of the survey grids were set up in vidis. These are well-kept grasslands managed by local communities through traditional grazing that promotes the growth of native grasses and shrubs. As a result, most of the camera traps were placed in these vidis to monitor wildlife activity in these important habitats. A smaller number of grids were in Reserved Forests, which exist in only a few patches across the landscape. These areas are mostly filled with Neltuma juliflora, an invasive species that often decreases the diversity of native plants. The remaining grids were in agricultural lands and gauchar, which are village grazing grounds. These represent human-modified areas used for livestock and farming. Overall, this distribution shows that the survey design effectively covered the main habitat types in the landscape, focusing especially on community-managed vidis that are vital refuges for wildlife in a mostly human-influenced environment.

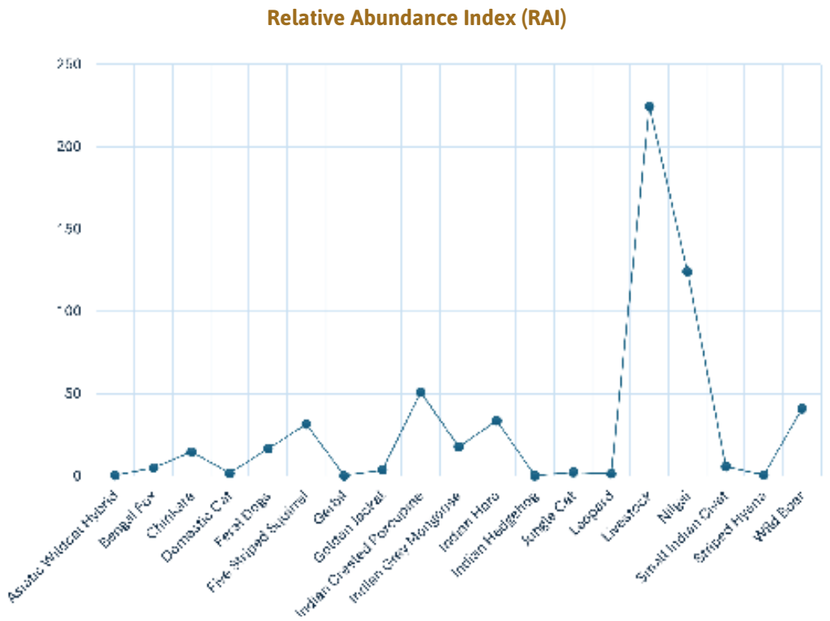


Figure 20. Graph showing species-wise Relative Abundance Index (RAI) recorded during the camera-trapping exercise in Chotila Taluka. The RAI was calculated based on the total number of captures for each species and the average number of camera trap nights across all deployed cameras, providing a comparative measure of species activity and relative occurrence within the landscape.

The Chotila ecosystem is active and complex, with high levels of activity recorded for domestic livestock and large wild herbivores such as Nilgai, as indicated by the Relative Abundance Index (RAI).However, these elevated activity levels are influenced by multiple interacting factors, including land-use patterns, grazing pressure, habitat structure, seasonality, and detectability, and therefore should be interpreted as indicators of relative use rather than direct measures of population abundance.

This concentration emphasises the crucial role of maldhari grazing practices in land use. Any conservation efforts must consider pastoralist livestock as an essential stakeholder and part of the ecosystem.

In addition to livestock, there is a strong presence of wild herbivores, including Wild Boar and Indian Crested Porcupine, along with a moderate number of mesocarnivores like Indian Grey Mongoose and Golden Jackal. This suggests that the ecosystem supports various species and maintains food webs across different levels.

Large carnivores such as the Leopard and the Striped Hyena were observed at much lower rates, indicating they exist at low densities or are avoiding heavily used areas. This situation points to their vulnerability and the potential for conflict with humans, especially given the high density of livestock in the area.
These findings underscore the central role of the Maldhari community in maintaining ecological health within a mixed-use landscape. They demonstrate that livestock management and the conservation of globally threatened species such as the Striped Hyena (*Hyaena hyaena*) and the Leopard (*Panthera pardus*) are not inherently incompatible but instead involve overlapping interests with context-specific areas of conflict. Recognising, understanding, and managing these interactions is essential for designing conservation strategies that are both ecologically effective and socially acceptable in shared landscapes. Accordingly, a key approach emerging from this study is the formalisation of Maldhari ecological stewardship, which would recognise and support traditional practices that contribute to habitat structure, connectivity, and species persistence. Such an approach can strengthen

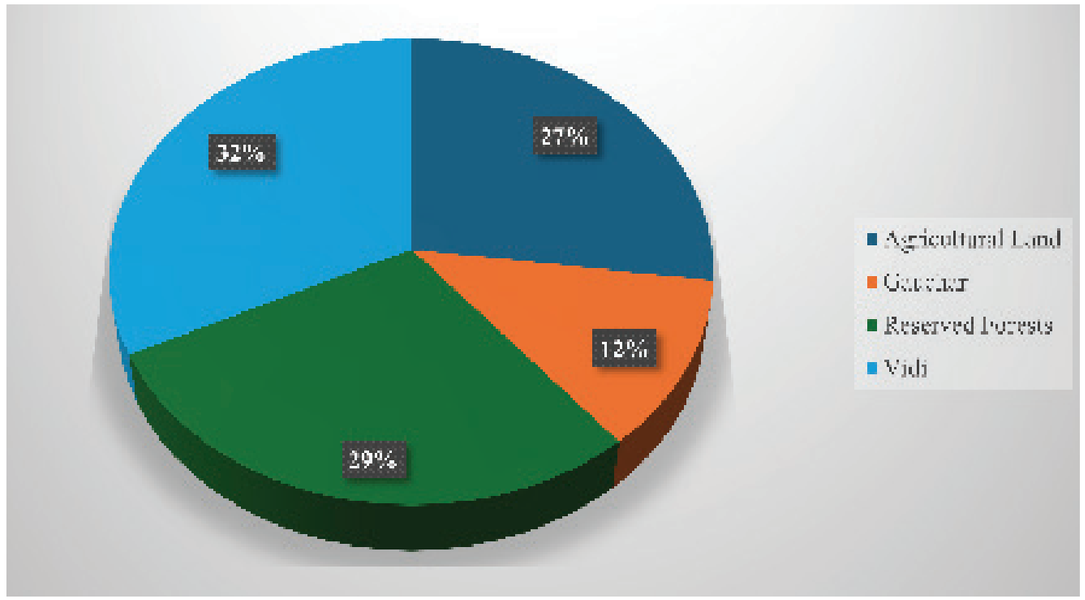


Figure 21. Pie chart showing the distribution of species richness among different habitats in Chotila Taluka.

coexistence between pastoralist livelihoods and conservation objectives, particularly for wide-ranging predators and habitat-specialist species.

This pie chart **(Figure 20)** displays how different habitats in Surendranagar support various mammal species. Among the four types—Agricultural Land, gauchar (community grazing land), Reserved Forests, and Vidi (private or institutional grazing land)—the vidis (n=32%) and Reserved Forests (n=29%) support the highest number of species. Together, they account for over 60% of the total mammal diversity recorded in the area.

This shows that vidis are very important for wildlife. These lands are often less disturbed, have good grass cover, and experience less livestock pressure compared to gauchars or farmlands. Because of this, vidis provide safe spaces for many animals—from herbivores like Nilgai and Chinkara to carnivores like Jackals and Hyenas—to rest, feed, and breed.
Reserved Forests also serve as crucial habitats, providing shade, vegetation, and protection.
In comparison, Agricultural lands (n=27%) still attract several adaptable species that move through fields to find food, such as foxes, jackals, and wild boars. However, gauchars (n=12%) support the fewest species, likely because heavy livestock grazing and frequent human activity make them less suitable for wildlife.

Overall, the results highlight that vidis are vital habitats for wildlife within Surendranagar's grazing landscape. Careful protection and management of these areas—by minimising disturbances, regulating grazing pressure, and maintaining natural vegetation cover—will be key to conserving the many mammal species that rely on them.

At the same time, ensuring a balanced use of gauchars and agricultural lands, alongside the protection of vidis and Reserved Forests, will help sustain biodiversity across the region. Strengthening and securing habitat corridors between these areas and across the broader landscape will provide safe movement routes for wildlife, offering refuge for threatened species and supporting the revival of their populations throughout Surendranagar's semi-arid ecosystems.

