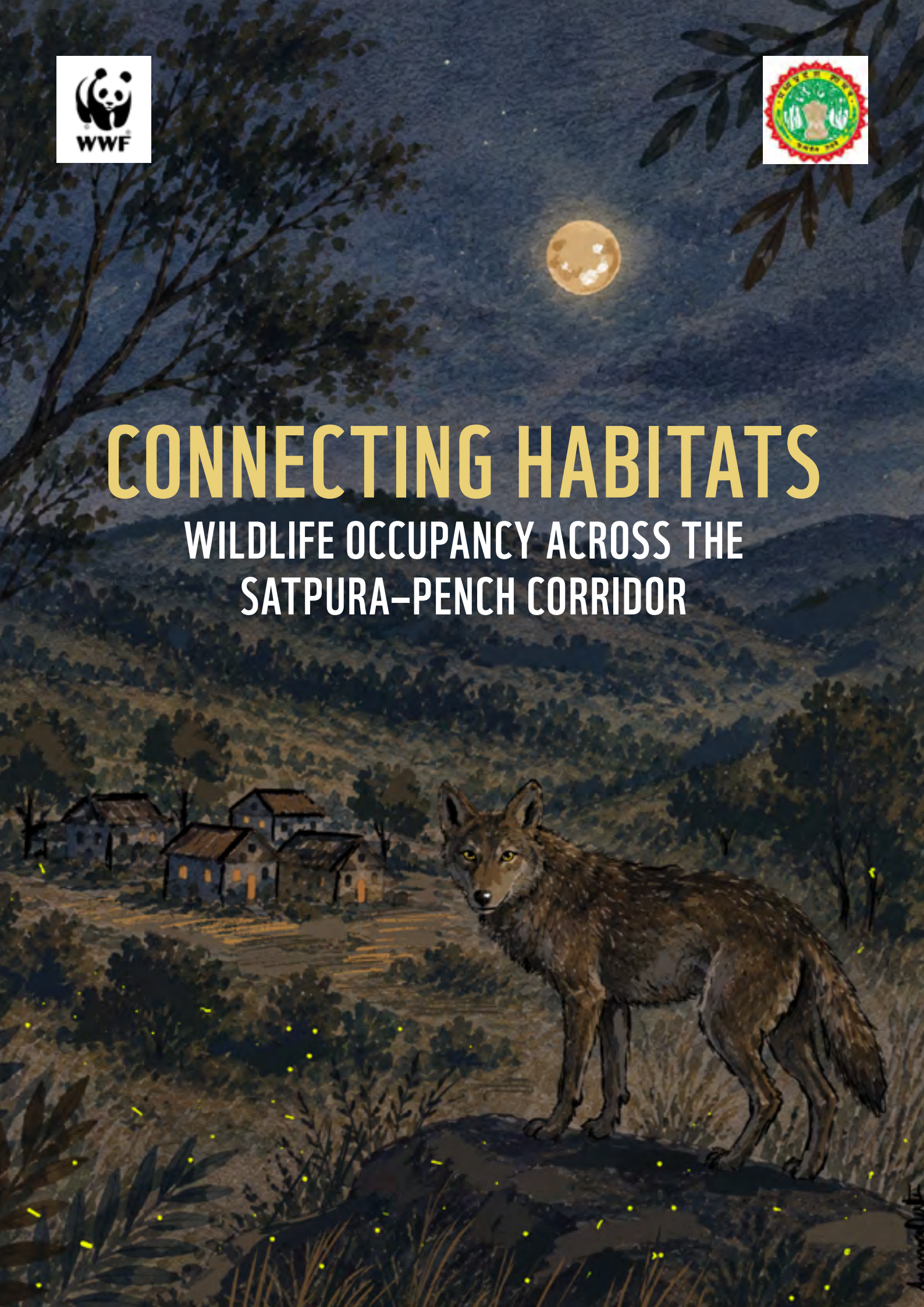

CONNECTING HABITATS

WILDLIFE OCCUPANCY ACROSS THE SATPURA–PENCH CORRIDOR



Report by
World Wide Fund for Nature - India (WWF-India)

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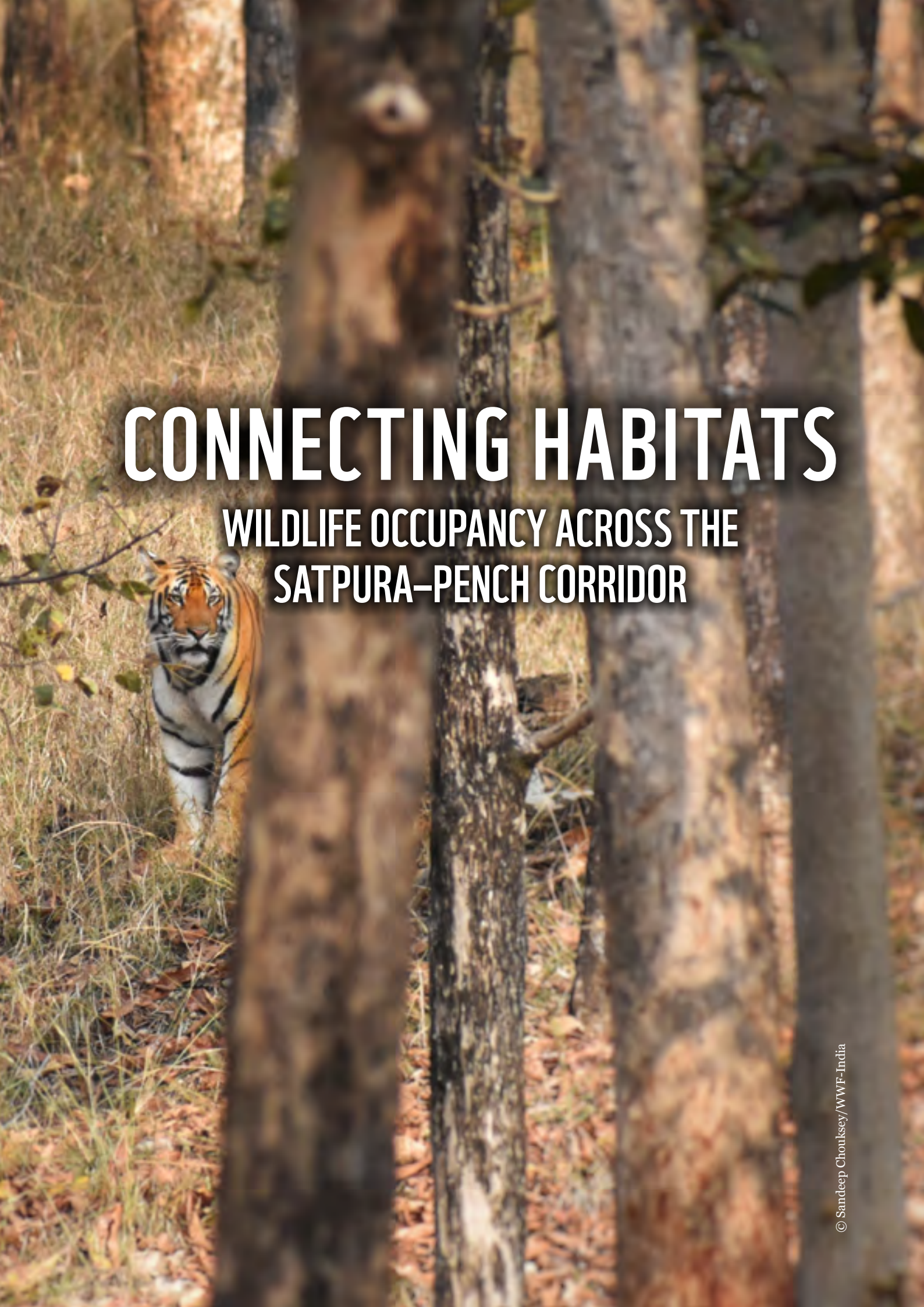

CONNECTING HABITATS

WILDLIFE OCCUPANCY ACROSS THE SATPURA–PENCH CORRIDOR

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FOREWORD

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FOREWORD



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EXECUTIVE SUMMARY

The Satpura–Pench Corridor (SPC) is one of the most important wildlife linkages in Central India, connecting the Satpura and Pench Tiger Reserves, and facilitating the movement and persistence of tigers and other large mammal metapopulations across the Central Indian landscape. However, habitat fragmentation, infrastructure development, mining, agricultural intensification, and other anthropogenic pressures are increasingly altering the corridor. Despite these pressures, the corridor continues to support a diverse assemblage of wildlife while retaining its functional role as a movement and dispersal landscape for several species. A contemporary, spatially extensive assessment was therefore required to establish how wildlife currently uses the landscape and to identify areas critical for maintaining corridor connectivity.

Between December 2024 and April 2025, an extensive camera-trap survey was conducted across approximately 1,650 km² of the corridor. The survey covered 821 sampling units of 2 km² each, distributed across seven forest divisions and 21 ranges. The study represents the first comprehensive, corridor-wide assessment of wildlife occurrence and habitat use across the SPC, providing a contemporary baseline for the corridor. Camera-trap detections were used to document mammal occurrence, estimate Relative Abundance Indices, and model species- and guild-level habitat use while accounting for imperfect detection. Individual identification of large carnivores, combined with spatial analyses, was used to examine patterns of wildlife use and identify potential bottlenecks within the corridor.

A total of 26 mammalian species were documented, including tiger (*Panthera tigris*), leopard (*Panthera pardus*), Asiatic wild dog (*Cuon alpinus*), Indian wolf (*Canis lupus pallipes*), sloth bear (*Melursus ursinus*), honey badger (*Mellivora capensis indica*), four-horned antelope (*Tetracerus quadricornis*), chinkara (*Gazella bennettii*), nilgai (*Boselaphus tragocamelus*), and wild pig (*Sus scrofa*). The widespread occurrence of leopards, wild pigs, nilgai, and chowsingha demonstrates the corridor's continued importance in providing habitat and connectivity beyond protected area (PA) boundaries.

Occupancy analysis revealed that carnivore presence was strongly associated with areas supporting higher prey abundance, while herbivore distribution was influenced largely by tree cover and proximity to PAs. Within the corridor, the Lawaghoghri–Ambada–Sausar area emerged as an important area of overlap, supporting high probabilities of use by both carnivores and ungulates. The study also identified critical gaps in structural connectivity that threaten the corridor's long-term integrity. These structurally vulnerable sections are characterised by multiple human-induced pressures. The Navegaon–Junnardeo gap was identified as the most critical bottleneck within the corridor, with limited forest cover, multiple infrastructure barriers, and the conspicuous absence of large carnivore detections. The continued degradation of such bottlenecks could substantially reduce connectivity between the two tiger reserves.

The study's findings highlight an important conservation reality: although wildlife continues to persist and move through human-dominated landscapes, such as agricultural areas, across the SPC, wildlife occurrence within the corridor does not necessarily indicate functional connectivity between the two PAs, particularly where critical bottlenecks constrain movement. Maintaining connectivity across the SPC will require coordinated multi-stakeholder action to extend conservation efforts beyond reserved forests to private agricultural lands and revenue lands. This will entail a combination of approaches, including habitat restoration, mitigating the impacts of linear infrastructure, wildlife-friendly land-use planning, mining safeguards, improved livestock management, and community stewardship of private land and commons. Protecting and restoring this corridor is critical not only for the conservation of tigers and other wide-ranging species, but also for maintaining the ecological integrity of the Central Indian landscape.

कार्यकारी सारांश

सतपुड़ा–पेंच कॉरिडोर (SPC) मध्य भारत के सबसे महत्वपूर्ण वन्यजीव भ्रमण मार्गों (Wildlife Corridors) में से एक है। यह सतपुड़ा और पेंच टाइगर रिज़र्व को जोड़ता है तथा बाघों और अन्य बड़े स्तनधारी जीवों की आवाजाही, प्रसार (dispersal) और दीर्घकालिक अस्तित्व (persistence) को बनाए रखने में महत्वपूर्ण भूमिका निभाता है। यह कॉरिडोर मध्य भारतीय परिदृश्य में विभिन्न वन्यजीव आबादियों के बीच जैविक संपर्क (Connectivity) बनाए रखने में भी सहायक है।

हालाँकि, आवास (Habitat) का विखंडन, सड़क और रेल जैसी अवसंरचना (Infrastructure) का विकास, खनन, कृषि का विस्तार तथा अन्य मानवीय गतिविधियाँ इस कॉरिडोर की संरचना और कार्यक्षमता को लगातार प्रभावित कर रही हैं। इसके बावजूद, यह क्षेत्र आज भी अनेक वन्यजीव प्रजातियों को आवास प्रदान करता है और उनके आवागमन तथा प्रसार के लिए एक कार्यशील परिदृश्य (Functional Landscape) के रूप में अपनी भूमिका निभा रहा है। इसलिए यह जानना आवश्यक था कि वर्तमान समय में वन्यजीव इस परिदृश्य का किस प्रकार उपयोग कर रहे हैं और कौन-से क्षेत्र कॉरिडोर की संपर्क क्षमता (Connectivity) बनाए रखने के लिए सबसे अधिक महत्वपूर्ण हैं।

दिसंबर 2024 से अप्रैल 2025 के बीच लगभग 1,650 वर्ग किलोमीटर क्षेत्र में एक व्यापक कैमरा ट्रैप सर्वेक्षण किया गया। इस सर्वेक्षण में 2 वर्ग किलोमीटर के 821 सैंपलिंग यूनिट शामिल थे, जो 7 वन मंडलों और 21 वन परिक्षेत्रों (Ranges) में फैले हुए थे। यह अध्ययन पूरे सतपुड़ा–पेंच कॉरिडोर में वन्यजीवों की उपस्थिति और आवास उपयोग का पहला व्यापक मूल्यांकन है और भविष्य के अध्ययनों के लिए एक आधार (Baseline) उपलब्ध कराता है।

कैमरा ट्रैप से प्राप्त चित्रों के आधार पर स्तनधारी प्रजातियों की उपस्थिति दर्ज की गई, Relative Abundance Index (RAI) का अनुमान लगाया गया तथा विभिन्न प्रजातियों और प्रजाति समूहों (Guilds) के आवास उपयोग का विश्लेषण किया गया। विश्लेषण में इस बात का भी ध्यान रखा गया कि सभी उपस्थित प्रजातियाँ हर बार कैमरा ट्रैप में दर्ज नहीं होतीं। बड़े मांसाहारी जीवों की व्यक्तिगत पहचान तथा स्थानिक विश्लेषण (Spatial Analysis) की सहायता से उनके उपयोग के पैटर्न और कॉरिडोर के संभावित अवरोधक क्षेत्रों (Bottlenecks) की पहचान की गई।

अध्ययन के दौरान 26 स्तनधारी प्रजातियाँ दर्ज की गईं। इनमें बाघ (***Panthera tigris***), तेंदुआ (*Panthera pardus*), ढोल (***Cuon alpinus***), भारतीय भेड़िया (***Canis lupus pallipes***), रीछ (***Melursus ursinus***), बिज्जू/हनी बैजर ***(Mellivora capensis indica***), चौसिंगा (***Tetracerus quadricornis***), चिंकारा (***Gazella bennettii***), नीलगाय (***Boselaphus tragocamelus***) तथा जंगली सूअर (***Sus scrofa***) प्रमुख हैं।

तेंदुआ, जंगली सूअर, नीलगाय और चौसिंगा की व्यापक उपस्थिति दर्शाती है कि यह कॉरिडोर आज भी संरक्षित क्षेत्रों के बाहर वन्यजीवों को आवास और सुरक्षित आवाजाही के अवसर उपलब्ध करा रहा है। कई स्थानों पर प्रजनन कर रहे तेंदुओं (Breeding Leopards) का दर्ज होना तथा बड़े मांसाहारी जीवों द्वारा कॉरिडोर के कुछ हिस्सों का बार-बार उपयोग यह भी दर्शाता है कि पर्याप्त शाकाहारी जीवों की उपलब्धता न केवल वन्यजीवों की आवाजाही को बढ़ावा देती है, बल्कि बड़े मांसाहारी जीवों के लिए महत्वपूर्ण भोजन संसाधन भी प्रदान करती है।

ऑक्यूपेंसी (Occupancy) विश्लेषण से पता चला कि मांसाहारी जीव मुख्यतः उन क्षेत्रों में अधिक पाए गए जहाँ शिकार प्रजातियों (Prey) की उपलब्धता अधिक थी। वहीं शाकाहारी जीवों का वितरण मुख्य रूप से वृक्ष आवरण (Tree Cover) और संरक्षित क्षेत्रों की निकटता से प्रभावित था। पूरे कॉरिडोर में लावाघोघरी–अंबाड़ा–सौसर क्षेत्र ऐसा महत्वपूर्ण क्षेत्र पाया गया जहाँ मांसाहारी और शाकाहारी दोनों समूहों की उपस्थिति की संभावना अधिक थी।