CHAPTER 6

DISCUSSION



This chapter discusses the study's findings within the wider context of Surendranagar's semi-arid grasslands. The results show that a mix of vidis, gauchars, agricultural fields, and patches of Reserved Forest supports a variety of mammal species, from top predators to grassland specialists. Even with ongoing human activity and livestock presence, this area still serves as a shared space where wildlife and pastoral livelihoods are closely connected. The diversity found in Chotila and Thangadh talukas emphasizes the ecological importance of human-influenced grasslands and highlights the key role of local land stewards in supporting biodiversity. Wildlife and pastoral systems in this region do not conflict; instead, they seem to shape each other through established land use practices, care, and seasonal movement.

Grassland Mosaic as a Living Landscape

Camera trap surveys showed that large herbivores like Nilgai (*Boselaphus tragocamelus*) and Wild Boar (*Sus scrofa*) are common. They were found alongside mesocarnivores such as the Golden Jackal (*Canis aureus*), Indian Fox (*Vulpes bengalensis*), and Jungle Cat (*Felis chaus*). These species were recorded in various land-use types, including community-managed vidis that are actively grazed. This indicates a high level of ecological adaptability.

The consistently high number of species found in vidis and Reserved Forests suggests that these areas serve as strongholds for biodiversity in a landscape that is otherwise used intensively. Vidis show how locally managed land-use practices, guided by traditional ecological knowledge, social norms, and stewardship ethics, can maintain habitat quality and ecological links in fragmented grassland systems.

Shrinking Commons and Emerging Ecological Pressures

Despite their ecological value, commons across the landscape are rapidly shrinking and degrading. Converting gauchars to croplands, the spread of invasive species like *Neltuma juliflora, Senna uniflora,* and *Lantana camara,* and fragmentation caused by roads, power lines, and other infrastructure are increasing pressures on wildlife and pastoral livelihoods.

As commons diminish, available forage decreases. This leads to greater grazing pressure on the remaining patches and more competition for resources. Wide-ranging carnivores such as the Striped Hyena, Leopard, and Wolf are forced to navigate human-dominated areas more often. This often results in livestock being killed and subsequent retaliatory actions.

These changes disrupt the historically negotiated balance between Maldhari pastoralists and grassland ecosystems. The loss of commons is not just about land use; it causes a deeper socio-ecological disruption that threatens biodiversity, livelihoods, and community resilience. Recognizing and restoring commons as both ecological and cultural assets is crucial for sustainable conservation planning in the



Figure 22. (A) shows a gauchar severely invaded by Senna uniflora, reflecting shrub encroachment and degraded habitat structure, while (B) depicts a healthy grass vidi dominated by native grasses, highlighting intact grassland ecology and better habitat quality.



Figure 23.Camera trap records from community-managed vidis showing Nilgai (Boselaphus tragocamelus), Wild Boar (Sus scrofa), Golden Jackal (Canis aureus), Indian Fox (Vulpes bengalensis), and Jungle Cat (Felis chaus), highlighting their ecological adaptability across actively grazed grasslands.

Local Stewardship and Traditional Knowledge: Case Studies

The study highlighted several examples of both individual and group efforts that support biodiversity at the grassroots level. These case studies show how **traditional ecological knowledge (TEK)**, daily practices, and a sense of responsibility for the land help build ecological resilience. They also back up a community-led conservation model based on real-life experiences.

Case 1: Ghula Kaka of Gunda – Sustaining Wildlife through Everyday Care

In Gunda village, **Ghula Kaka** has maintained a small waterhole on his farmland that serves as a critical dry-season resource for wildlife. Camera trap data recorded regular use of this water source by Golden Jackals, Indian Crested Porcupines, Small Indian Civets, and several bird species.

This low-cost, locally managed intervention demonstrates how small-scale actions—guided by observation and empathy—can yield substantial ecological benefits. Ghula Kaka's efforts exemplify coexistence in practice, reinforcing the idea that conservation outcomes often emerge from routine acts of care rather than formal protection alone. His practice of sharing knowledge with younger community members further strengthens intergenerational stewardship.



Figure 24. Camera trap images showing a Jungle Cat (Felis chaus), Small Indian Civet (Viverricula indica), Indian Crested Porcupine (Hystrix indica), and Golden Jackal (Canis aureus) using a waterhole developed and maintained by Ghula Kaka in his farmland at Gunda village. This privately managed water source provides vital drinking water for wildlife throughout the year, exemplifying how local stewardship and awareness support coexistence and ecological resilience in human-dominated landscapes.

Case 2: Raju Bhai Khachar of Rajapara – Guardian of a Productive Vidi

Raju Bhai Khachar's 435-acre *vidi* in Rajapara represents a model of active and sustained private stewardship. Despite residing in Rajkot, he visits the vidi weekly to monitor grass condition and manually remove invasive species such as *Neltuma juliflora* and *Senna uniflora*. As a result, the vidi remains among the most productive grasslands in the region.

Camera trap data, wildlife sightings, and pastoralist reports confirm the presence of Chinkara *(Gazella bennettii),* Jungle Cat, Indian Fox, and occasional signs of Striped Hyena. These observations highlight the capacity of well-managed private grasslands to support both livestock and wildlife, reinforcing the ecological importance of *vidis* within the Surendranagar landscape.



Figure 25. Lush green Vidi of Rajapara, owned and managed by Raju Bhai Khachar, is maintained free of invasive species through regular monitoring and manual removal. This well-managed grassland exemplifies sustainable land stewardship, supporting healthy soil, native vegetation, and diverse wildlife within the Surendranagar landscape.



Figure 26. Wildlife diversity recorded in Raju Bhai Khachar's 435-acre vidi, including Chinkara, Jungle Cat, Indian Fox, and signs of Striped Hyena—highlighting the habitat's high ecological value and suitability for grassland fauna.

Case 3: Meru Bhai of Gugaliyana – Keeper of Traditional Grassland Wisdom

Meru Bhai from Gugaliyana possesses extensive traditional knowledge about native grasses, shrubs, and ethnoveterinary practices. He can identify species by their local names, describe seasonal changes, and detail their nutritional and medicinal benefits. This knowledge provides important insights for restoring grasslands and supporting sustainable grazing. By combining traditional knowledge with scientific monitoring, people like Meru Bhai foster management methods that are both culturally relevant and ecologically sound. His mentoring of youth helps pass on grassland knowledge to future generations.



Figure 27. Grassland awareness session conducted to promote the understanding and identification of native floral species, featuring Meru Bhai from Gugaliyana as a Traditional Ecological Knowledge (TEK) holder. During the session, he guided maldhari youth and children in recognising local grasses, herbs, and shrubs, fostering intergenerational learning and strengthening community-based conservation practices.

Case 4: Women Stewards of Reshamiya – Reviving Biodiversity Through Knowledge and Tradition

In Reshamiya village, two women—**Mittalben Tramta** of the Maldhari community and **Manjuben Mansukhbhai Mori** of the Rawal community—demonstrate how traditional ecological knowledge (TEK) and community-driven stewardship continue to support biodiversity, cultural resilience, and sustainable living in the semi-arid grasslands of Surendranagar.

Mittalben represents the new wave of youth-led pastoral stewardship. Building on generations of Maldhari knowledge, she actively documents and practices ethno-veterinary methods for livestock health care, contributing to the well-being of indigenous breeds such as the Kankrej cow, Bhujang buffalo, and Kachhi goat. By sharing her traditional knowledge on scientific and public platforms, she demonstrates how pastoral wisdom can complement contemporary animal health practices. Supported by GRAMSEVA and government bodies, these community-led efforts help sustain cultural identity while promoting ecologically sound livestock management.

Complementing this, Manjuben carries forward the Rawal community's intimate understanding of grassland plants and seasonal food systems. She prepares traditional dishes using species like Drimia indica (kaleem ali), Momordica dioica (kankoda), prickly pear fruit, and the sap of the gorad tree (gunder). Her knowledge, passed down over five decades, connects families to the land and ensures continued use of local, seasonal, and climate-resilient foods. By teaching younger women about edible grasses and creepers during daily activities such as collecting firewood, she sustains a living tradition of ecological and culinary heritage.

Together, Mittalben and Manjuben highlight how TEK—whether in pastoral management or plant-based food systems—forms a foundation for sustainable resource use in a fragile landscape. Their contributions show that everyday practices rooted in observation, tradition, and community responsibility can significantly strengthen biodiversity conservation. Their roles, bridging both generational wisdom and contemporary engagement, exemplify the resilience and continuity of local stewardship in Reshamiya.


THE HINDU

Manjuben Mansukhbhai Mori, an expert in all things grass, creeper and cactus

The 65-year-old is dedicated to passing on her knowledge of traditional preparations to the younger generation

Updated - December 22, 2023 04:44 pm IST

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ચોટીલા તાલુકાના ઠાંગા પંથકના રેશમિયા ગામની યુવતીએ ગુજરાતનું પ્રતિનિધિત્વ કર્યું

માલધારી પરિવારની દીકરી આંતરરાષ્ટ્રીય પરિષદમાં ઝળકી

મિત્તલ ટરમટાએ પરિષદમાં ભાગ લઈ વરસાંગણાની જડીબુટ્ટીથી પશુઓની રોજિંદી સારસંભાળ પર પકડ્યા પાડ્યો

ઘરગથ્થું ઈલાજ માટે દેશી જડીબુટ્ટી ઉપયોગી

Figure 28. Celebrating the women stewards of Reshamiya — Manjuben Mansukhbhai Mori, who preserves traditional knowledge of grasses, creepers and cactus-based food, and Mittalben Tramta, a young Maldhari pastoralist representing Gujarat on global platforms through her work on indigenous livestock breeds. Their stories highlight how traditional ecological knowledge and community-led stewardship continue to shape conservation and resilience in the Surendranagar grasslands.



Figure 29. A vision for the future—reimagining Chotila's grasslands as resilient ecosystems enriched with native trees, shrubs, and herbaceous flora, restoring indigenous vegetation structure and strengthening ecological balance through community-led stewardship

Reimagining Grasslands as Shared Futures

The Surendranagar landscape showcases both the challenges and opportunities of coexistence. Its vidis, gauchars, and agricultural lands create a complex network where livelihoods and ecosystems are closely connected. The survival of top and mesocarnivores, the resilience of herbivore populations, and the continuation of traditional stewardship all indicate that conservation and pastoralism can work hand in hand.

However, moving forward requires balancing use and protection by empowering local communities, safeguarding commons, and ensuring connectivity between habitats. By doing so, the grasslands of Surendranagar can serve as a living example of coexistence, where ecological health and human well-being develop together through collective care and shared responsibility.

Toward a Framework for Community Led Conservation

These local stories support a community-centred approach to conservation in Surendranagar's grassland areas. Instead of excluding people from conservation efforts, strategies should build on their existing connections to the land. Therefore, Sahjeevan's conservation work in Surendranagar centres around strengthening community actions by leveraging legal provisions of Biological Diversity Act, 2002 and integrating private vidis into legal conservation framework that recognises these vidis as an ecological common managed according to local norms of care, reciprocity, and responsibility.

Strengthening Biodiversity Management Committees (BMCs)

In recent years, Sahjeevan's community engagement has strengthened Biological Diversity Management Committees (BMCs) across village clusters in the Chotila and Thangadh blocks. Key interventions that ensure sustained community participation include identifying traditional knowledge holders, understanding their cultural and economic connections to the landscape, and nurturing ecological stewardship among the youth. Additionally, the process involves documenting traditional knowledge and practices, assisting communities in preparing People's Biodiversity Registers (PBRs), and developing and executing localized conservation action plans.

Scientific Baseline and Spatial Mapping

Field surveys documented **18 mammal species** in the area, including important carnivores. High-resolution maps identified safe areas for species within community-managed vidis and assessed habitat quality across vidis, Reserved Forests, and other land uses. These results aid in meeting the requirements of the Wildlife (Protection) Act, 1972, offering the ecological support needed for future legal protection measures, like Community Reserves and corridor planning.

Socio-Ecological Assessment and Use Dynamics

Detailed socio-ecological studies are in progress to record traditional grazing practices, vidi management systems, seasonal livestock movements, and human–wildlife conflict areas. Early findings show differences in grazing intensity and habitat resilience based on land use, which strengthens the scientific basis for targeted restoration, capacity assessments, and community-led governance efforts.

Institutional Conservation Framework for Governance of Vidis

Consultations have started with pastoral communities, Kathi Darbar groups, and Forest Department officials to identify conservation priorities; communities' vision for these landscapes and to explore appropriate legal frameworks that promote communities' actions for conservation of landscape to protect and conserve wildlife and strengthen traditional economies in the region. A series of consultations with Kathi darbars to understand the legal status of these private vidis; their perceptions to get into conservation or community reserves; it's pros and cons, etc led us to build foundation to explore legal provisions and framework that ensures communities engagement in wildlife conservation actions and to protect and manage their landscape. Meetings with the Principal Chief Conservator of Forests, Gujarat and subsequent meetings with the Minister, Environment and Forest, Government of Gujarat has shown the state's willingness to collaborate with Sahjeevan to support this idea and to move forward in declaring it as either community reserves or community reserves. The PCCF believed if we succeed in this direction, this will be the State's first initiative where the forest department and communities have joined hands for the conservation actions. Both these efforts have yielded positive results to carve a path and further work on mobilising communities; developing technical proposals showcasing ecological significance and conservation value of these Vidis; and working closely with the state government to facilitate legal procedures for official declaration of Community/



CHAPTER 7

CONCLUSION



Synthesis of Key Findings and The Coexistence

The systematic study of semi-arid grasslands fundamentally challenges their mischaracterization as ecological "wastelands," instead positioning them as resilient, high-value ecosystems that warrant immediate and robust conservation measures. These landscapes harbour remarkable biodiversity, including 18 documented mammalian species among which six fall under Schedule I protection—such as the Indian Grey Wolf, Striped Hyena, Indian Leopard, Indian Fox, Jungle Cat, and Asiatic Wildcat—demonstrating their role as critical refuges for threatened wildlife. Community-managed grazing lands, known as vidis, exhibit the highest levels of species richness and habitat quality, a direct outcome of traditional pastoralist practices rooted in local Traditional Ecological Knowledge (TEK), including rotational grazing and sustainable land stewardship that foster wildlife persistence alongside human needs.

In stark contrast, the predominant threats to these ecosystems involve the progressive loss and degradation of common grazing lands or gauchars, coupled with their diversion for industrial development, mining activities, and the unchecked proliferation of invasive species like *Neltuma juliflora.* These pressures not only undermine ecological integrity but also imperil the livelihoods of pastoral communities such as the Maldhari and Darbar groups, who depend on these lands for their cultural and economic survival. Exclusionary conservation approaches, often characterized by fortress-style models that displace local users, prove entirely incompatible with the dynamic socio-ecological realities of these grasslands; the accumulated evidence thus mandates the adoption of Sahjeevan, a principled framework of coexistence that legally safeguards habitats while empowering communities as the primary stewards, ensuring that human activities actively sustain rather than erode biodiversity.

The foundational research conducted from December 2024 to May 2025 has laid a solid groundwork for this mandate, encompassing a comprehensive scientific baseline and mapping exercise that details the 18 mammalian species and identifies key refuges, such as those for the Indian Grey Wolf, thereby supplying the essential data compliant with the Wildlife Protection Act (WLPA), 1972, for pursuing protective designations like Community Reserves. Parallel socio-ecological assessments, which remain ongoing, have meticulously documented vidi management protocols, grazing regimes, carnivore-livestock conflict hotspots, and carrying capacity estimates, thereby validating ecologically viable focus areas and underscoring the need for enhanced connectivity across landscapes. Institutional engagements, also ongoing, have facilitated critical dialogues with pastoral associations, landowner groups, and forest authorities, forging the necessary consensus to underpin community-led governance structures and ensuring broad buy-in from the outset.

Limitations of the Study

The study acknowledges several limitations that must be considered for proper interpretation and for guiding future research and conservation planning. These limitations reflect broader patterns recognised in wildlife monitoring literature.

Temporal Scope: The camera trap surveys captured the dry season (December 2024–May 2025), excluding monsoon and post-monsoon periods. This seasonal sampling provides only a snapshot, potentially missing species and behaviours unique to other parts of the year. Wildlife activity and distributions can shift significantly between seasons, especially in semi-arid environments.