अध्ययन ने कॉरिडोर की संरचनात्मक संपर्क क्षमता (Structural Connectivity) में कुछ गंभीर कमजोरियों की भी पहचान की। ये क्षेत्र अनेक मानवीय दबावों से प्रभावित हैं। इनमें नवेगांव– जुन्नारदेव गैप सबसे महत्वपूर्ण अवरोधक (Critical Bottleneck) के रूप में सामने आया। इस क्षेत्र में वन आवरण सीमित है, कई सड़क और रेल जैसी अवसंरचना बाधाएँ मौजूद हैं तथा बड़े मांसाहारी जीवों की उपस्थिति लगभग नहीं के बराबर दर्ज हुई। यदि ऐसे क्षेत्रों का क्षरण लगातार जारी रहा, तो सतपुड़ा और पेंच टाइगर रिज़र्व के बीच वन्यजीव भ्रमण गंभीर रूप से प्रभावित हो सकता है।

इस अध्ययन के निष्कर्ष संरक्षण की एक महत्वपूर्ण वास्तविकता को सामने लाते हैं। यद्यपि वन्यजीव सतपुड़ा–पेंच कॉरिडोर में कृषि क्षेत्रों जैसे मानव-प्रभावित परिदृश्यों का उपयोग करते हुए आज भी जीवित हैं और आवाजाही कर रहे हैं, लेकिन केवल उनकी उपस्थिति यह सिद्ध नहीं करती कि दोनों संरक्षित क्षेत्रों के बीच प्रभावी जैविक संपर्क (Functional Connectivity) बना हुआ है। विशेष रूप से उन स्थानों पर, जहाँ महत्वपूर्ण अवरोधक (Bottlenecks) वन्यजीवों की आवाजाही को सीमित करते हैं।

सतपुड़ा–पेंच कॉरिडोर की संपर्क क्षमता को बनाए रखने के लिए विभिन्न विभागों, संस्थाओं और स्थानीय समुदायों के समन्वित प्रयास आवश्यक हैं। संरक्षण कार्यों को केवल आरक्षित वनों तक सीमित न रखकर निजी कृषि भूमि और राजस्व भूमि तक विस्तारित करना होगा। इसके लिए वन आवास पुनर्स्थापन (Habitat Restoration), सड़क एवं रेल जैसी रेखीय अवसंरचना (Linear Infrastructure) के प्रभावों का प्रभावी शमन (Mitigation), वन्यजीव-अनुकूल कृषि भूमि उपयोग योजना (Wildlife-friendly Land-use Planning), खनन गतिविधियों के लिए उपयुक्त सुरक्षा उपाय, बेहतर पशुधन प्रबंधन

तथा निजी और सामुदायिक भूमि के संरक्षण में स्थानीय समुदायों की सक्रिय भागीदारी आवश्यक होगी।

इस कॉरिडोर का संरक्षण और पुनर्स्थापन केवल बाघों और अन्य दूर तक विचरण करने वाली प्रजातियों के लिए ही नहीं, बल्कि पूरे मध्य भारतीय परिदृश्य की पारिस्थितिक अखंडता (Ecological Integrity) बनाए रखने के लिए भी अत्यंत आवश्यक है।



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1. INTRODUCTION

In recent decades, there has been a growing emphasis on landscape-level conservation, with the recognition that many terrestrial mammals range and meet their life-history needs across interconnected habitat patches. A landscape-level conservation approach explicitly considers areas beyond protected areas (PAs) to include areas under territorial forest divisions, ecological corridors, and surrounding agricultural matrices that collectively sustain wildlife populations. Maintaining connectivity between habitat patches across these landscapes supports long-term species recovery and persistence by facilitating dispersal and enhancing genetic exchange between metapopulations.

Ecological corridors are integral components of connected landscapes. While they are often recognised for enabling wildlife movement between habitat patches, their ecological role extends beyond facilitating animal dispersal. Corridors also sustain a range of biotic and abiotic processes, including seed dispersal, hydrological connectivity, and the movement of nutrients and energy across landscapes (Matejcek and Verne, 2021). Additionally, vegetation within these corridors can contribute to regional rainfall and reduce soil erosion, thereby providing solutions to environmental risk and contributing directly to human wellbeing (DeFries et al., 2005; Matejcek and Verne, 2021).

Wildlife corridors are rarely contiguous in natural habitats. Instead, they typically comprise multi-use landscapes that include forests, grasslands, agricultural fields, and built-up areas interspersed with linear infrastructure. Some of these land-use classes are not completely permeable and can impede the movement of large carnivores. Studies have established that the movement of large mammals is most strongly affected by human land use, high human population density, and the density of linear infrastructure (roads, railways, power lines, and canals). These features create high-resistance areas that reduce overall landscape permeability and restrict animal movement. The resulting habitat fragmentation converts continuous forest habitats into smaller, isolated patches embedded within human-dominated landscapes (Bennett, 2003; DeFries et al., 2005; Thatte et al., 2018).

For wide-ranging, large carnivores such as tigers and leopards, landscape connectivity is imperative. Dispersal is an inherent life-history trait in these species, and individuals may range over hundreds of kilometres in search of suitable territories, access to cover and prey, and breeding opportunities. In this context, landscape connectivity has two dimensions: structural connectivity refers to the physical arrangement and condition of habitat patches, and the permeability of the surrounding landscape, while functional connectivity refers to the actual movement of animals and the resulting genetic exchange between populations.

1.1 SATPURA–PENCH CORRIDOR: OVERVIEW

The Central Indian landscape constitutes one of the most significant strongholds for tigers in the country, with numerous PAs linked through a network of forested and mixed-use landscapes. Multiple landscape genetics and connectivity modelling studies conducted in the region have shown how forest linkages and the surrounding agricultural matrices collectively serve as corridors (*see Figure 1*) for tigers and other wildlife (Joshi et al., 2013; Sharma et al., 2013; Yumnam et al., 2014; Thatte et al., 2018; Dutta et al., 2024).


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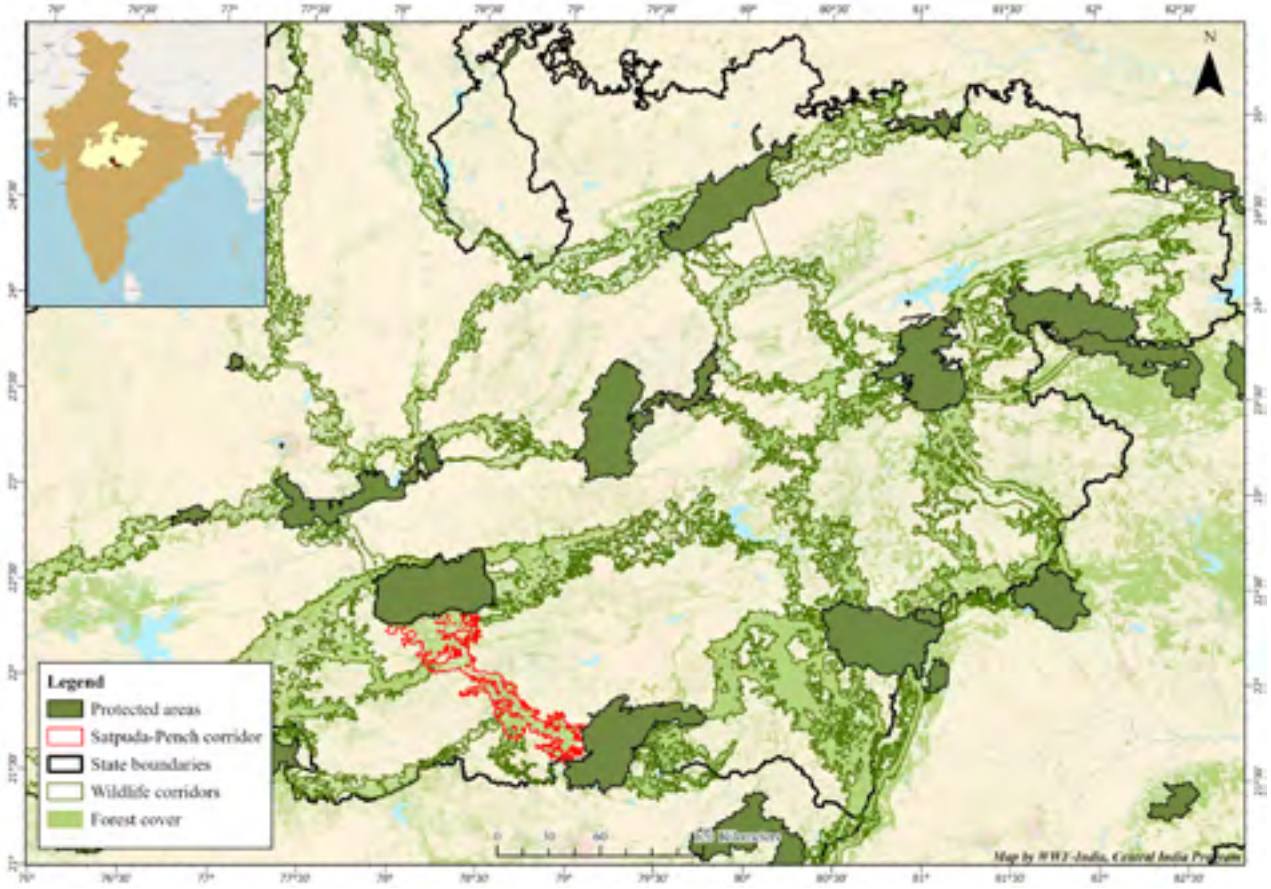

Figure 1: The Central Indian tiger corridor map highlighting Satpura–Pench Corridor and its connectivity with other major protected areas (PAs)

1.1.1 Ecological profile

The Satpura–Pench Corridor (SPC) (*see Figure 1*) links Satpura Tiger Reserve (STR) with Pench Tiger Reserve (PTR). As shown in Figure 2, the SPC serves as the principal east–west dispersal pathway for large mammals in Central India (Qureshi et al., 2014). It lies in the southern part of Madhya Pradesh and connects two tiger source populations: STR (2,133 km²), and PTR (1,180 km²). The corridor extends across three districts of Madhya Pradesh—Chhindwara, Pandhurna and Betul—with a small portion overlapping with Nagpur district in Maharashtra.

Geologically, the corridor lies within the Satpura–Maikal ranges of the Deccan plateau. It is characterised by lower Gondwana sandstone outcrops in the north, transitioning southwards into Precambrian metamorphic granite–gneiss formations, while Deccan trap igneous formations occur along its eastern and western margins (Bhattacharjee, 2017; Singh and Shukla, 2004). Elevation varies widely from 52 to 1,396 m above sea level.

Vegetation across the corridor is dominated by southern tropical dry deciduous and moist deciduous forests, following the classification of Champion and Seth (1968). Teak (*Tectona grandis*) constitutes the primary canopy species across much of the landscape, occurring in both pure and mixed stands. Associated tree species include *Terminalia tomentosa*, *Anogeissus latifolia*, *Lagerstroemia parviflora*, and *Boswellia serrata*. In relatively moist valleys and localised depressions in the northern part of the corridor, patches of sal (*Shorea robusta*) and bamboo reflect moist deciduous forest types within an otherwise dry deciduous matrix.

Forest conditions vary across the corridor (*see Figure 2*). Areas adjoining settlements and roads exhibit canopy thinning, intensive livestock grazing, and fuelwood extraction, while more structurally intact forest patches persist within reserved forest divisions and PAs. Hydrologically, the SPC is traversed by two major river systems: the Tawa, which flows northwards into the Narmada basin, and the Kanhan, which drains southwards into the Godavari basin. The corridor receives a mean annual rainfall of approximately 1,155 mm (Patil et al., 2022).

SPC is rich in faunal diversity. Although this is the first survey to cover the entire crude corridor boundary, tigers, leopards and several other wildlife species have been recorded in the area. The corridor

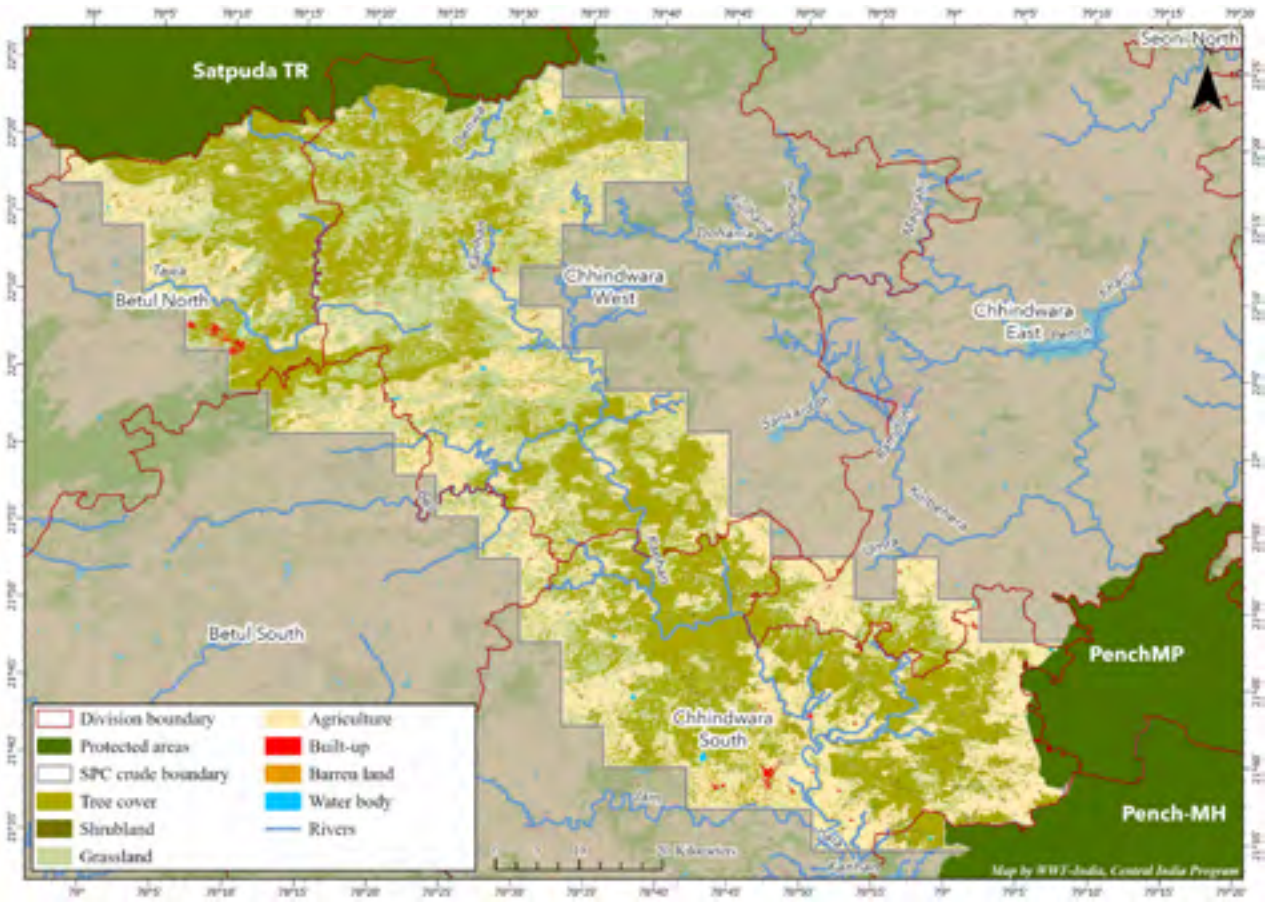

Figure 2: Land-use land-cover change map highlighting the Satpuda–Pench Corridor with forest division boundaries

is also rich in avifaunal diversity, with 243 bird species reported, including 58 migratory species, five threatened species, eight endemics, and 26 species listed under Schedule I of the Wildlife (Protection) Act (SoIB, 2026). In addition, the region supports 26 High Conservation Priority species (SoIB, 2023). During the survey, a wide range of birds were observed, including small passerines, hornbills, raptors, and waterfowl. Two vulture species—the white-rumped vulture (*Gyps bengalensis*) and Egyptian vulture (*Neophron percnopterus*) were documented in the Tamia hills, the only part of the corridor where vulture populations have been recorded.

1.1.2 Land use: Agriculture, infrastructure and mining

Within the approximately 4,000 km² crude corridor boundary of the SPC (crude corridor boundary of the SPC referred from Satpura - Pench Corridor Profile; Coalition for Wildlife Corridors. 2022), around 50% of the area is under forest cover, 12% of the area comprises open forests, and 35% is under human use (Roy et al., 2016). Agriculture is predominantly rain fed and occupies about 35% of the corridor. Maize is the principal *kharif* crop, along with cotton, soybean, and red gram, while irrigated areas towards the northern parts of the corridor, particularly Betul district, support wheat and sugarcane cultivation. The Chhindwara district is nationally recognised for orange cultivation. Cropping patterns are strongly influenced by soil characteristics, with shallow loamy soil supporting pulses and millets, and deeper black cotton soils favouring cotton and soybean production.

A road network of nearly 70 km of national highways and around 140 km of state highways criss-crosses the corridor (Shanu et al., 2019). Major highways, including NH 347, SH 45, SH 41 and NH 547, traverse the corridor in both east–west and north–south directions, while railway lines intersect the corridor's western and central sections (*see Figure 3*). Multiple structural bottlenecks have been identified in the corridor, notably the Damua–Jamai transition zone, the Lawaghogri–Ambada mid-section, and the southern Kanhan linkage, where forest cover within the corridor has been lost to agricultural intensification. The Kanhan-Ambada area is further traversed by NH 547 and Nagpur–Chhindwara railway line.

There are 798 villages in the corridor with a cumulative population of >86,000 people (*see Figure*

3) and a density of 5,980.09 people/km² (calculated through India villages demography, 2011, ESRI) Moderate- to high-density clusters (1,863–9,950 and above) occur around Damua, Sarni, Jamai, Lawaghogri, Ambada, Sillewani, Kanhan, and Sausar, with the highest population class (>27,460) concentrated in localised nodes within the Damua–Sarni belt and southern sections near Kanhan and Sausar. Population clusters are spatially associated with linear infrastructure networks and mining belts (*see Figure 3*), suggesting infrastructure-driven settlement aggregation.

Parts of Chhindwara district fall within the Pench–Kanhan coalfield of the Gondwana coal-bearing region of Central India. Coal mining operations in this region are administered by Western Coalfields Limited (WCL), a subsidiary of Coal India Limited. According to official WCL reports and district mining profiles, established collieries in Pench and Kanhan include the Newton, Chikli, Borkuhi, Eklahera, Chandameta, Datla, and Shivpuri mines. Mining infrastructure comprises both underground and opencast mines, together with haul roads, overburden dumps and coal-handling facilities. In addition to coal extraction, minor mineral quarrying and limited manganese deposits are reported within parts of the district. Mining sites are concentrated primarily in the north-western and central portions of the corridor, particularly around Sarni, Damua, and Sangakheda.

1.1.3 Communities and livelihoods

The major tribal (*adivasi*) communities in the corridor include the Gond and Korku, who constitute a significant proportion of the local population. The communities maintain socio-cultural and livelihood linkages with forest ecosystems. Livelihoods within the corridor are primarily agrarian, supplemented by forest-based subsistence activities and wage labour. Key forest resources harvested include fuelwood, livestock fodder, and non-timber forest products (NTFPs) such as tendu leaves (*Diospyros melanoxylon*), mahua flowers (*Madhuca longifolia)*, and char seeds (*Buchanania lanzan*). Seasonal non-timber forest product (NTFPs) collection contributes to household income, particularly among tribal communities.

1.2 CONSERVATION IMPERATIVES

Land-use and land-cover (LULC) analyses of the area have documented progressive habitat loss and increasing fragmentation in parts of the SPC over recent decades, resulting from the conversion of forest to agriculture and other land uses. This has led to the degradation of structural connectivity and increased landscape resistance to animal movement (Banerjee et al., 2020). Coal deposits and active

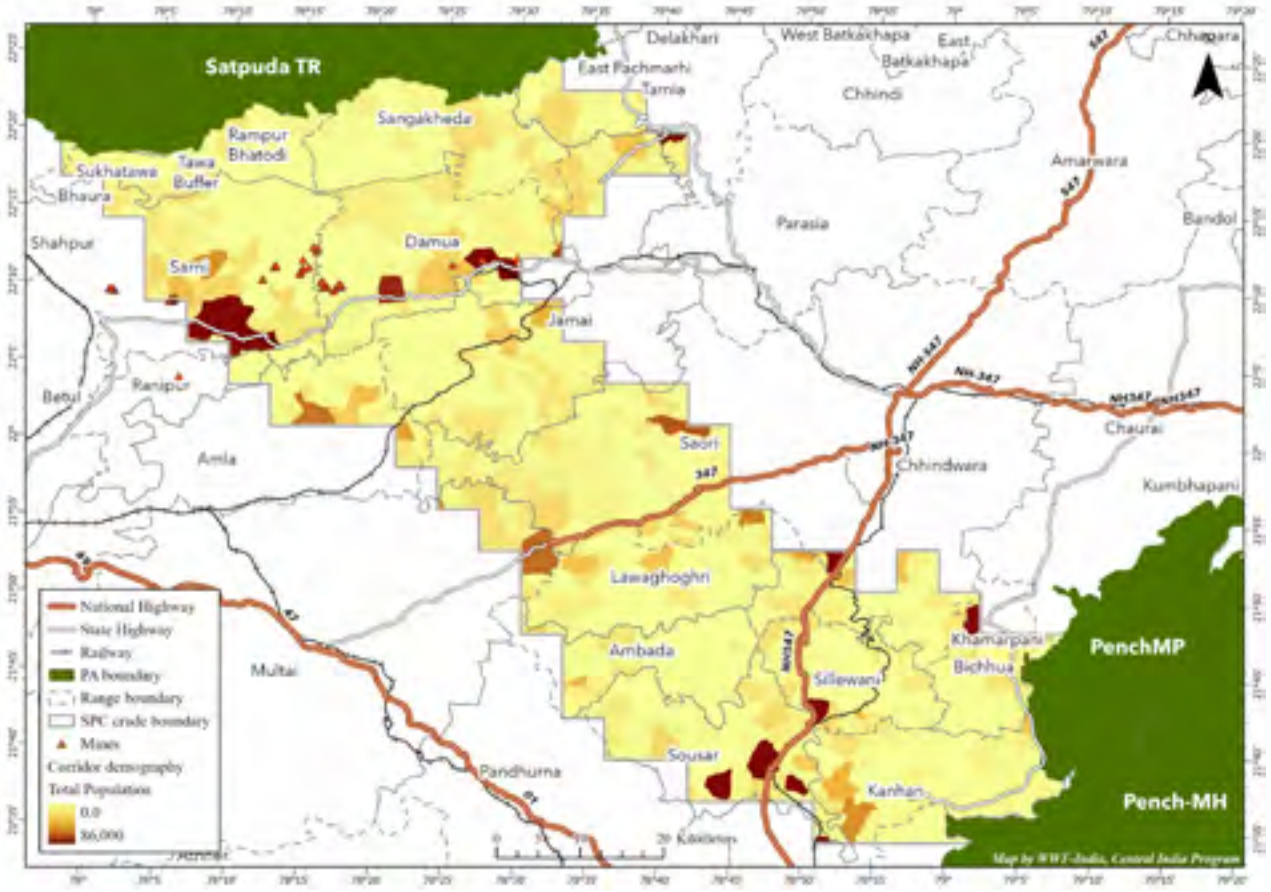

Figure 3: Corridor map depicting national and state highways, mining areas and demography

mining operations within parts of the SPC add persistent—and often irreversible pressures—both directly through habitat loss and indirectly through road expansion and increased human activity, thereby amplifying the risk of corridor severance (Gupta, 2021; Banerjee et al., 2020).

Despite the importance of habitat corridors in maintaining population viability and ensuring long-term persistence, they face enormous pressure from competing land-use demands, development activities, and the livelihoods of forest-dependent communities, yet remain outside the ambit of formal legal protection. It was only after Sariska lost all its tigers in 2005 that the Wildlife (Protection) Act, 1972 was amended to legally incorporate the identification and conservation of corridors between tiger reserves to maintain long-term tiger viability.

The need for corridor delineation and protection was also recognised in the second National Wildlife Action Plan (NWAP; 2006–2016). Subsequently, Wildlife Institute of India (WII) and National Tiger Conservation Authority (NTCA) have recognised 32 habitat corridors, while the Wildlife Trust of India (WTI) has identified 101 elephant corridors across the country. The third NWAP (2017–2031) integrates a landscape-level approach to wildlife conservation, with a focus on corridor conservation through the identification of corridors, assessment of the status of wildlife species and their habitats, development of a strategy for managing feral animals, and implementation of a policy on invasive alien species. WWF-India has since contributed to generating various corridor profiles and tiger conservation plan (TCP) corridor chapters.

1.3 STUDY OBJECTIVES

WWF-India undertook the first comprehensive, corridor-wide camera-trap assessment of wildlife occurrence and habitat use across the SPC between December 2024 and April 2025. The study was designed to provide a contemporary understanding of wildlife distribution, identify areas important for connectivity, and generate evidence to support future corridor management.

Specifically, the objectives of this report are to:
(a) assess the status and distribution of wildlife species across the SPC;
(b) identify weak links and potential bottlenecks affecting corridor connectivity; and
(c) provide data-driven management recommendations.

WWF-INDIA'S WORK IN THE SATPURA–PENCH CORRIDOR

WWF-India has been working in the Satpura–Pench Corridor since 2014 through its Sustainable Agriculture and PrFoduction Landscape programme. The key highlights of our work include:

• Supporting 9,000 small and marginal cotton farmers in adopting organic and regenerative practices;

• Strengthening four Farmer Producer Companies (FPCs);

• Improved soil health and recovery of insect populations in regenerative plots;

• Achieving up to 43% higher net returns for regenerative farmers;

• Defining, demonstrating and mainstreaming wildlife-friendly agricultural practices;

• Expanding regenerative and wildlife-friendly practices to additional crops, including oranges, maize and paddy;

• Implementing sustainable harvesting protocols for non-timber forest products (NTFPs) in collaboration with State Rural Livelihood Missions (SRLMs);

• Addressing key drivers of habitat fragmentation, such as roads and mining, through systematic ecological studies;

• Building the capacity of the forest department through training and equipment support.



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2. METHODOLOGY

2.1 FIELD SURVEY AND DATA COLLECTION

The survey was conducted in seven forest divisions comprising 21 ranges (*see Table 1, Figure 4*) across the Satpura–Pench Corridor (SPC) from December 2024 to April 2025. The survey area was divided into 821 smaller sampling units of 2 km² (approx. 1.41 km × 1.41 km) covering an extent of approximately 1,650 km² within the broader corridor boundary (Patil et al., 2022). The entire study area was divided into five sampling blocks, with each block sampled for a minimum of 20 days. One camera trap was deployed in each sampling unit, with a mean inter-camera distance of 1.5 km. We used three camera-trap models—Cuddeback C1, C5 and Spartan Lumen camera—for the sampling. Prior to camera deployment, over 20 training sessions were held to build forest staff capacity in camera deployment, animal sign identification, and to familiarise them with corridor conservation issues. Camera traps were deployed along forest roads, trails, and streams based on animal signs to maximise detection probability. All the camera traps were monitored during the survey period.

2.2 DATA ANALYSIS

Camera-trap data were collected from the field, compiled across all surveyed divisions, and systematically curated prior to analysis. The dataset was screened for date and time inconsistencies and corrected where necessary. The species-wise segregation of images was done using AI-assisted image classification and then manually verified to address any misclassification error. To understand the movement of large carnivores across the corridor, we identified leopard individuals for all the divisions. Since one camera was deployed at each location, only single flank photographs (whichever flank had the greater number of photos) were used to estimate the minimum number of individuals. Movements of identified individuals were mapped in ArcGIS Pro 3.6.3 to identify potential gaps in functional connectivity.

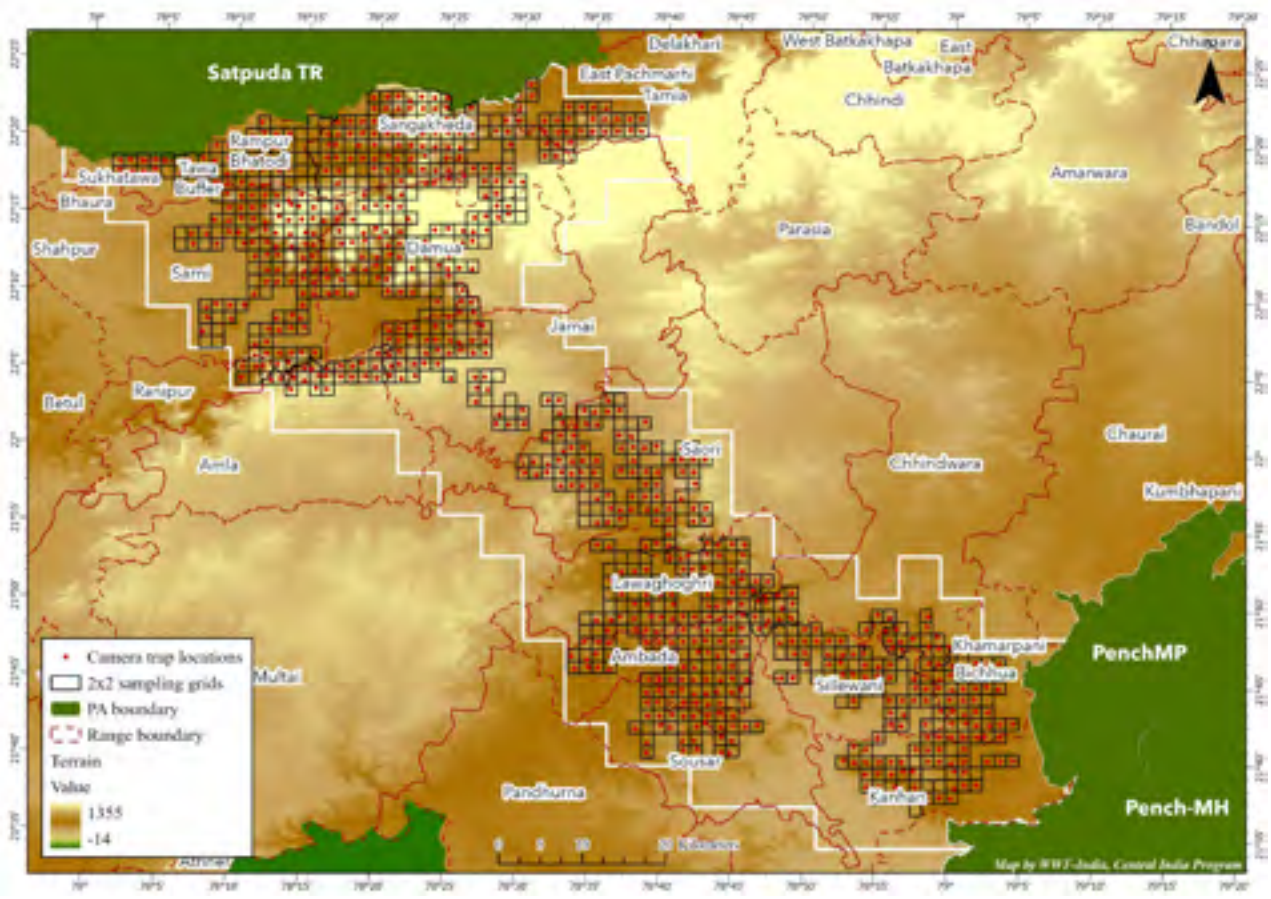

Figure 4: Range-wise camera-trap points and grids overlaid for the survey with terrain

Table 1. List of forest divisions and number of sampling units surveyed in each division

Division	Range	Area (km²)	No. of 2-km² grids sampled
Chhindwara West	Sangakheda	436.47	96
	Tamia	491.38	22
	Damua	537.29	73
	Parasia	661.53	33
	Jamai	830.27	34
	Saori	1075.37	75
Chhindwara South	Bichhua	217.61	35
	Sillewani	253.28	51
	Ambada	276.35	64
	Lawaghoghri	355.96	62
	Sausar	385.51	34
	Kanhan	630.05	50
Chhindwara East	Chhindwara	1145.99	32
Betul South	Amla	794.21	21
Betul North	Ranipur	207.21	5
	Rampur Bhatodi	224.26	67
	Sarni	790.32	71

a) Single-season occupancy

Detection histories were generated for each species using a detection (1) and non-detection (0) framework, where each sampling grid represented a site and each 24-hour sampling period represented a survey occasion. Single-season occupancy modelling was employed to estimate species occupancy/ site use (ψ) while accounting for imperfect detections (p) (MacKenzie et al., 2002). Single-season occupancy models were fitted only for species with sufficient detections to achieve model convergence. Accordingly, leopard, jungle cat, four-horned antelope (chowsingha), and nilgai were selected for analysis. The ecological interpretation of ψ is determined by the size of the sampling unit relative to the species' home range. If sampling units are smaller than home ranges, ψ reflects site use indicating that a site was visited at least once during the sampling period. As sampling units become comparable to or larger than home ranges, ψ more closely represents occupancy (MacKenzie



et al., 2018; Steenweg et al., 2017). Given the 2-km² sampling unit, the estimated occupancy parameter (ψ) was interpreted as site use/habitat use for leopard, wild pig and nilgai, and occupancy for jungle cat and chowsingha. The data were analysed in R Studio 4.3.1 (R Core Team, 2024) using the *unmarked* package (Fiske and Chandler, 2011).