Spatial Scope: Research was focused on Thangadh and Chotila talukas, limiting the geographic breadth of the findings. Ecological dynamics, grazing intensity, and species distributions may differ across other regions of Surendranagar, so extrapolation to the entire district must be made with caution.

Detection Probability: Camera traps, while invaluable for detecting elusive species, cannot guarantee exhaustive detection. Absence of recorded images does not mean true absence, particularly for wide-ranging species like Indian Grey Wolves. Movement patterns, trap placement, and limited sampling periods can all introduce detection bias, as corroborated by comparable studies.

Sampling and Analytical Constraints: The strategy blended systematic grid-based and opportunistic TEK-informed placements, maximising detections but not designed for precise density or abundance. The use of the Relative Abundance Index (RAI) is suitable for relative activity but doesn't yield accurate population estimates. Such an approach, while pragmatic, is a recognised limitation in wildlife camera-trap research.

Mismatched Timing and Limited Groundwork: Logistical challenges impacted deployment, retrieval, and spatial planning, leading to uneven sampling coverage and variable detection rates across sites. This inconsistency—common in field-based studies—affects uniformity and comparability of the data.

Land Ownership, Permissions, and Equipment Loss: Incomplete communication with all landowners occasionally led to unauthorised deployments and ultimately the loss of equipment. This emphasises the importance of rigorous community engagement, prior informed consent, and transparent field protocols before conducting research in mixed-use, privately managed landscapes.



Figure 30. Seasonal transformation of the grassland landscape: The same area captured during the peak dry season (brown, desiccated grass cover) and the monsoon period (lush green vegetation), illustrating pronounced seasonal variability in grassland productivity and habitat

CHAPTER 8

RECOMMENDATIONS



Based on scientific evidence generated through systematic studies in semi-arid grassland ecosystems, this chapter presents a set of integrated recommendations aimed at safeguarding long-term biodiversity while simultaneously enhancing community well-being. Anchored in Sahjeevan's principle of *coexistence (Sahjeevan),* these recommendations recognise pastoral livelihoods as intrinsic to grassland ecology and propose a phased, participatory pathway for conservation action that combines ecological protection with sustainable development.

Conservation Recommendations

Conservation efforts in semi-arid grasslands must prioritise ecologically valuable habitats and traditional land-use systems that have historically supported biodiversity. Community-managed *vidis*, which harbour a wide range of species including Schedule I carnivores such as the Indian Fox (*Vulpes bengalensis*), Striped Hyena (*Hyaena hyaena*), Indian Leopard (*Panthera pardus*), and Golden Jackal (*Canis aureus*), require immediate protection from degradation, fragmentation, and incompatible land uses. These landscapes represent functioning conservation units and should be treated as such.

Reserved Forests within the landscape act as critical refuges for wildlife and should be managed in conjunction with surrounding commons to maintain ecological connectivity. Fragmented protection that isolates Reserved Forests from pastoral commons risks undermining landscape-level ecological processes.

Sustainable grazing practices practiced by pastoral communities are central to maintaining grassland structure, species diversity, and native plant assemblages. These systems, rooted in traditional ecological knowledge, should be formally recognised and supported through policy mechanisms, rather than being viewed as threats to wildlife conservation.

Restoration of degraded commons (vidis) should be undertaken through community-led initiatives, with a focus on removing invasive species such as *Senna uniflora* and reseeding native grasses like *Cenchrus ciliaris*. Such efforts can reduce habitat fragmentation, enhance forage availability, and ease grazing pressure on intact vidis.

Mitigating human–wildlife conflict remains essential for sustaining coexistence. Priority interventions include community-based livestock insurance schemes, timely and fair compensation mechanisms, predator-proof corrals, strategic use of Livestock Guardian Dogs, and bio-fencing. Together, these measures can reduce economic losses, strengthen tolerance towards carnivores, and prevent retaliatory actions.

Policy Recommendations

A fundamental policy shift is required to reclassify semi-arid grasslands from "wastelands" to ecosystems that are ecologically functional and socio-economically valuable. Such reclassification would enable legal protection, access to conservation financing, and institutional recognition that reflects the biodiversity and livelihood significance of these landscapes.

Formal recognition of Community Conserved Areas—particularly through notification of Community Reserves under the Wildlife (Protection) Act, 1972—should be actively pursued. These designations strengthen local stewardship, provide legal safeguards against industrial and infrastructure threats, and create shared governance structures between communities and the Forest Department.
Decision-making and benefit-sharing mechanisms must be centred on local institutions such as pastoral sangathans and landowner collectives to ensure transparency, inclusivity, and relevance. Further, integration of Biodiversity Management Committees (BMCs) under the Biological Diversity Act with Community Forest Rights Management Committees (CFRMCs) under the Forest Rights Act, 2006, can secure customary access rights while reinforcing conservation accountability.

Future Directions for Community-led Conservation

Long-term ecological monitoring should be institutionalised through a combination of camera trapping, sign surveys, habitat assessments, and community-led citizen science initiatives. Monitoring frameworks should track wildlife populations, habitat health, grazing dynamics, and land-use change over time. Establishing an open-access geospatial database on biodiversity, land use, and anthropogenic pressures will enable informed, adaptive governance.
Building youth capacity is critical for sustaining conservation outcomes. Training programmes in biodiversity monitoring, grassland ecology, and conservation



Figure 31. Community-led habitat restoration in Reshamiya Village: Local community members actively removing Senna uniflora, demonstrating collective stewardship and participatory efforts to restore native grassland (vidi) ecosystems.



Figure 32. Pastoral vigilance in the grasslands: Maldharis attentively guarding their livestock during grazing, reflecting traditional pastoral practices, coexistence with wildlife, and active stewardship of the grassland landscape.

leadership can foster intergenerational stewardship and local ownership. Linking ecosystem health to livelihoods—through producer cooperatives for wool and dairy, low-impact eco-tourism models that reinvest in restoration, and value-added enterprises—can further strengthen conservation incentives.

A robust framework for community-led conservation in semi-arid landscapes should therefore include:

Strengthening community institutions: Revitalising Biodiversity Management Committees and other statutory bodies to anchor conservation action locally.

Participatory monitoring: Training local youth to conduct biodiversity surveys and contribute to data analysis.

Restoration of degraded commons: Supporting removal of invasive species and regeneration of native grasses through collective action.

Livestock–wildlife coexistence programmes: Developing compensation, conflict mitigation, and awareness mechanisms to reduce retaliatory killing.

Recognition of local conservation champions: Individuals such as Ghula Kaka, Raju Bhai, Meru Bhai, Mittalben, and Manjuben exemplify custodianship rooted in lived ecological knowledge; recognising their contributions can inspire wider participation.

Youth stewardship: Education initiatives that link ecological understanding with livelihoods to promote sustainable resource use.

Sahjeevan's Action Plan: A Roadmap for Community Centric Conservation

Building upon the above recommendations, Sahjeevan's action plan is structured around three interlinked pillars: **legal recognition, community governance, and adaptive management.** The plan adopts a cluster-based approach that remains responsive to local institutions, ecological feedback, and administrative processes, enabling scalability at the district level without diluting community stewardship. The focus is on consolidating and formalising existing conservation practices rather than expanding into new territories.

Legal Recognition of Community Reserves under the Wildlife (Protection) Act, 1972

Sahjeevan will facilitate structured consultations with the Forest Department, pastoral communities, and private or communal landholders to assess the feasibility of notification under Section 36 of the Wildlife (Protection) Act, 1972. These consultations aim to build informed consent, clarify legal provisions and post-notification rights and responsibilities, delineate reserve boundaries using ecological baseline data, and align customary use patterns with land tenure records.





Figure 33. Intergenerational knowledge exchange in action—youth participants gaining hands-on ecological insights in the field under the mentorship of experienced practitioners, learning by doing and bridging traditional wisdom with scientific understanding. Alongside this, Kathi Darbars engaging in a focused meeting with vidi owners in Chotila, collaboratively shaping a concrete action plan for vidi conservation and sustainable stewardship.

Preparation of Detailed Technical Proposals for Community / Conservation Reserves

Based on consultation outcomes, site-specific technical proposals will be prepared for submission to the Chief Wildlife Warden (CWLW). Each proposal will include species inventories, habitat condition assessments, connectivity analyses, documented village resolutions and consent records, and GIS-supported boundary maps validated through field verification.