The site covariates were selected based on a priori ecological hypotheses. Since habitat corridors are multi-use landscapes, site covariates were grouped into four categories that represent the major driving factors of species occurrence—habitat, terrain, resource and disturbance. In addition to the remotely sensed data, camera-trap data was used to address resource availability and disturbance. Relative Abundance Indices (RAIs) of dogs, livestock, and humans were used to capture small-scale variation in anthropogenic disturbance, while wild prey RAI was used to incorporate prey availability as driving factor for large carnivore occurrence. All covariates, along with their source and hypotheses are listed in Table 2.

We visualised the data and ran exploratory data analysis (Zurr et al., 2017) to check the structure, outliers, correlation and zero-inflation. If two variables showed correlation of ($r \geq 0.60$), one variable was selected to avoid the multicollinearity. Sampling effort was consistent across all the camera traps and hence, no detection variables were included. Instead, camera efficiency, calculated as the ratio of number of blank triggers and total detections per camera, was evaluated as a detection covariate. However, it did not show any influence on detection in any of our models. For each species, a candidate set of models was developed based on the ecological hypotheses using combinations of covariates. Occupancy models were fitted using the *occu()* function in the *unmarked* package, with occupancy (ψ) modelled as a function of site covariates and detection probability (p) fixed at ~1. Models were ranked using Akaike's Information Criterion (AIC) values (Burnham and Anderson, 2002) and model weight. Occupancy/ site-use and detection probability were calculated by model averaging where multiple competing models existed.

To asses the habitat use of wildlife in the corridor, we compiled detections for two species guilds: ungulates and carnivores. This approach was adopted since the detections of individual species were insufficient to fit single-season occupancy models. Although pooling detections of species that might have different occupancy (ψ) and detectability (p) has limitation in explaining the species/guild's habitat preference, the outputs may help in prioritising the probable habitat that might be occasionally used by wildlife. We then fitted separate single-season occupancy models for each guild while accounting for variation in occupancy and detection processes. Predicted habitat use values were generated from the top-ranked models and spatially projected across the study landscape using Arc GIS- Pro. These predictions were subsequently used to develop guild or species-specific occupancy maps. We also generated a bivariate map using the occupancy probabilities of herbivores and carnivores to identify areas of high conservation importance for wildlife.

Table 2. Environmental drivers of animal occupancy along with data source, resolution and the primary hypothesis

S.no	Feature variable	Description and source	Predicted relationship with species occurrence
1	Wild prey (RAI) (computed separately for sambar, chital, chowsingha, chinkara, nilgai, wild pig, gaur)	Camera-trap (CT) data, with the omission of repetitive capture events within a 30-minute window	Higher wild prey availability increases predator (e.g. tiger, leopard) occupancy or use. Occupancy of tigers in human-dominated landscapes was positively associated with wild prey availability (e.g. Karanth et al. 2011)
2	Feral dog presence (RAI)	Camera-trap (CT) data, with the omission of repetitive capture events within a 30-minute window	Free-ranging dog presence may reduce wildlife use or cause displacement, increasing competition and disease risk. Free-ranging dogs can overlap spatially with wild carnivores and alter wildlife habitat use patterns (e.g. Mahar et al., 2024). Dogs may also be preyed upon by large carnivores. Hence, the directionality of this relationship could be negative or positive
3	Tree cover (%)	Satellite data (30m ESA Worldcover V2, Univ. Maryland tree-cover loss)	Greater forest cover improves habitat suitability. Large carnivores show strong positive associations with forest area/cover and occupancy (Harihar and Pandav, 2012)
4	Night light (%)	VIIRS Nightlight dataset/ night-light proxy for human disturbance	High night-light (proximity to lit-up human settlements reduces wildlife presence or alters behaviour) (Barceló et al., 2025)

5	Distance to water bodies (metres)	Waterbody map (WWF-India, Tech for Conservation LULC data + NDWI)	Water is a key resource within large carnivore territories, including water sources. Prey species may also aggregate near water sources (Lamichhane et al., 2019)
6	Extent of linear infrastructure (roads and railways) (metres)	OpenStreetMap (Euclidean distance)	Linear infrastructure fragments habitats, raises mortality risk, is associatedwith light and noise, and can adversely impact occupancy of large carnivores both positively and negatively (e.g. Habib et al., 2022)
7	Extent of built-up area within the grid (%)	Land-use layer (WWF-India, Tech for Conservation LULC data)	Built-up areas are associated with round-the-clock human presence and associated disturbances (e.g. noise). They can also attract large carnivores for feeding on feral animals and provisioning and so settlements are predicted to both positively and negatively impact carnivore occurrence (eg. Bateman and Fleming, 2012)
8	NDVI (mean)	Vegetation index (Sentinel 2A)	Higher NDVI value (derived from forest canopy and agriculture within a grid) may be indicative of greater vegetation productivity and potentially higher herbivore (prey species) densities (e.g. Harihar and Pandav, 2012)
9	Distance from protected areas (PAs)/core areas	PA network land use land cover (LULC)	Occupancy/habitat use declines with increasing distance from PAs that often serve as core habitats that sustain breeding large carnivore populations. (e.g. Shanu et al., 2016)
10	Land under agriculture within the grid (%)	Land-use layer (WWF-India, Tech for Conservation)	Higer areas under agriculture in a grid implies less primary habitat (forests), potentially affecting carnivore occupancy (eg. T Ramesh et al., 2020)
11	Land under teak forest (%) (monoculture/ plantation)	Vegetation layers of Roy et.al., 2015	Monoculture or plantation forests may provide poorer quality habitats (lack structural complexity and understory cover) for wildlife (ungulate prey) compared to natural mixed deciduous forests and may thereby be associated with lower large carnivore use and lower occupancy. Plantation forests often (e.g. Harihar and Pandav, 2012).
12	Land under bamboo forest (%)	Vegetation layers of Roy et.al., 2015	Bamboo-dominated forest may support prey species. Bamboo stands often provide good cover and foraging for prey species like wild pig and spotted deer, which may, in turn, benefit predators (e.g. T Ramesh et al., 2020).
13	Land under/extent of scrub (%)	Vegetation layers of Roy et.al., 2015	Degraded habitats and scrublands support lower densities of primary prey (like sambar and wild boar) compared to continuous, undisturbed forests. (e.g. Ranjan et al., 2025)
14	Fragmentation index (Forest: Agriculture)	Landscape configuration from land-use data (WWF-India, Tech for Conservation)	Higher fragmentation (smaller forest patches) reduces habitat contiguity, increases edge effects, potentially reduces habitat suitability, and increases human-wildlife conflict risk, all of which can contribute to lower large carnivore habitat use. (e.g. Shanu et al., 2016)
15	Distance to mines/ mining activity (metres)	Land-use layer (WWF-India, Tech for Conservation)	Proximity to mines and associated infrastructure can both adversely impact wildlife habitat quality and be direct sources of disturbance to wildlife (Ranjan et al., 2025)
16	Vehicle (RAI)	Camera-trap (CT) data, with the omission of repetitive capture events within a 30-minute window	Higher vehicle activity within wildlife habitats can contribute to reduced wildlife presence. Transport infrastructure and vehicular traffic raise mortality risk and reduce occupancy of large mammals (Tyagi et al., 2019)
17	Livestock (RAI)	Camera-trap (CT) data, with the omission of repetitive capture events within a 30-minute window	High livestock presence may drive reduction in wild prey use/ abundance (T Ramesh et al., 2020). Livestock may also be an important food resource for large carnivores and can lead to HWC (Miller et al., 2016)

18	Human (RAI)	Camera-trap (CT) data, with the omission of repetitive capture events within a 30-minute window	Higher numbers of people within wildlife habitats can reduce wildlife space use. Human disturbance strongly affects the diel activity and reduces presence of sensitive mammals in modified landscapes (Barceló et al., 2025)
19	Terrain ruggedness index (mean %)	SRTM data (30 m)	Rugged terrain may provide refuge and limit human access to wildlife habitats (Mills et al., 2023)

b) Relative Abundance Index (RAI)

Species RAIs were calculated for species that did not have enough camera-trap captures for the occupancy modelling during the sampling period. RAI was calculated as:

$$\text{RAI} = \left(\frac{\text{A}}{\text{N}}\right) \times 100$$

Where *A* is the number of independent detections of a species and *N* is the total camera-trap effort.

Two photographs were considered independent if they were captured more than 30 minutes apart. The resulting RAI values were then mapped using Inverse Distance Weighted (IDW) in ArcGIS Pro 3.6.3.



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3. RESULTS

We photo-captured 26 mammalian species during the survey (*see Table 3*). Among large felids, leopards were photo-captured in 108 grids, followed by tigers, which were recorded in 19 grids (n=19). Four species of canids—Asiatic wild dog, Indian wolf, golden jackal and the Indian fox—were also photo-captured. Among the eight ungulate species photo-captured during the survey, wild pig was the most frequently detected (n=222), followed by four-horned antelope (n=87).

Table 3. Species photo-captured during the survey

S. No.	Family	Species name	Total grid captures (n)
1	Felidae	Tiger (*Panthera tigris*)	19
2	Felidae	Leopard (*Panthera pardus*)	108
3	Felidae	Jungle cat (*Felis chaus*)	62
4	Felidae	Rusty-spotted cat (*Prionailurus rubiginosus*)	6
5	Canidae	Indian wolf (*Canis lupus*)	15
6	Canidae	Asiatic wild dog (*Cuon alpinus*)	25
7	Canidae	Golden jackal (*Canis aureus*)	26
8	Canidae	Bengal fox (*Vulpes bengalensis*)	6
9	Ursidae	Sloth bear (*Melursus ursinus*)	14
10	Mustelidae	Honey badger (*Mellivora capensis*)	18
11	Viverridae	Asian palm civet (*Paradoxurus hermaphroditus*)	45
12	Viverridae	Small Indian civet (*Viverricula indica*)	32
13	Herpestidae	Ruddy mongoose (*Herpestes smithii*)	1
14	Manidae	Indian pangolin (*Manis crassicaudata*)	2
15	Bovidae	Gaur (*Bos gaurus*)	5
16	Bovidae	Nilgai (*Boselaphus tragocamelus*)	55
17	Bovidae	Four-horned antelope (*Tetracerus quadricornis*)	87
18	Bovidae	Chinkara (*Gazella bennettii*)	18
19	Cervidae	Sambar (*Rusa unicolor*)	36
20	Cervidae	Chital (*Axis axis*)	21
21	Cervidae	Barking deer (*Muntiacus muntjak*)	14
22	Suidae	Wild pig (*Sus scrofa*)	222
23	Cercopithecidae	Northern plains gray langur (*Semnopithecus entellus*)	392
24	Cercopithecidae	Rhesus macaque (*Macaca mulatta*)	98
25	Hystricidae	Indian crested porcupine (*Hystrix indica*)	54
26	Manidae	Indian pangolin (*Manis crassicaudata*)	1

3.1 SPECIES OCCURRENCE AND HABITAT USE IN THE CORRIDOR

3.1.1 Relative Abundance Index (RAI)

The RAI maps revealed spatial and ecological variation in species' habitat use across the corridor. Tiger detections (*see Figure 5a*) were limited in number and spatial extent, resulting in low RAI values across most of the corridor. Tiger detections were concentrated near the boundaries of protected areas (PAs) in the Ambada, Sausar, Kanhan, Lawaghoghri, Sarni, and Ghoradongri ranges, indicating that these areas may function as important interfaces between protected habitats and the intervening corridor landscape. In contrast, leopards showed a ubiquitous presence across the corridor (*see Figure 5b*), without any effect of the distance to PAs. On a few occasions, leopards were photo-captured with cubs (>1 year of age), indicating breeding within the corridor habitat. Asiatic wild dogs were photo-captured only on a few occasions, either as solitary individuals or in small packs of three to four, in the Damua, Amla, Ghoradongri and Sangakheda ranges in the northern parts of the corridor and the Lawagoghri, Ambada, Sillewani, Kanhan and Sausar ranges in the southern parts of the corridor (*see Figure 5c*). Indian wolves (*see Figure 5d*) were detected at relatively fewer locations, primarily near settlements, in the Ambada, Kanhan, Sausar, Sangakheda, Damua, Delakhari and Sarni ranges. Sloth bears (*see Figure 5e*) were mostly detected in close proximity to the Satpura Tiger Reserve, likely reflecting dispersal from the adjoining PA. Jackals and jungle cats (*see Figure 5f, 5g*) occurred predominantly near agricultural fields. Bengal fox (*see Figure 5h*) was detected sporadically across the corridor during the survey period. Elusive species such as the honey badger (*see Figure 5i*) and rusty-spotted cats (*see Figure 5j*) were also detected on several occasions within the corridor.

Among the large herbivores, gaur (*see Figure 5k*) exhibited very low RAI values, reflecting the limited number of detections. The species was detected near PAs, particularly in the Sarni, Ghoradongri, Ambada, Kanhan and Bichhua ranges. Detections were confined to areas with high forest cover and in proximity to protected or semi-protected habitats. Sambar (*see Figure 5l*), chital (*see Figure 5m*), and chinkara (*see Figure 5n*) were detected at only a few locations, with no apparent pattern in their spatial distribution. Barking deer (*see Figure 5o*) was confined to Jamai and Rampur Bhatodi ranges, with only a few detections. Nilgai (*see Figure 5p*) was mostly detected close to Pench Tiger Reserve, in Ambada and Sausar ranges, likely due to spillover from the adjacent protected area. Wild pig (*see Figure 5q*) and four-horned antelope (chowsingha) (*see Figure 5r*) showed a ubiquitous presence in the corridor, consistent with their generalist habitat preferences.



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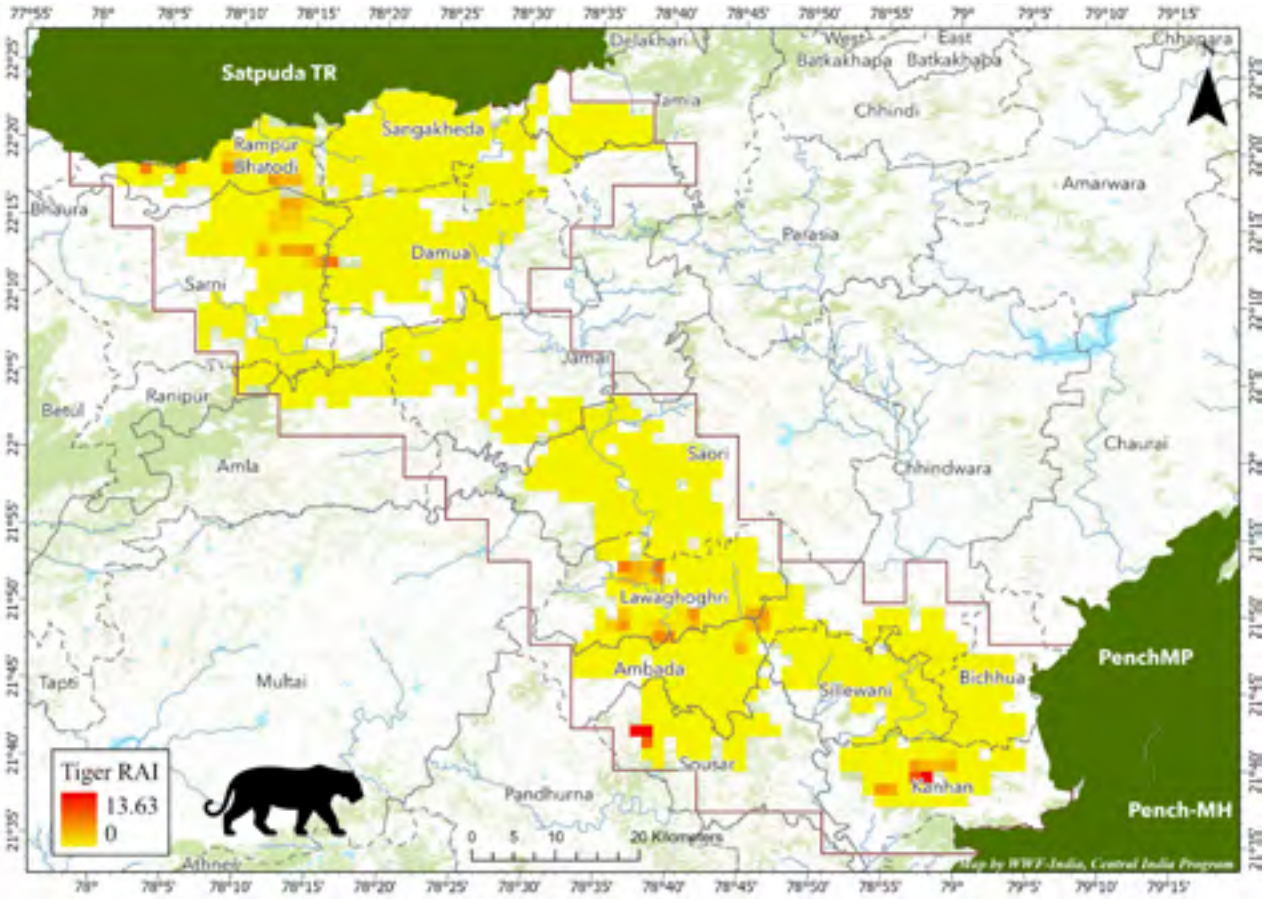