Following approval and notification, reserve boundaries will be demarcated using GPS coordinates, signage will be installed, and reserve status will be communicated through village-level meetings. This process is expected to be completed within a 12-month timeframe, subject to administrative procedures.

Activation and Strengthening of Statutory Community Institutions (BMCs and CFRMCs)

Across Gujarat, Biodiversity Management Committees (BMCs) have been constituted, though many remain non-functional. In collaboration with the Gujarat Biodiversity Board, Sahjeevan will support the reactivation of these BMCs, facilitate preparation of People's Biodiversity Registers (PBRs), and assist in identifying priority conservation actions.
Given the mosaic of commons within the Surendranagar landscape, Sahjeevan will also facilitate the formation and strengthening of Community Forest Rights Management Committees (CFRMCs) under the Forest Rights Act, 2006. These committees will play a key role in documenting customary grazing routes, seasonal access patterns, and conservation priorities. Capacity-building efforts will focus on roles and responsibilities, record-keeping, coordination with line departments, and conflict resolution.

Establishment of Community Reserve Management Committees (CRMCs)

Upon notification of Community Reserves, Community Reserve Management Committees (CRMCs) will be constituted as per WLPA provisions. These committees will include representatives from pastoral communities, landholders, village institutions, and the Forest Department. Sahjeevan will provide handholding support to ensure CRMCs function as effective decision-making bodies, including assistance with drafting bylaws, operational guidelines, financial management, compliance requirements, and enforcement responsibilities.

Preparation and Execution of Management Plans

Sahjeevan will support statutory committees in preparing long-term Management and Conservation Plans grounded in scientific data on species presence, habitat condition, and connectivity, alongside documented grazing practices, wildlife interactions, and socio-economic considerations. These plans will serve as legal instruments guiding resource use, conservation practices, monitoring, and adaptive management.
Priority actions will be phased to address habitat restoration, grazing regulation, human–wildlife conflict mitigation, and livelihood strengthening. The plans will also emphasise leveraging existing government schemes to ensure sustainable financing for implementation.

Ecological Education for Youth Stewardship

Building on Sahjeevan's experience with field-based certificate courses in Grassland Ecology in the Banni landscape—conducted in collaboration with Kutch University and later Shiv Nadar University—a similar programme is being designed for the Surendranagar landscape. This course will equip local youth with scientific understanding of their ecosystems and actively engage them in conservation actions led by statutory committees.

Policy Interventions and Knowledge-Sharing Platforms

To disseminate learnings from this pilot and foster cross-regional collaboration, Sahjeevan will organise periodic knowledge-sharing workshops. These platforms will enable exchange of experiences, partnership building, and collective advocacy. Recognising that many interventions—such as sustainable financing mechanisms and formal recognition of community conservation roles—require enabling policy environments, Sahjeevan will work to identify policy gaps and engage in dialogue at state and national levels to support community-led conservation.

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Annexure I: Species Checklist

Table 4. Species checklist of Chotila Commons showing all mammalian species recorded through camera trapping, along with the corresponding number of photographic captures for each species. This table provides a summary of species occurrence and detection frequency, offering insights into relative activity and habitat use within the study area.

S.No	Common Name	Scientific Name	Family	IUCN Conservation status	WLPA Status
1	Asiatic Wildcat Hybrid	*Felis lybica ornata* × *Felis catus*	Felidae	Not Evaluated	Not Listed (Hybrid)
2	Bengal Fox	*Vulpes bengalensis*	Canidae	Least Concern (LC)	Schedule II
3	Feral Dogs	*Canis lupus familiaris*	Canidae	Not Evaluated	Not Listed (Domesticated)
4	Five Striped Squirrel	*Funambulus pennantii*	Sciuridae	Least Concern (LC)	Not Listed
5	Golden Jackal	*Canis aureus*	Canidae	Least Concern (LC)	Schedule II
6	Indian Hedgehog	*Paraechinus micropus*	Erinaceidae	Least Concern (LC)	Schedule IV
7	Indian Crested Porcupine	*Hystrix indica*	Hystricidae	Least Concern (LC)	Schedule IV
8	Indian Grey Mongoose	*Herpestes edwardsii*	Herpestidae	Least Concern (LC)	Schedule II
9	Indian Grey Wolf	*Canis lupus pallipes*	Canidae	Least Concern (LC)	Schedule I
10	Indian Hare	*Lepus nigricollis*	Leporidae	Least Concern (LC)	Schedule IV
11	Jungle Cat	*Felis chaus*	Felidae	Least Concern (LC)	Schedule II
12	Leopard	*Panthera pardus*	Felidae	Vulnerable (VU)	Schedule I
13	Livestock	—	Bovidae	Not Evaluated	Not Listed (Domesticated)
14	Nilgai	*Boselaphus tragocamelus*	Bovidae	Least Concern (LC)	Schedule III
15	Rodent	*Rattus spp.*	Muridae	Least Concern (LC)	Not Listed
16	Small Indian Civet	*Viverricula indica*	Viverridae	Least Concern (LC)	Schedule II
17	Striped Hyena	*Hyaena hyaena*	Hyaenidae	Near Threatened (NT)	Schedule I
18	Wild Boar	*Sus scrofa*	Suidae	Least Concern (LC)	Schedule III
19	Bengal Monitor	*Varanus bengalensis*	Varanidae	Near Threatened (NT)	Schedule I
20	Oriental Garden Lizard	*Calotes versicolor*	Agamidae	Least Concern (LC)	Not Listed

Table 5. Species checklist of Vavdi Reserved Forest showing all mammalian species recorded through camera trapping, along with the corresponding number of photographic captures for each species. This table provides a summary of species occurrence and detection frequency, offering insights into relative activity and habitat use within the study area.

S.No	Common Name	Scientific Name	Family	IUCN Conservation status	WLPA Status
1	Asiatic Wildcat Hybrid	*Felis lybica ornata* × *Felis catus*	Felidae	Not Evaluated	Not Listed (Hybrid)
2	Bengal Fox	*Vulpes bengalensis*	Canidae	Least Concern (LC)	Schedule II
3	Feral Dogs	*Canis lupus familiaris*	Canidae	Not Evaluated	Not Listed (Domesticated)
4	Indian Hedgehog	*Paraechinus micropus*	Erinaceidae	Least Concern (LC)	Schedule IV
5	Indian Grey Mongoose	*Herpestes edwardsii*	Herpestidae	Least Concern (LC)	Schedule II
6	Indian Hare	*Lepus nigricollis*	Leporidae	Least Concern (LC)	Schedule IV
7	Jungle Cat	*Felis chaus*	Felidae	Least Concern (LC)	Schedule II
8	Leopard	*Panthera pardus*	Felidae	Vulnerable (VU)	Schedule I
9	Livestock	—	Bovidae	Not Evaluated	Not Listed (Domesticated)
10	Nilgai	*Boselaphus tragocamelus*	Bovidae	Least Concern (LC)	Schedule III
11	Small Indian Civet	*Viverricula indica*	Viverridae	Least Concern (LC)	Schedule II
12	Wild Boar	*Sus scrofa*	Suidae	Least Concern (LC)	Schedule III

Table 6. Species checklist of Gugaliyana Reserved Forest showing all mammalian species recorded through camera trapping, along with the corresponding number of photographic captures for each species. This table provides a summary of species occurrence and detection frequency, offering insights into relative activity and habitat use within the study area.

S.No	Common Name	Scientific Name	Family	IUCN Conservation status	WLPA Status
1	Asiatic Wildcat Hybrid	*Felis lybica ornata × Felis catus*	Felidae	Not Evaluated	Not Listed (Hybrid)
2	Bengal Fox	*Vulpes bengalensis*	Canidae	Least Concern (LC)	Schedule II
3	Feral Dogs	*Canis lupus familiaris*	Canidae	Not Evaluated	Not Listed (Domesticated)
4	Five Striped Squirrel	*Funambulus pennantii*	Sciuridae	Least Concern (LC)	Not Listed
5	Golden Jackal	*Canis aureus*	Canidae	Least Concern (LC)	Schedule II
6	Indian Hedgehog	*Paraechinus micropus*	Erinaceidae	Least Concern (LC)	Schedule IV
7	Indian Crested Porcupine	*Hystrix indica*	Hystricidae	Least Concern (LC)	Schedule IV
8	Indian Grey Mongoose	*Herpestes edwardsii*	Herpestidae	Least Concern (LC)	Schedule II
9	Indian Grey Wolf	*Canis lupus pallipes*	Canidae	Least Concern (LC)*	Schedule I
10	Indian Hare	*Lepus nigricollis*	Leporidae	Least Concern (LC)	Schedule IV
11	Jungle Cat	*Felis chaus*	Felidae	Least Concern (LC)	Schedule II
12	Leopard	*Panthera pardus*	Felidae	Vulnerable (VU)	Schedule I
13	Livestock	—	Bovidae	Not Evaluated	Not Listed (Domesticated)
14	Nilgai	*Boselaphus tragocamelus*	Bovidae	Least Concern (LC)	Schedule III
15	Rodent	*Rattus spp.*	Muridae	Least Concern (LC)	Not Listed
16	Small Indian Civet	*Viverricula indica*	Viverridae	Least Concern (LC)	Schedule II
17	Striped Hyena	*Hyaena hyaena*	Hyaenidae	Near Threatened (NT)	Schedule I
18	Wild Boar	*Sus scrofa*	Suidae	Least Concern (LC)	Schedule III
19	Bengal Monitor	*Varanus bengalensis*	Varanidae	Near Threatened (NT)	Schedule I
20	Oriental Garden Lizard	*Calotes versicolor*	Agamidae	Least Concern (LC)	Not Listed



Annexure II: Species Photograph

Mesocarnivores











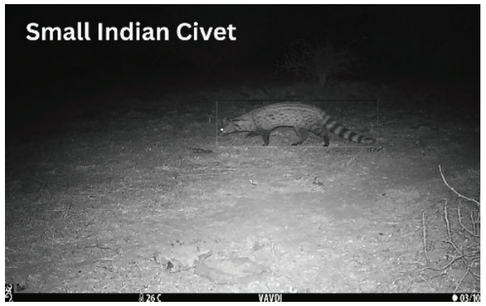






Figure 34. Camera trap images of mesocarnivores recorded during the study period across the grassland and semi-arid habitats of the study area. These captures highlight the presence and activity patterns of key mid-level predators, offering important insights into trophic interactions, habitat use, and overall ecosystem health within the landscape.

Carnivores







Figure 35. Camera trap images of carnivores documented during the study period across the study area. These records illustrate the presence, movement, and habitat use of apex and large carnivores, underscoring the ecological significance of the region's grassland–forest mosaic and the need for continued monitoring and conservation efforts.

Ungulates

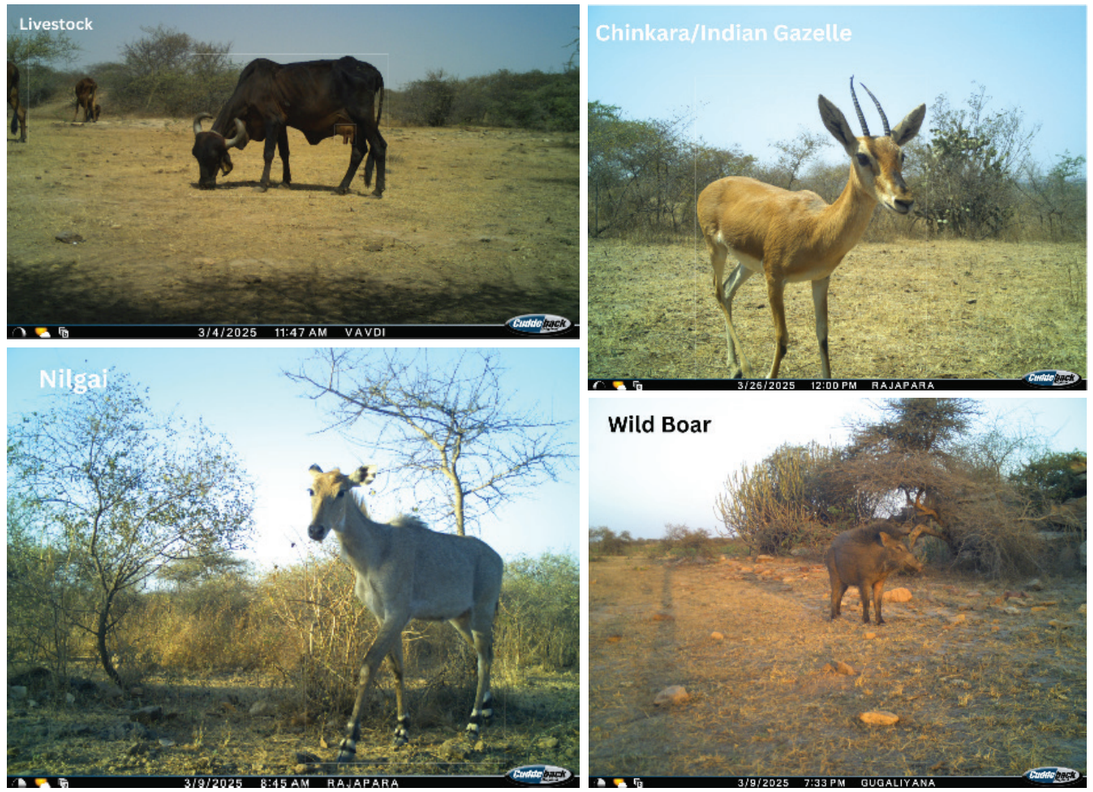


Figure 36. Camera trap images of ungulates and livestock recorded during the study period across the study area. These captures highlight the overlap between wild herbivores and domestic livestock in shared grazing landscapes, offering insights into habitat use, resource competition, and the dynamics of human–wildlife coexistence within the region.

Other Interesting Captures

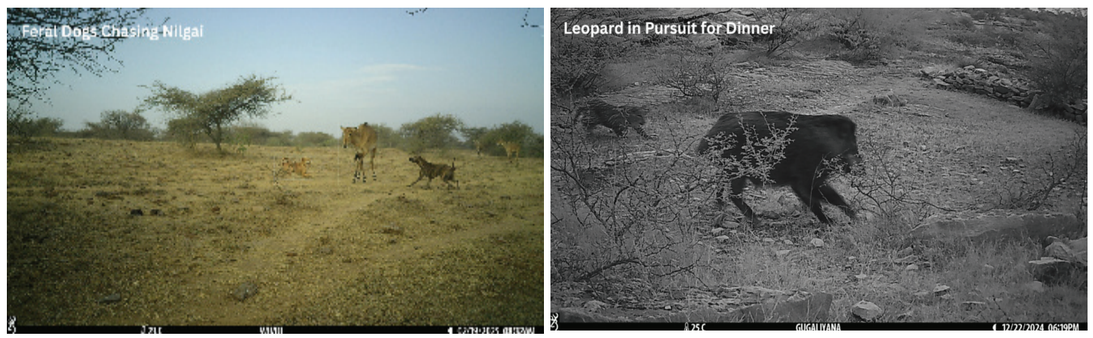


Figure 37. A selection of notable and unusual camera trap captures recorded during the study period across the study area. These images showcase unique wildlife behaviours, rare species occurrences, and unexpected interactions, reflecting the ecological richness and dynamic nature of the grassland–forest mosaic.



Figure 38. A selection of notable and unusual camera trap captures recorded during the study period across the study area. These images showcase unique wildlife behaviours, rare species occurrences, and unexpected interactions, reflecting the ecological richness and dynamic nature of the grassland–forest mosaic.