Figure 5a: Tiger

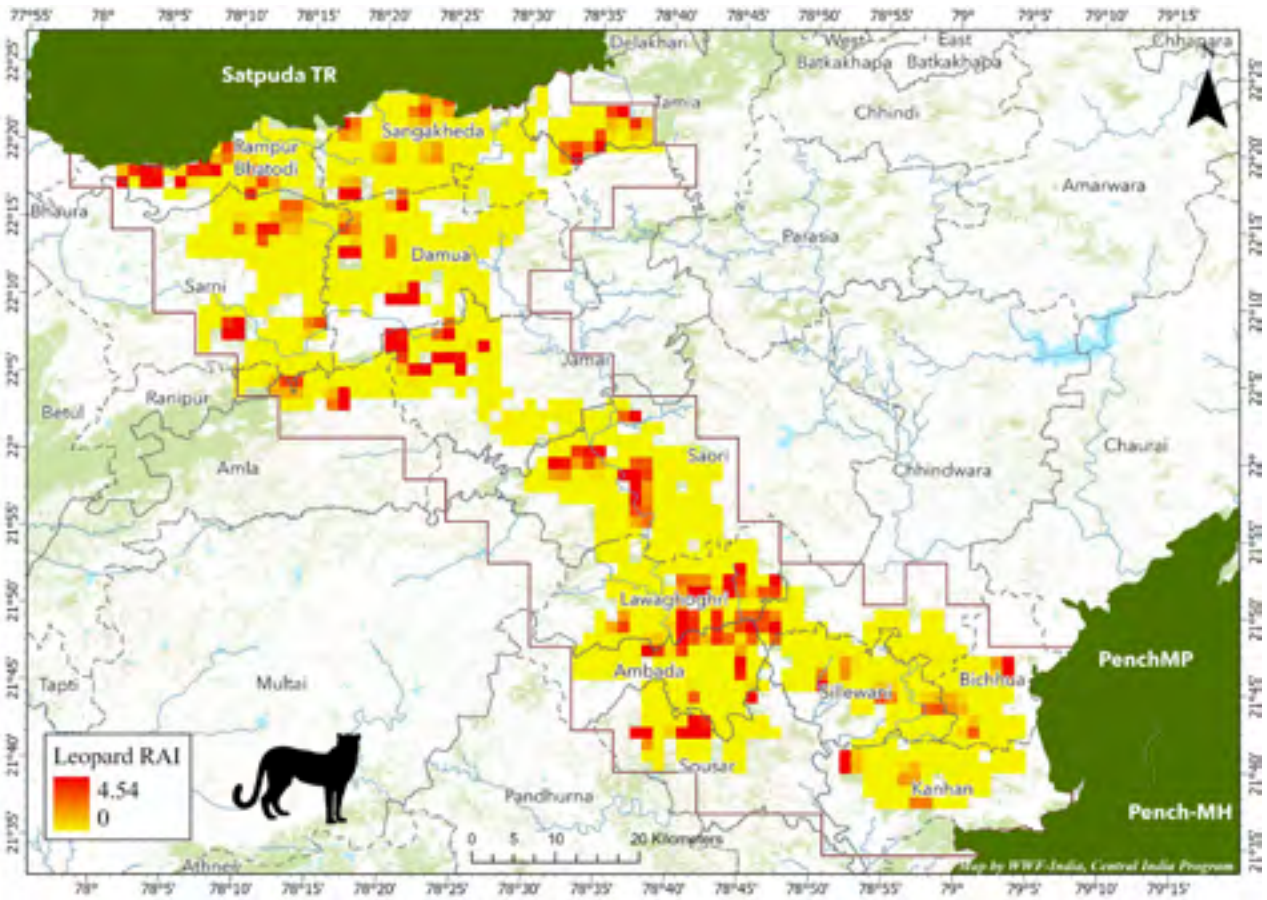


Figure 5b: Leopard

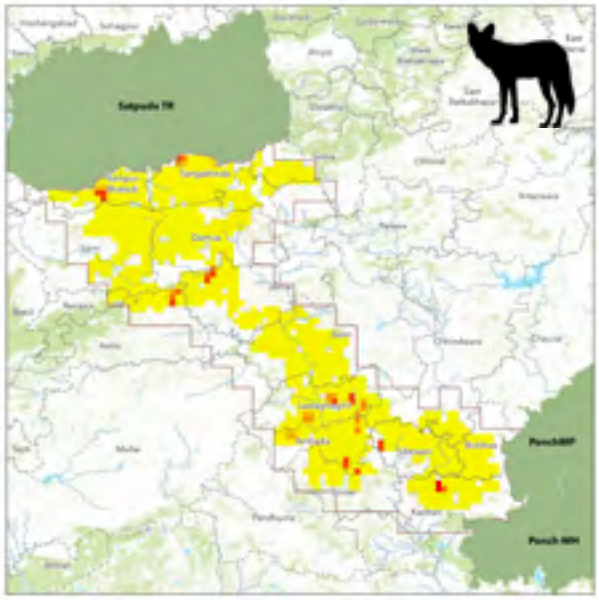


Figure 5c: Asiatic wild dog

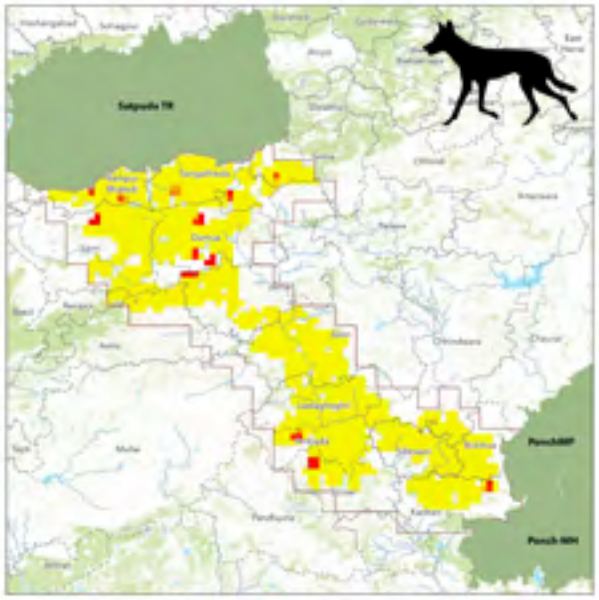
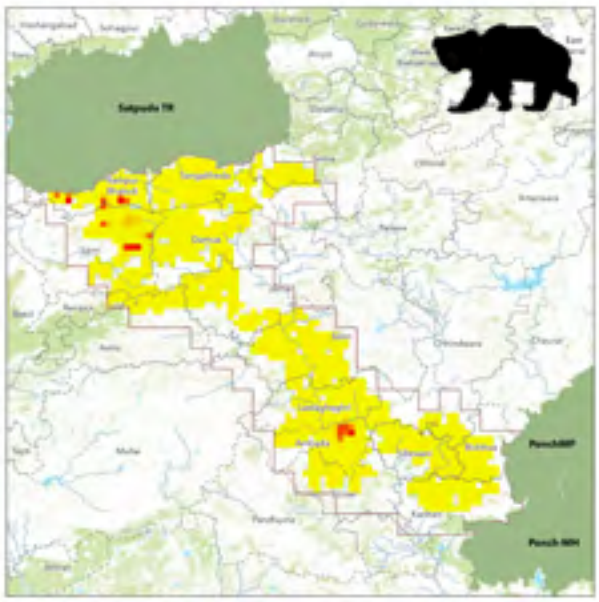


Figure 5d: Indian wolf



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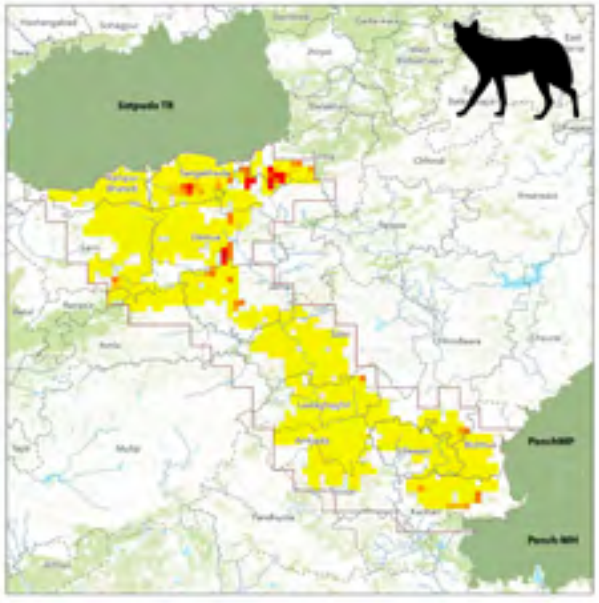