Annexure III: Additional Maps

Land Use- Land Cover Map of Thangadh and Chotila Talukas

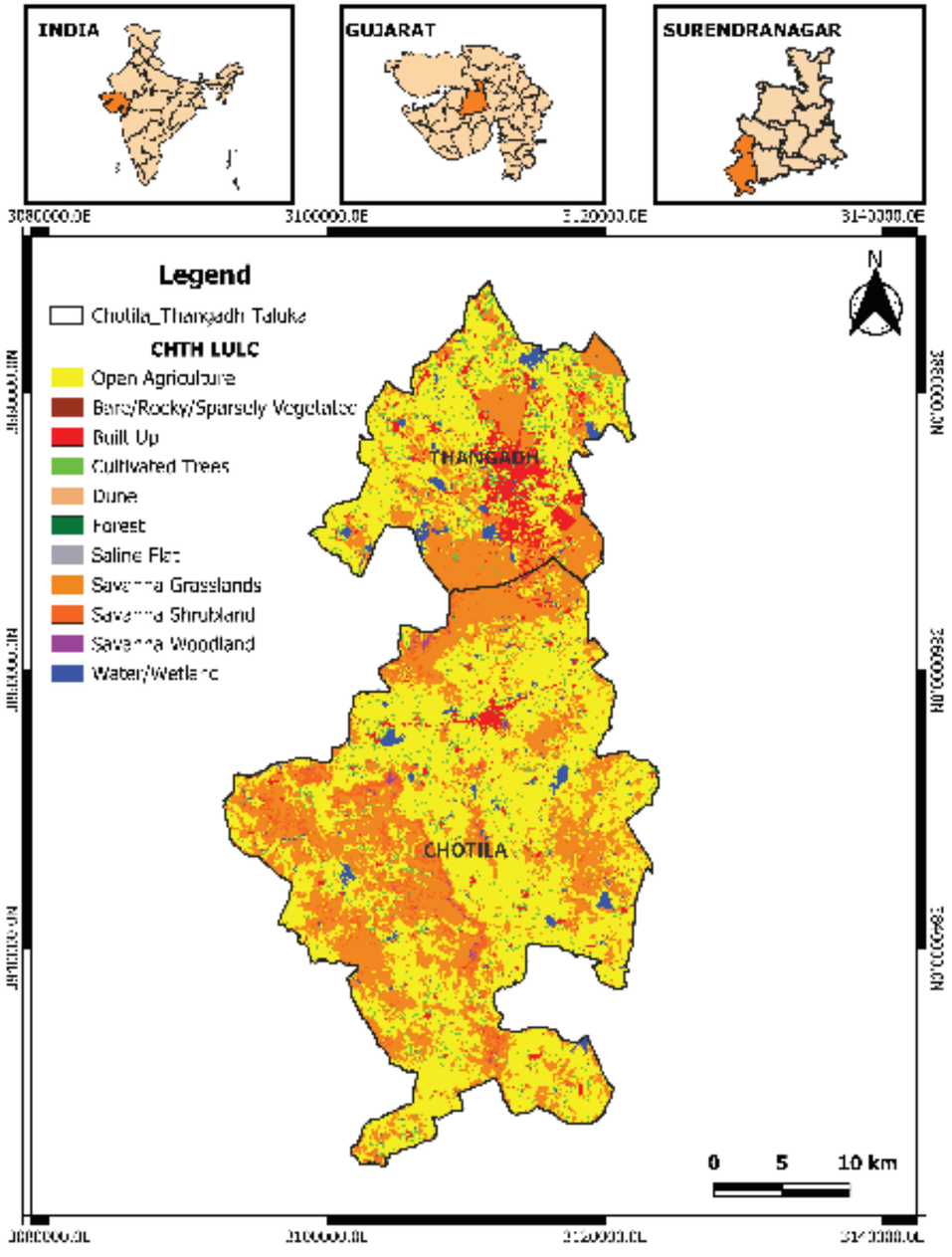


Figure 39. This map illustrates the diverse ecological matrix of the Chotila and Thangadh Taluka, which served as the primary sites for our recent camera trapping study for wild canids. The landscape is a mosaic of savanna ecosystems (locally known as vidis), forests, and seasonal agricultural fields. These areas are critical corridors for carnivores such as the Indian Fox, Striped Hyena, Golden Jackal, Indian Grey Wolf, and Leopards.

Camera Trap Locations across Commons of Chotila

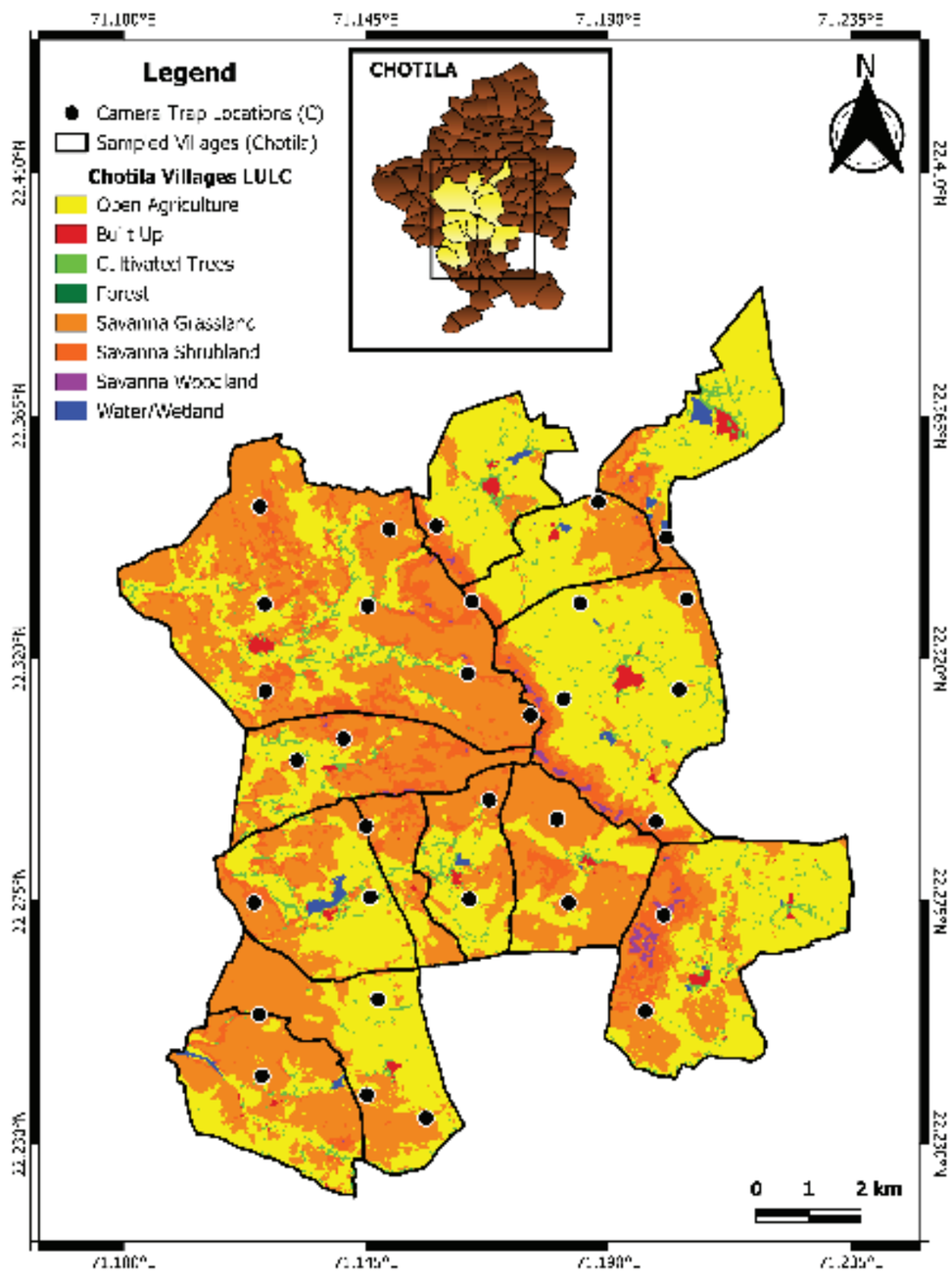


Figure 40. LULC Map and Sampling Design for the Chotila Study Area: The points overlaid on the LULC map represent the locations of camera traps deployed across selected villages. The sampling design prioritizes the savanna ecosystem (vidis), which serves as the primary habitat for species like the Indian Fox, Golden Jackal and Striped Hyena. The map further delineates agricultural lands and forest fragments, showing the spatial relationship between land-use patterns and the locations chosen for biodiversity monitoring.