Figure 5f: Jackal

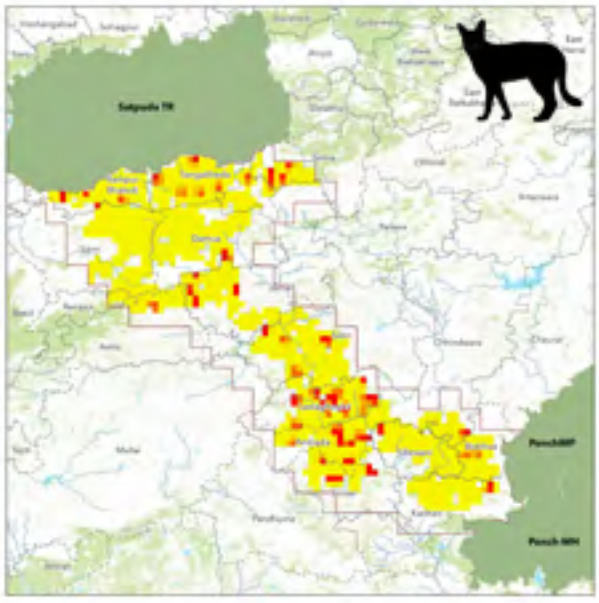

Figure 5g: Jungle cat

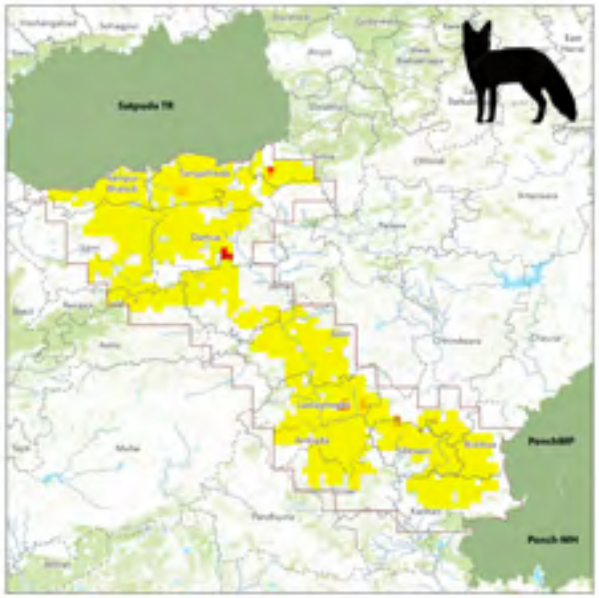

Figure 5h: Bengal fox

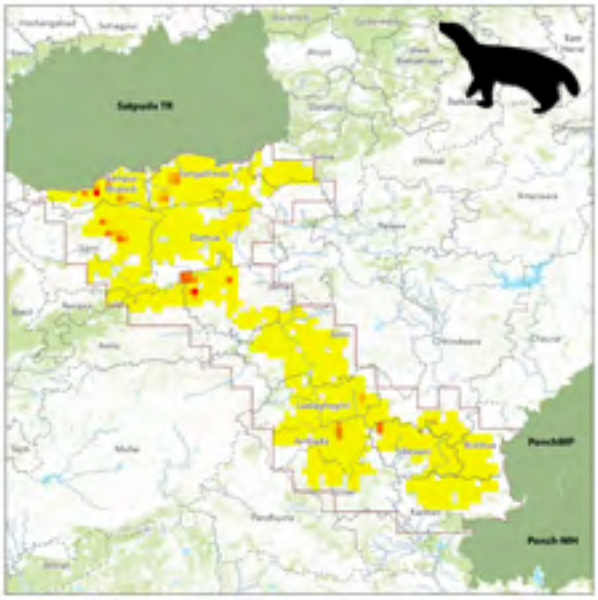

Figure 5i: Honey badger

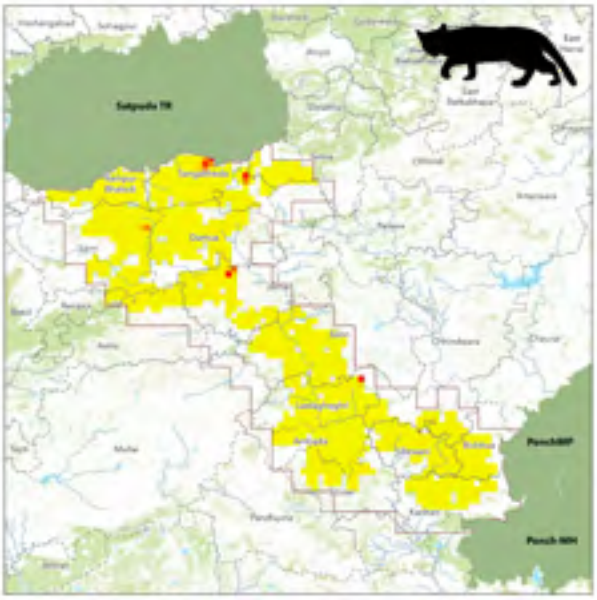

Figure 5j: Rusty-spotted cat

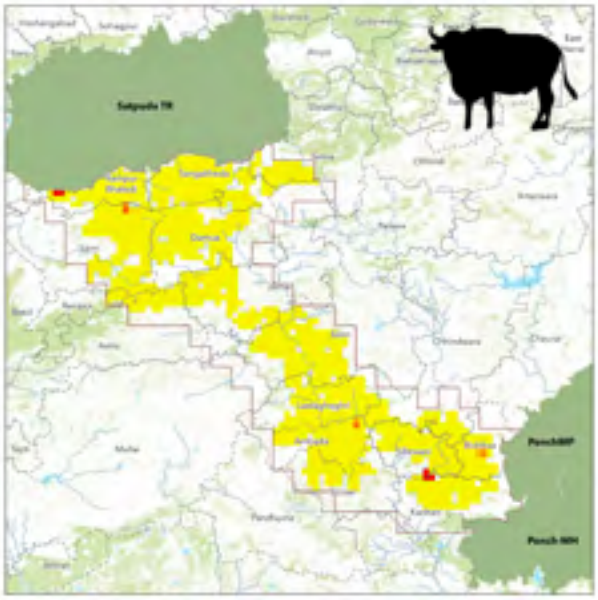

Figure 5k: Gaur

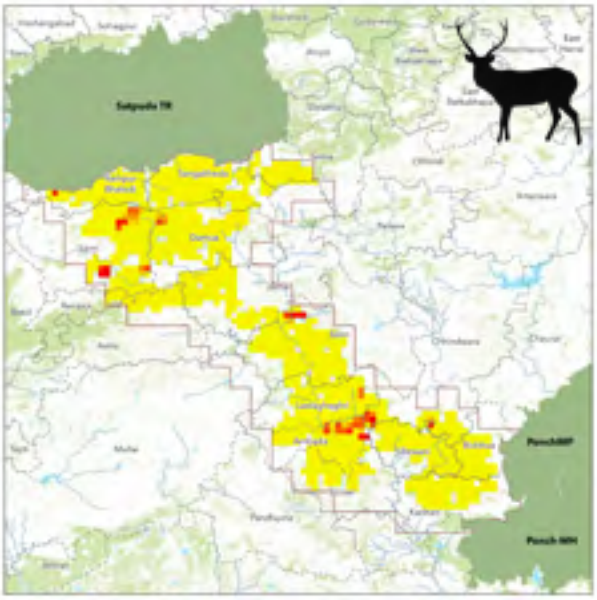

Figure 5l: Sambar

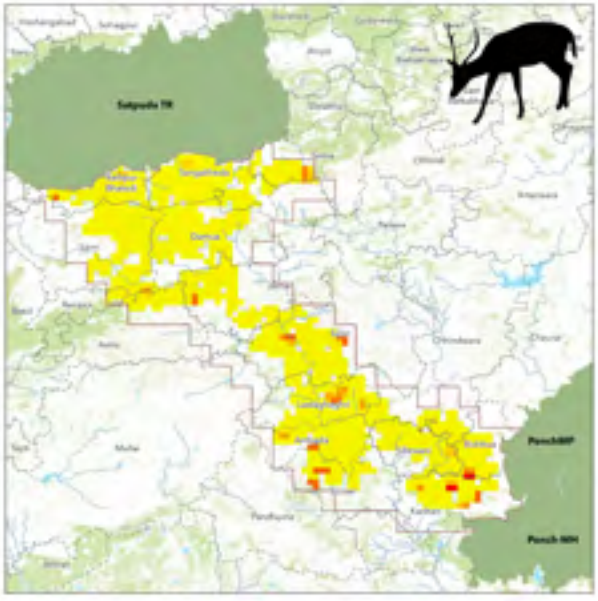

Figure 5m: Chital

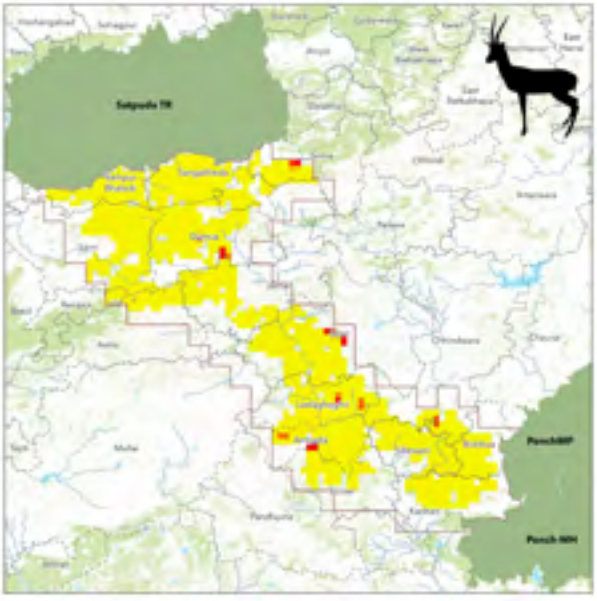

Figure 5n: Chinkara

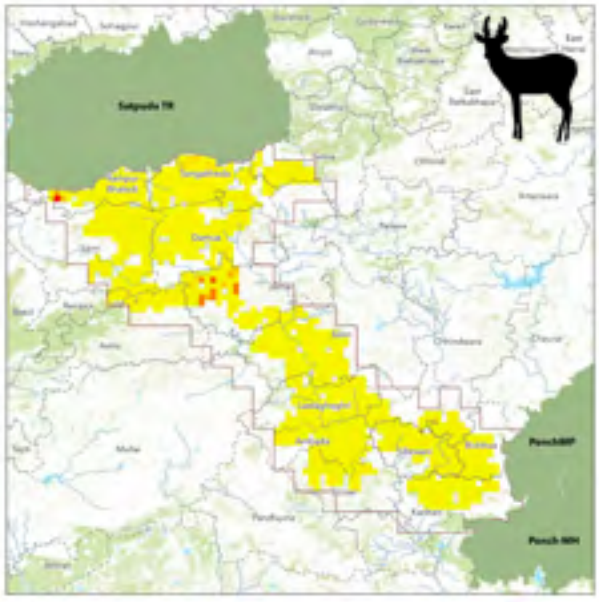

Figure 5o: Barking deer

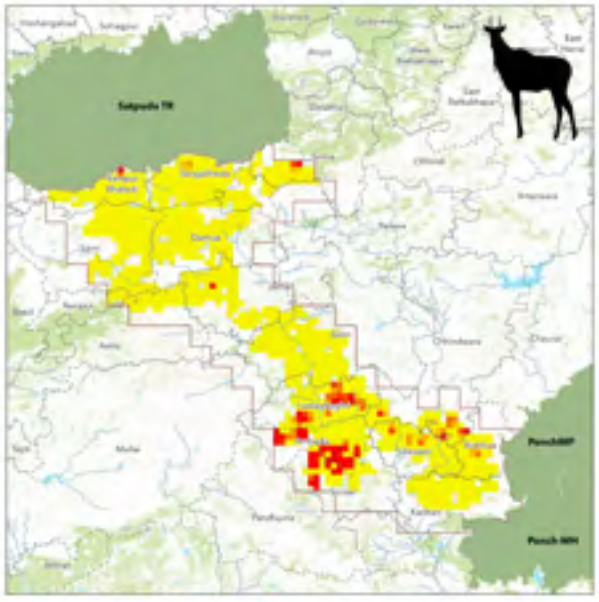

Figure 5p: Nilgai

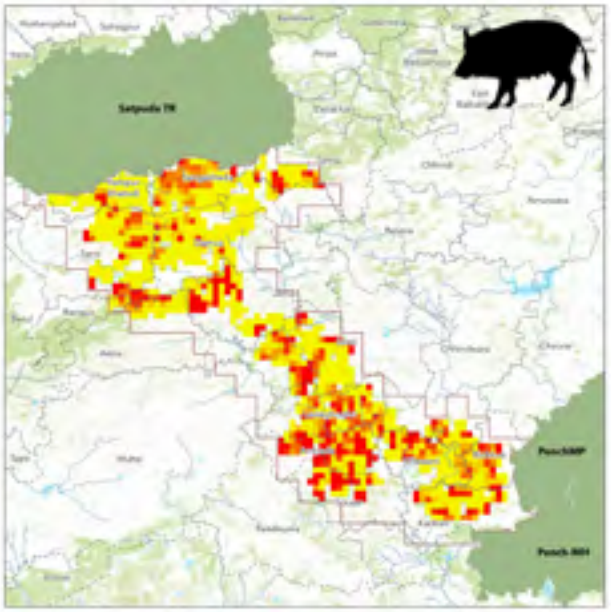

Figure 5q: Wild pig

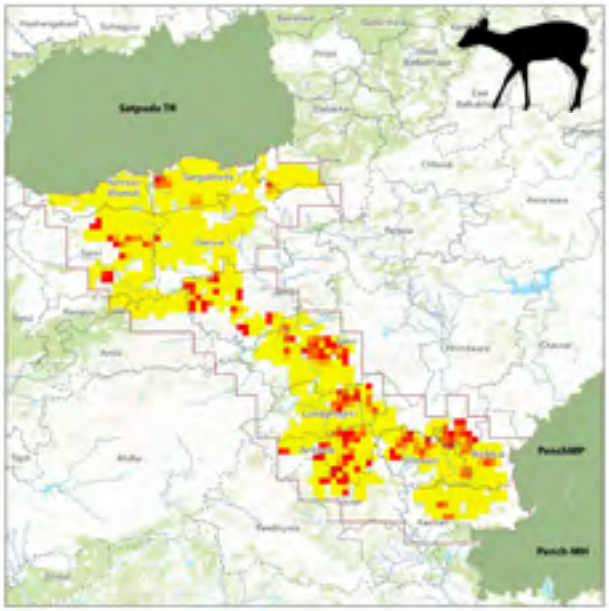

Figure 5r: Four-horned antelope/chowsingha

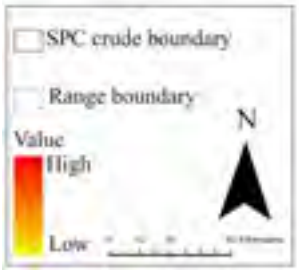

Figure 5 (a–r). Inverse Distance Weighting (IDW) maps showing the Relative Abundance Index (RAI) of species across the Satpura–Pench Corridor, arranged from top left to bottom right: tiger (5a), leopard (5b), Asiatic wild dog (5c), Indian wolf (5d), sloth bear (5e), golden jackal (5f), jungle cat (5g), Bengal fox (5h), honey badger/ratel (5i), rusty-spotted cat (5j), gaur (5k), sambar (5l), spotted deer (5m), chinkara (5n), barking deer (5o), nilgai (5p), wild pig (5q), and four-horned antelope/chowsingha (5r)

3.1.2 Habitat use/occupancy probability

a) Leopard

Leopards were photo-captured in 108 grids out of 821 sampling units (naïve ψ = 0.13). The best-supported model (mv20) included wild prey abundance (WP_RAI), tree cover, and scrub cover (Figure 6), accounting for 44% of the model weight. The top-ranked model estimated a habitat use probability of ψ = 0.47 ± 0.049, with a low detection probability (p = 0.016 ± 0.002). This model performed substantially better than the null model (ΔAICc = 32.55). Model selection based on AICc identified seven competing models with ΔAICc < 5 (Table 4). The repeated occurrence of WP_RAI and Tree_ cover in all top-ranked models highlights the importance of prey availability and forested habitat in determining leopard distribution within the study area. Occupancy probability of leopard increased significantly with both prey abundance and tree cover, while scrub cover showed a positive but non-significant relationship. Anthropogenic variables, such as distance to mines, built-up areas, roads and human activity, showed no effects on leopard habitat use probability. The habitat use probability map (*see Figure 11a*) predicted a ubiquitous distribution of leopards throughout the corridor.

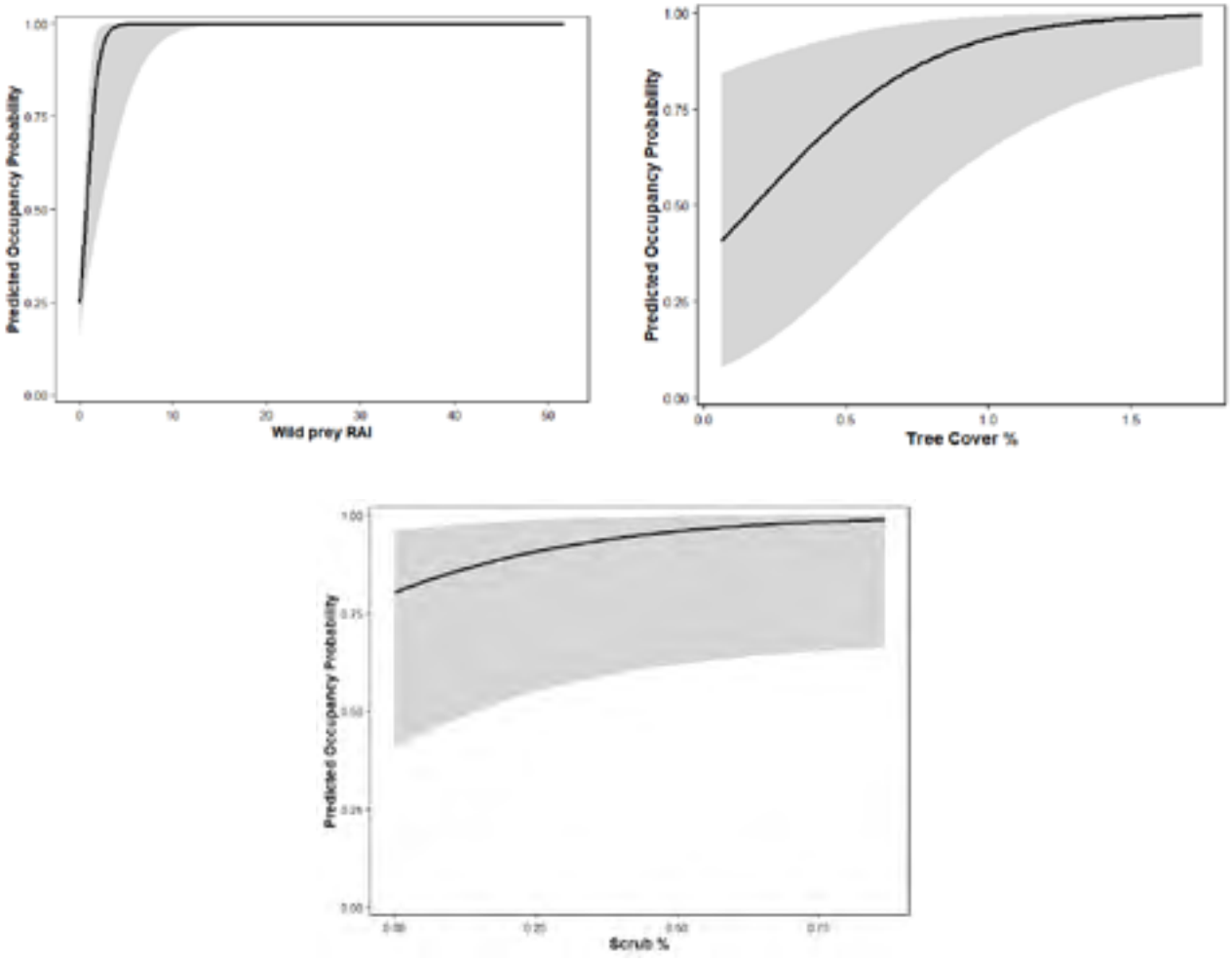

Figure 6: Probability of leopard habitat use of Satpura–Pench Corridor; response curves from the top-ranked occupancy model illustrating the influence of wild prey abundance (RAI), tree cover, and scrub cover on the habitat use



b) Jungle cat

Jungle cat was detected in 70 grids out of the 821 sampling units (naïve ψ = 0.085). The cumulative weight of the top four models was 0.55, indicating moderate model-selection uncertainty. The top-ranked model (mv28; AICc = 1052.62; weight = 0.18) included dog_RAI, night light, NDVI and distance from PAs. The model estimated an occupancy probability of ψ = 0.19 ± 0.21 and a detection probability of p = 0.027 ± 0.005. Occupancy probability of jungle cat coincided with feral dog RAI across the corridor, signifying use of the same forest–agriculture niche by both species. Distance from PAs showed a positive effect (β = 2.04 ± 1.2 SE), although the relationship was non-significant (α = 0.09), suggesting that jungle cats may frequently utilise habitats outside PAs (*see Figure 7*). Night light intensity was negatively associated with occupancy (β = −4.01 ± 2.11 SE; α = 0.057), indicating a tendency to avoid highly illuminated landscapes associated with urbanisation and human activity. Similarly, NDVI showed a negative but non-significant relationship with occupancy (β = −3.38 ± 2.6 SE; α = 0.2). The predicted occupancy map (*see Figure 11b*) shows the probability of jungle cat habitat use across the corridor.

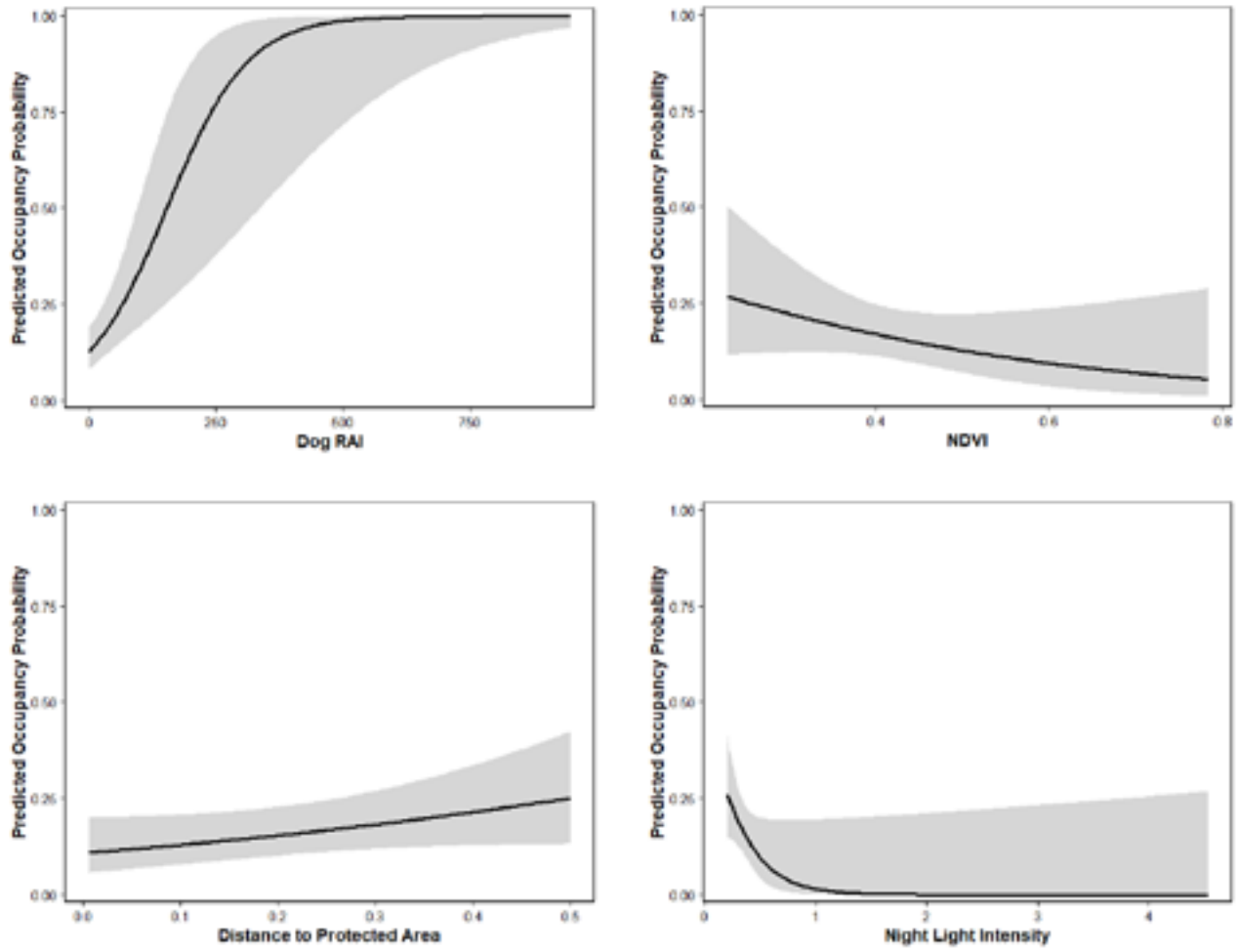

Figure 7: Response curves from the top-ranked jungle cat occupancy model illustrating the influence of feral dog (RAI) presence, NDVI, night light intensity and distance to protected area on the probability of jungle cat habitat use in SPC



d) Nilgai

Nilgai was detected in 62 out of the 821 sampling units (naïve ψ = 0.07). The highest-ranked model (mv13; AICc = 930.55; weight = 0.54) included distance from protected areas (D_PA), NDVI, built-up area and scrub cover as predictors of habitat use probability (*see Figure 8*). The estimated habitat use probability was ψ = 0.12 ± 0.17 with a detection probability of p = 0.04 ± 0.007. Parameter estimates from the best-supported model revealed a significant negative relationship between habitat use probability and NDVI (β = −17.36 ± 3.76 SE; α < 0.001), suggesting that nilgai presence decreased with increasing vegetation index. Distance from protected areas exerted a significant positive influence on occurrence (β = 3.66 ± 1.34 SE; α = 0.006), indicating higher probabilities of nilgai presence at sites located farther from PAs. Scrub cover showed a negative but statistically non-significant effect (β = −220.74 ± 449.64 SE; α = 0.62). Similarly, built-up area exhibited a negative yet non-significant relationship (β = −553.88 ± 342.04 SE; α = 0.105). The predicted habitat use probability map (*see Figure 11c*) shows a high probability of nilgai occurrence in the Lawaghoghri, Ambada and Sausar ranges.

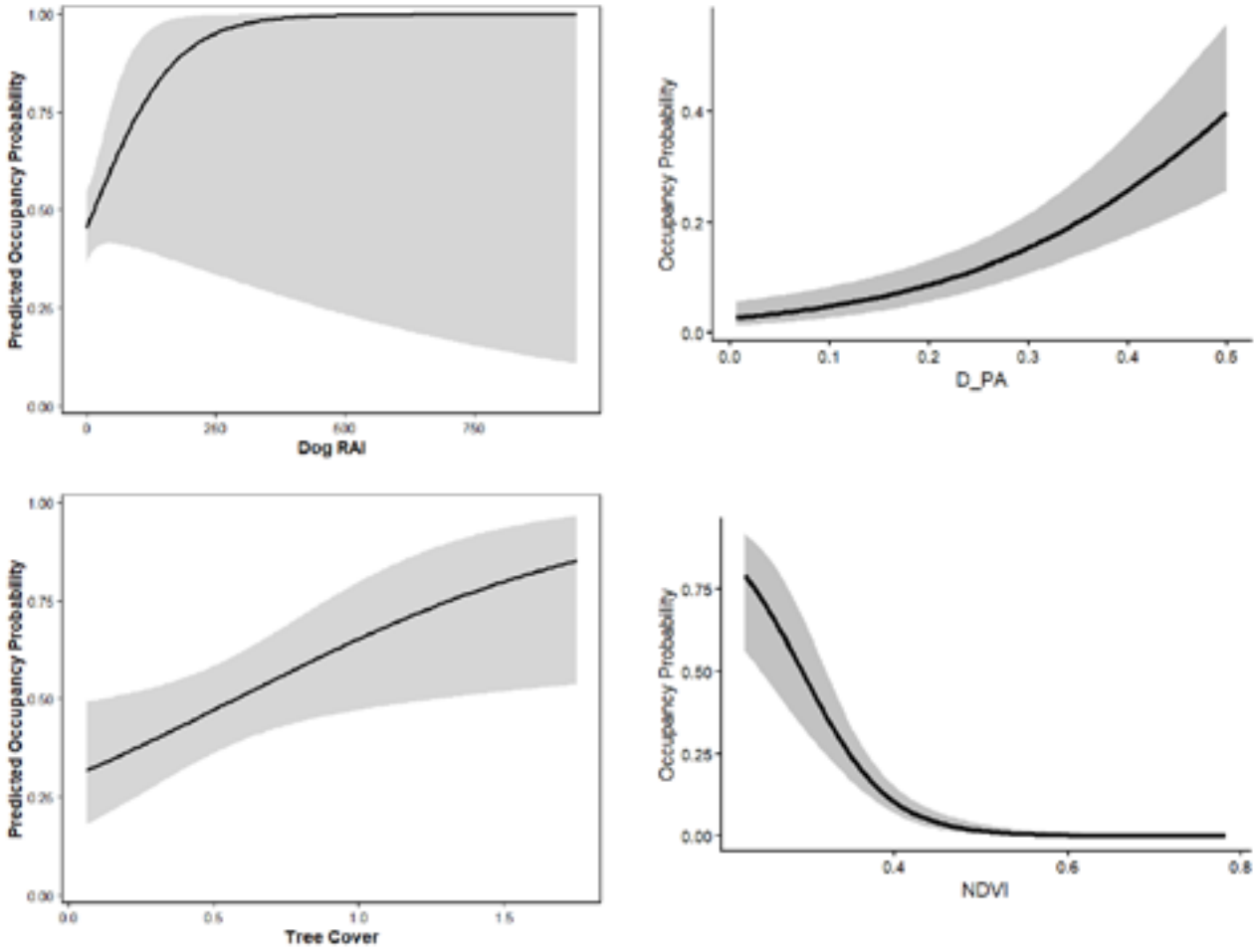

Figure 8: Response curves from the top-ranked nilgai occupancy model illustrating the influence of feral dog (RAI) presence, NDVI, tree cover and distance to protected areas (PAs) on the probability of nilgai habitat use in SPC



c) Four-horned antelope (chowsingha)

Chowsingha was detected in 91 grids out of 821 sampling units (naïve ψ = 0.11). The highest-ranked model included distance from PA (D_PA), human RAI (Hum_RAI), and NDVI as predictors of occupancy (Model 6; AICc = 1064.03, weight = 0.18) (*see Figure 9*). However, none of the habitat variables showed any statistical significance in predicting chowsingha occupancy. The estimated occupancy probability was ψ = 0.65 ± 0.13, with a detection probability of p = 0.008 ± 0.001.

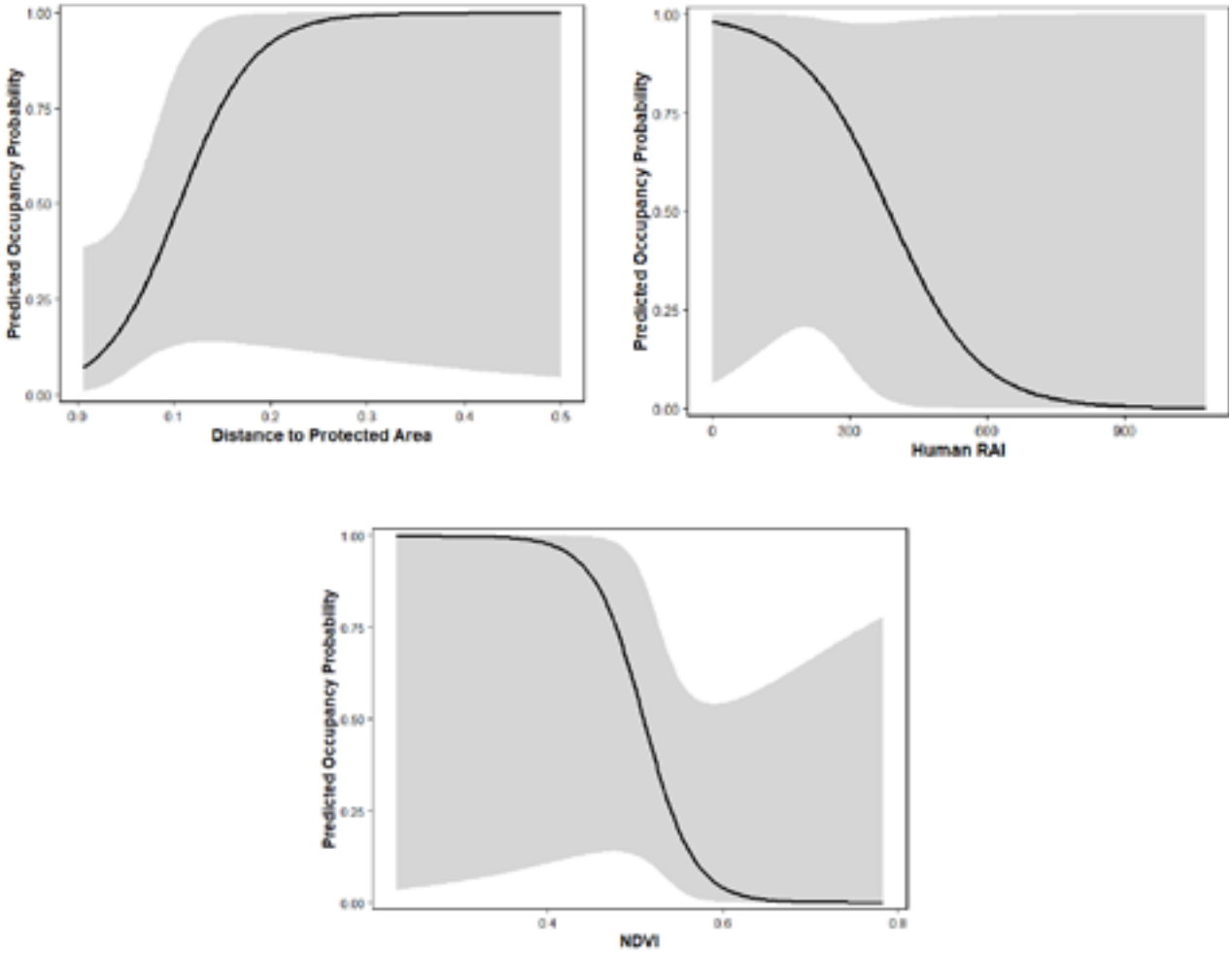

Figure 9: Response curves from the top-ranked chowsingha occupancy model illustrating the influence of distance to protected areas, NDVI and human presence (RAI) on the probability of chowsingha habitat use in the Satpura–Pench Corridor



e) Wild pig

Wild pig was detected in 222 out of the 821 sampling units (naïve ψ = 0.27). The top-supported models included distance to PAs, tree cover, bamboo forest cover (Bam_F), and feral dog RAI (Dog_RAI) (*see Figure 10*). Collectively, the top eight models accounted for approximately 70% of the cumulative model weight (mv6; AICc = 3006.95; weight = 0.15). The estimated habitat use probability was ψ = 0.51 ± 0.12 with detection probability of p = 0.04 ± 0.006. Wild pig habitat use was positively associated with distance to PAs (β = 3.301 ± 1.007 SE), tree cover (β = 1.49 ± 0.64 SE), bamboo forest cover (β = 2.09 ± 1.13 SE), and dog_RAI (β = 0.013 ± 0.007 SE), and preferentially occupy forested habitats associated with PA networks while also responding to local habitat composition. The positive association with dog_RAI suggests that wild pigs and feral dogs may share similar resource-use patterns or habitat preferences. The predicted occupancy probability of the wild pig map (*see Figure 11d*) indicates widespread habitat use throughout the corridor.

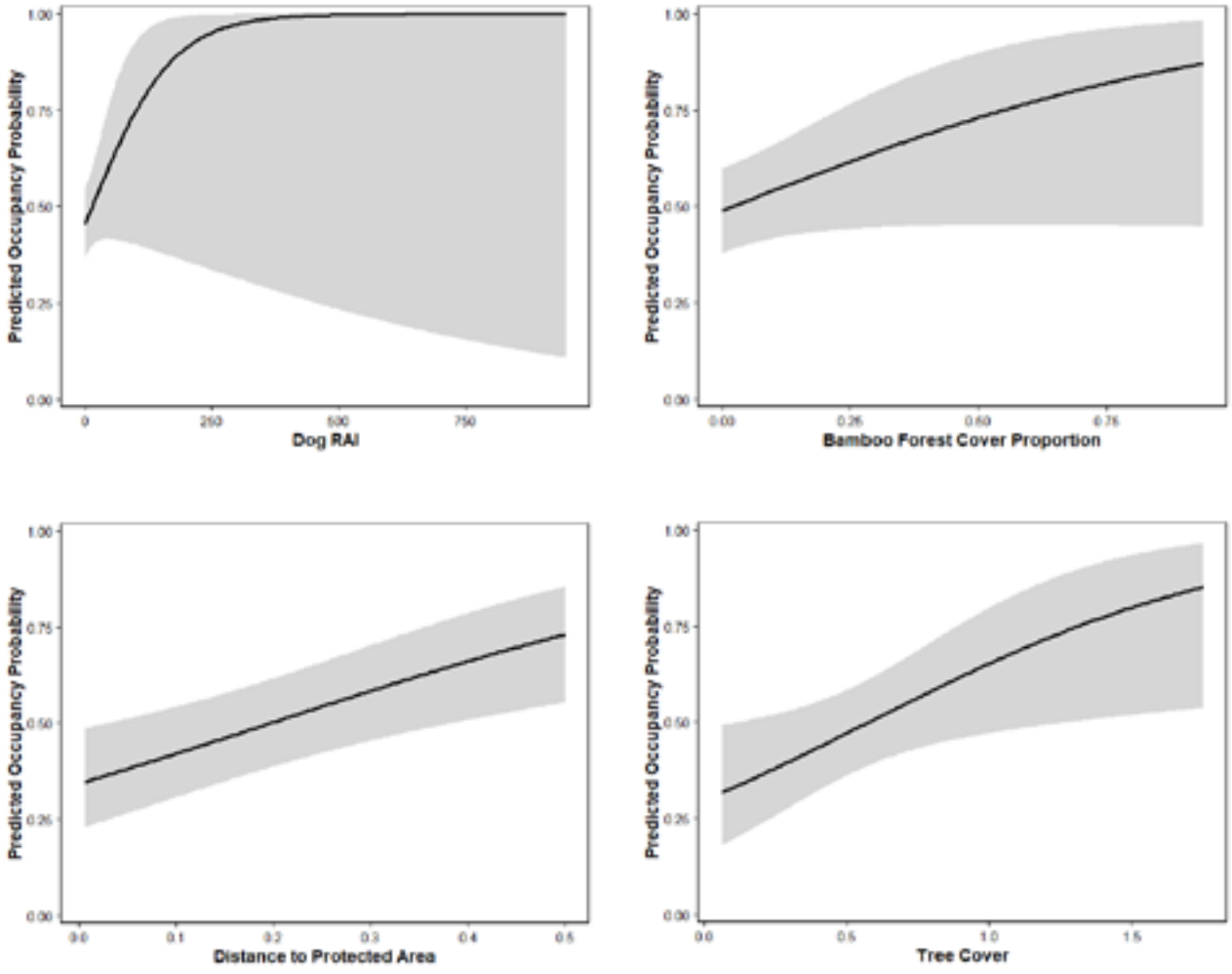

Figure 10: Response curves from the top-ranked wild pig occupancy model illustrating the influence of feral dog (RAI) presence, tree cover, distance to protected area (PA) and bamboo forest cover on the probability of wild pig habitat use in SPC