Camera Trap Locations in Gugaliyana Reserve Forest

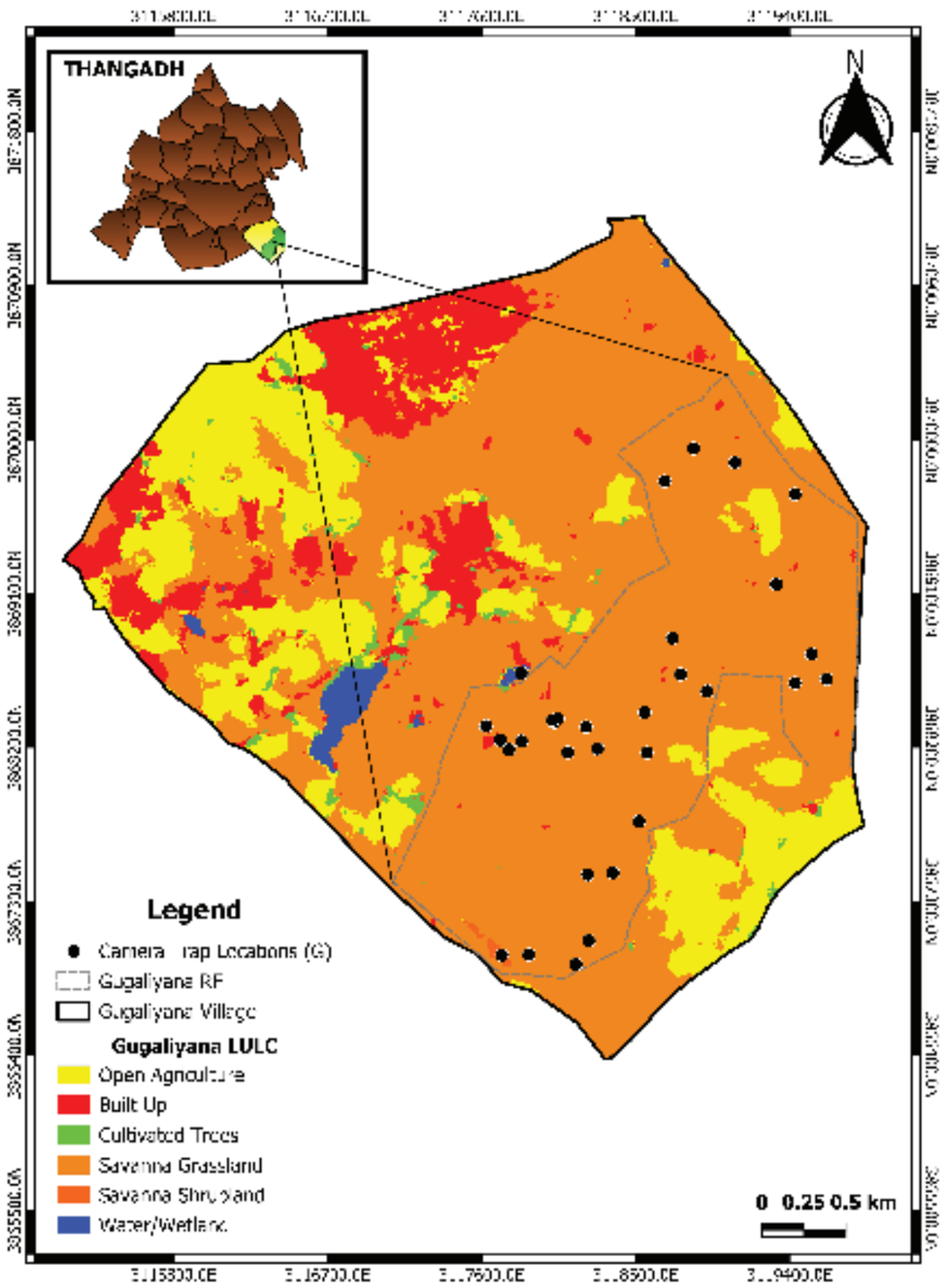


Figure 41. Camera Trap Sampling Design within the Gugaliyana Reserve Forest: The map displays a rough boundary outline of the Reserve Forest habitat, overlaid with the specific GPS-recorded locations of deployed camera trap units. This sampling was designed to monitor the occupancy, and diversity of wild canids (such as the Indian Fox, Indian Grey Wolf, Striped Hyena and Golden Jackal) within the forest core. The placement of points reflects a strategic focus on animal trails and clearings to maximize detection rates for elusive carnivores.

Camera Trap Locations in Vavdi Reserve Forest

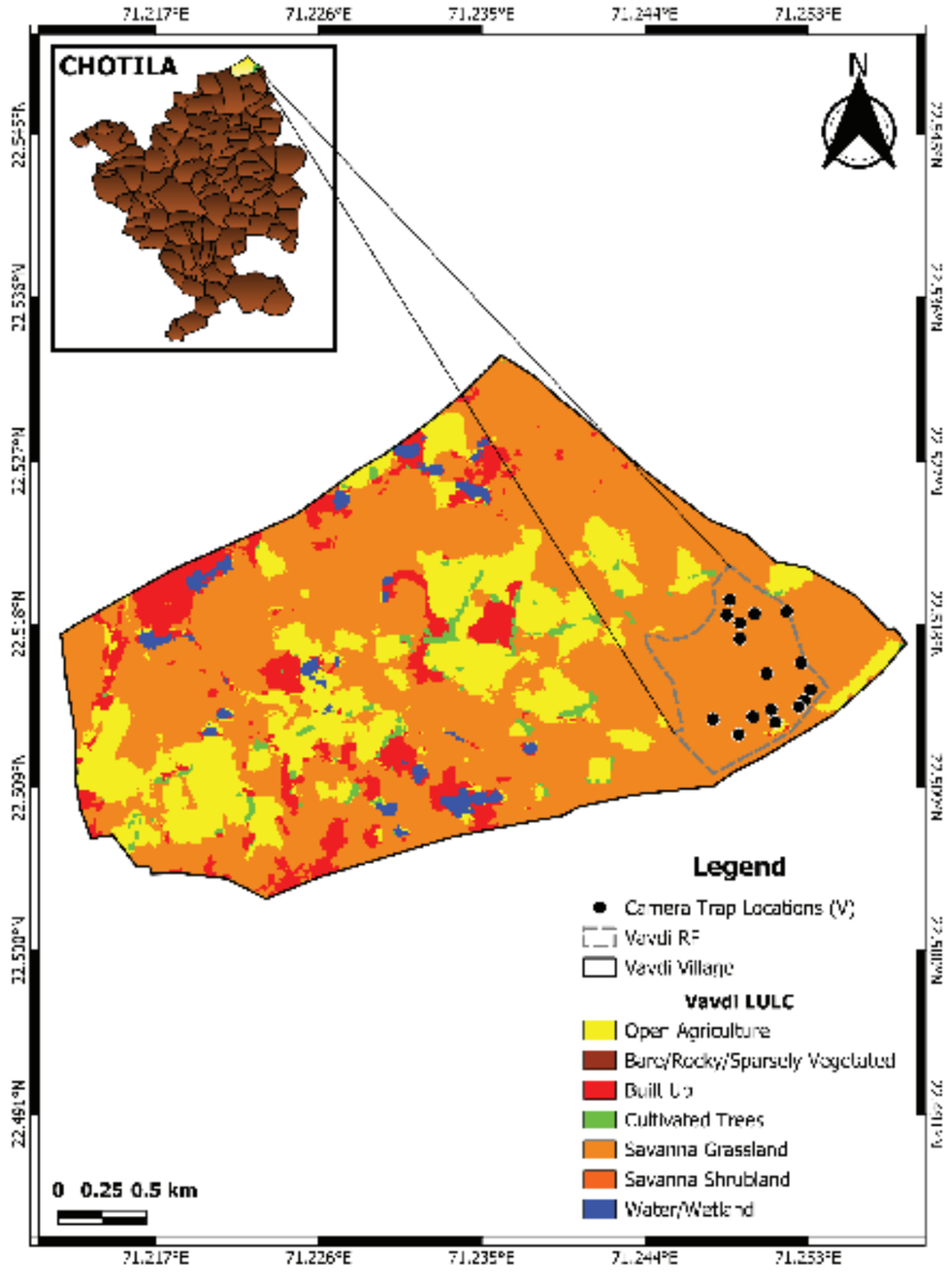


Figure 42. Monitoring Core Habitats—The Vavdi Reserve Forest (rough outline) Camera Trapping Study: As part of the intensive camera trapping exercise in Chotila Taluka, this map highlights the stations deployed within the Vavdi village boundaries. By focusing on the Vavdi Reserve Forest, the study documents how protected forest patches serve as critical refuges for Schedule I species, such as the Indian Leopard, Indian Fox, and Golden Jackal while highlighting the importance of the connectivity between these forests and communal grazing lands.