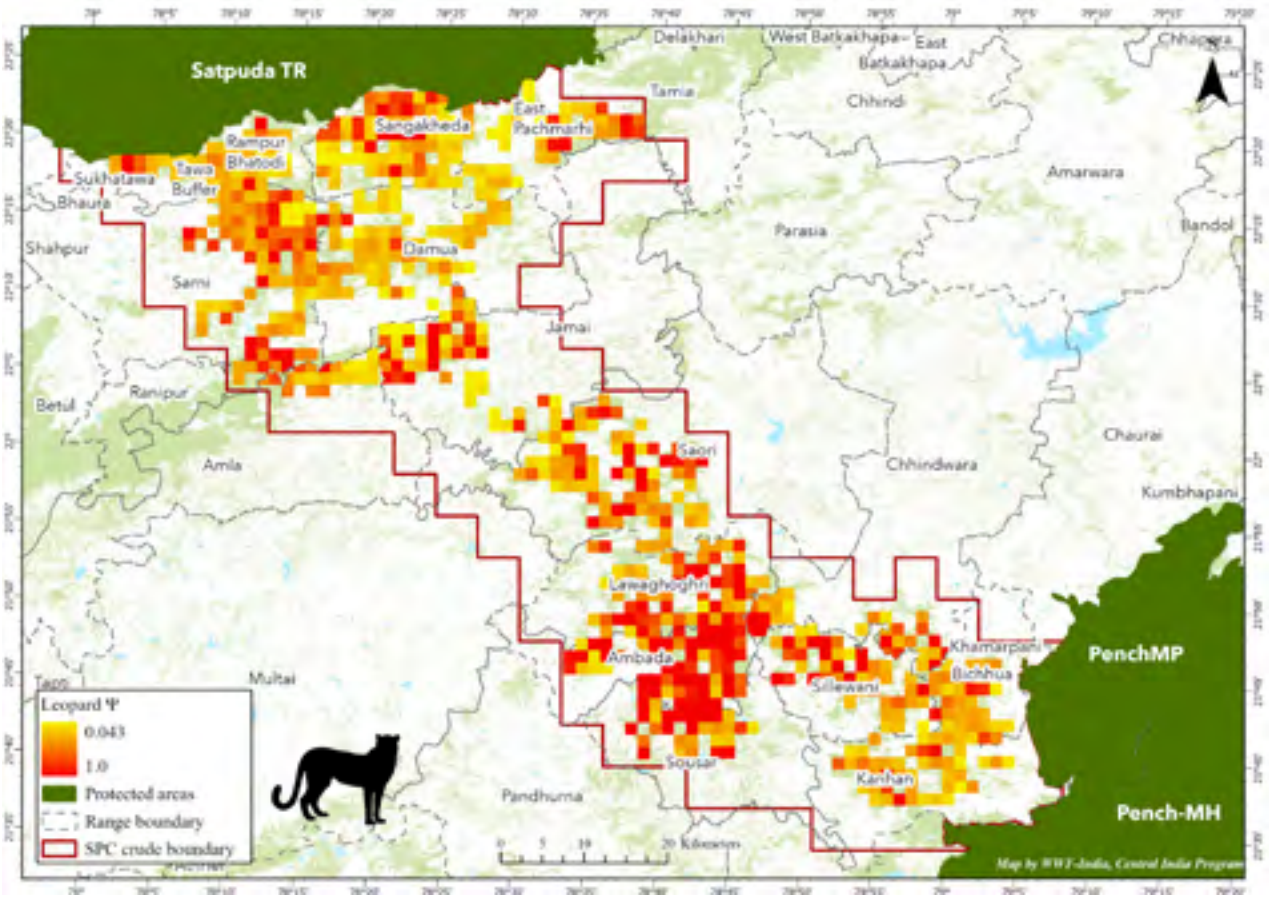

Figure 11a: Predicted leopard occupancy probability across SPC based on the best-supported occupancy model

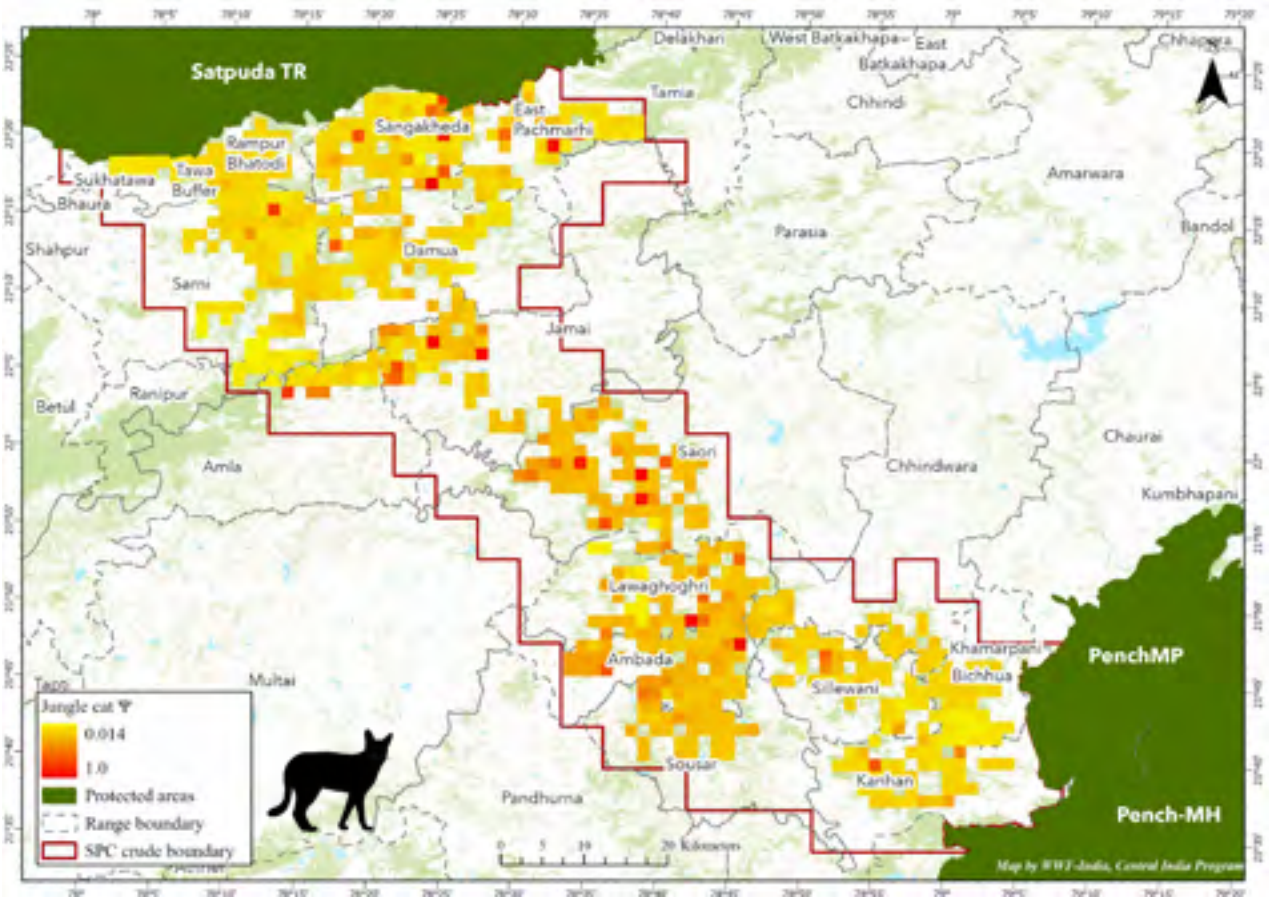

Figure 11b: Predicted jungle cat occupancy probability across Satpura–Pench Corridor based on the best-supported occupancy model

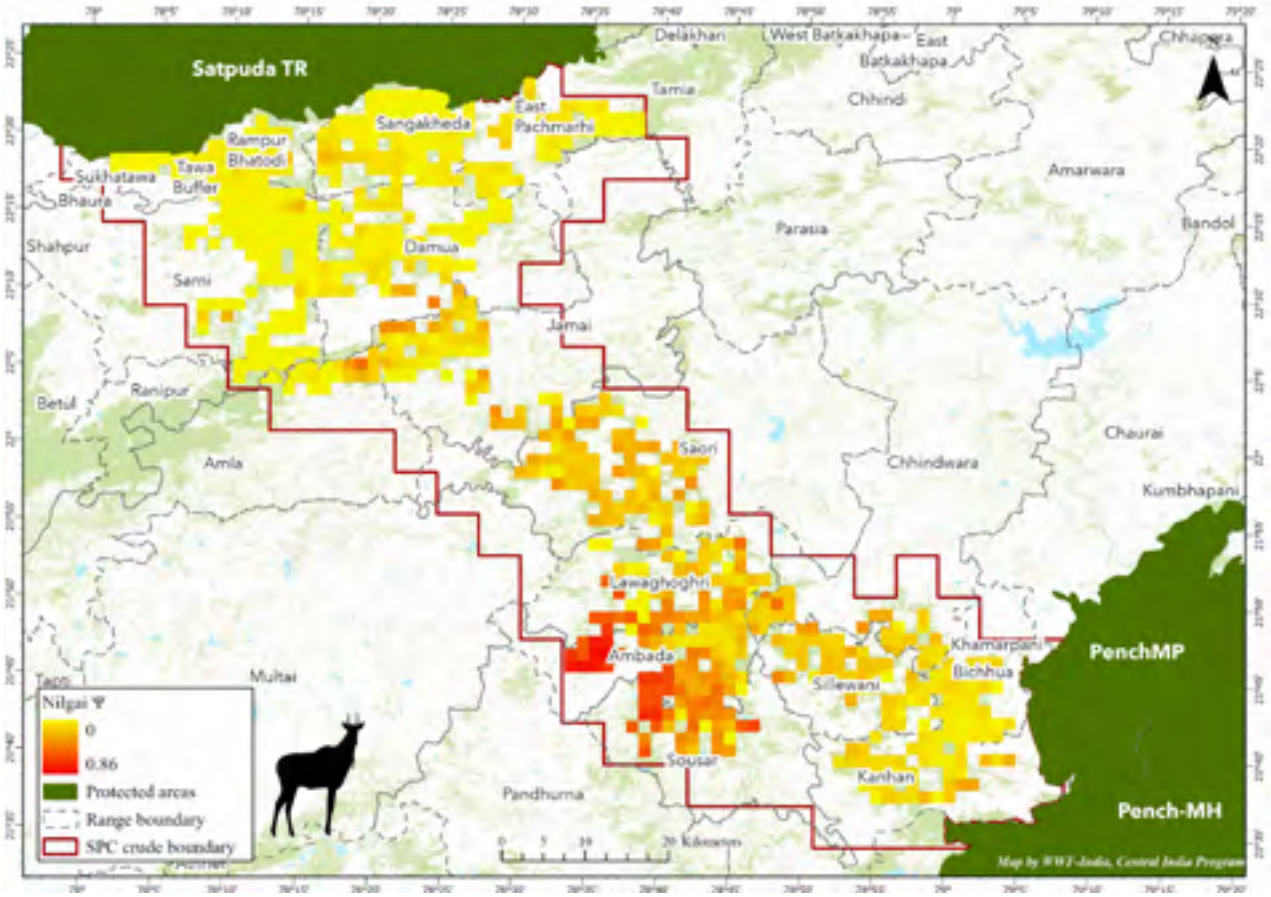

Figure 11c: Predicted nilgai habitat use probability across SPC based on the best-supported occupancy model

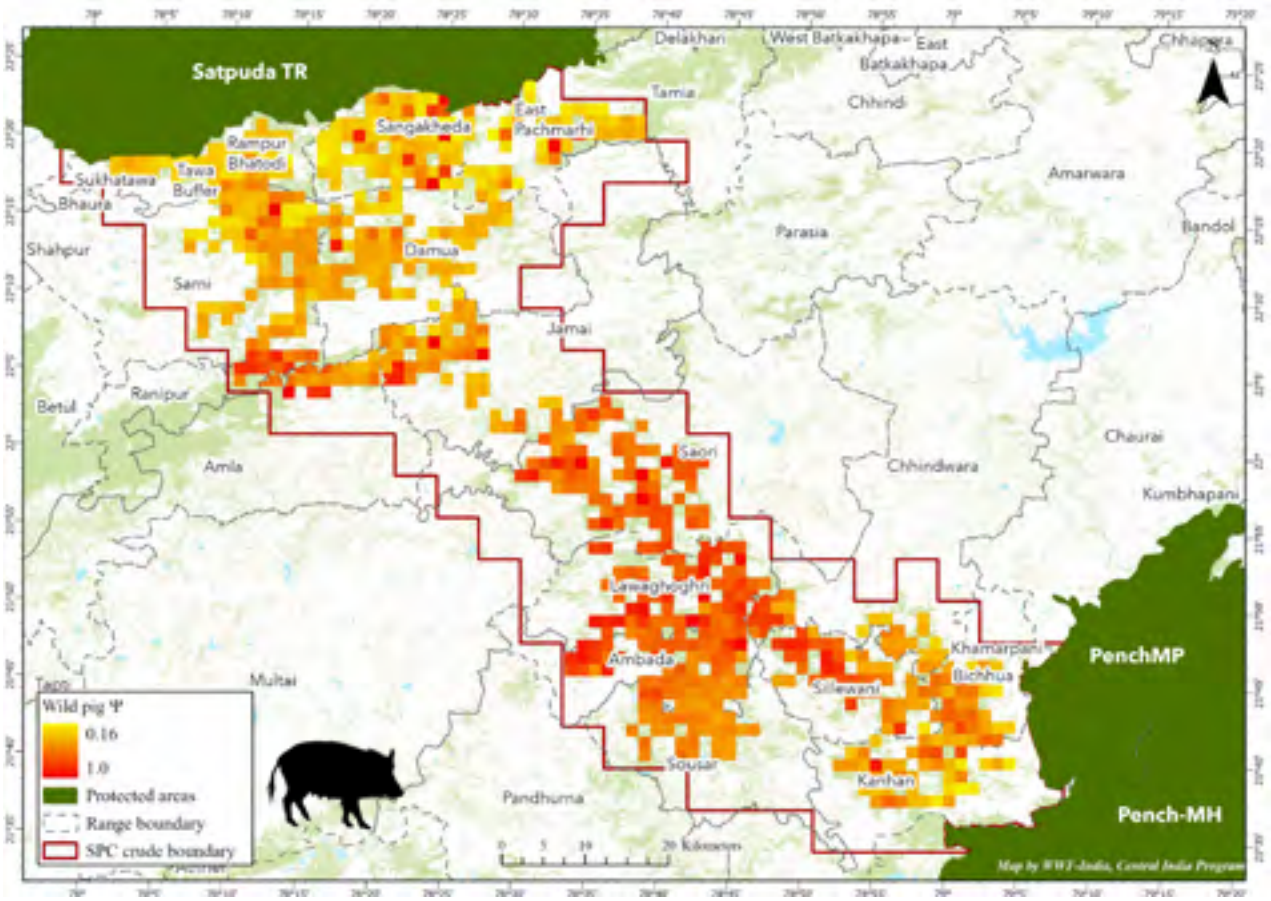

Figure 11d: Predicted wild pig habitat use probability across SPC based on the best-supported occupancy model

3.2 SPECIES CONNECTIVITY AND WEAK LINKS

3.2.1 Functional connectivity

The carnivore guild comprised tiger, leopard, Asiatic wild dog and Indian wolf. The models for cumulative detections of the carnivore guild estimated the occupancy probability at ψ = 0.43 ± 0.03, while the detection probability was estimated at p = 0.02 ± 0.003 (*see Table 5*). At least one species of carnivore was detected in 167 out of the 821 sampling units. The top-ranked model (Vehi_RAI) incorporated wild prey RAI (WP_RAI), fragmentation index (Frag_Index), and vehicle activity (AICc = 1904.87, AICcWt = 0.38) (*see Figure 12a*). The consistent occurrence of wild prey RAI in all highly ranked models highlights the importance of prey availability in determining carnivore occupancy. Fragmentation and vehicle activity also emerged as influential predictors.

The ungulate guild comprised chital, sambar, chinkara, chowsingha, wild pig and nilgai. Estimated occupancy probability for the herbivore guild was ψ = 0.56 ± 0.03, while detection probability was p = 0.05 ± 0.005. The top-ranked model included distance to PA (D_PA) and tree cover (AICc = 4461.65, AICcWt = 0.19) (*see Figure 12b*). Ungulate occupancy was positively associated with tree cover and distance to PA. The results suggest that carnivore occurrence is largely regulated by prey availability and landscape connectivity, whereas ungulate occupancy is primarily structured by habitat characteristics, including forest cover and proximity to PAs.

The predicted occupancy maps identified Lawaghoghri, Sausar and Ambada as an area with high probabilities of occurrence of both carnivores (*see Figure 13a*) and herbivore (*see Figure 13b*) guilds, marking its importance in wildlife conservation in the Satpura–Pench Corridor. Carnivores showed moderate to high probability of site use throughout the corridor, with the highest probabilities occurring close to protected areas, likely due to spillover effects of the adjacent PAs. In contrast, herbivores showed higher probabilities of occurrence away from PAs and maintained connectivity across the northern and southern parts of the corridor.

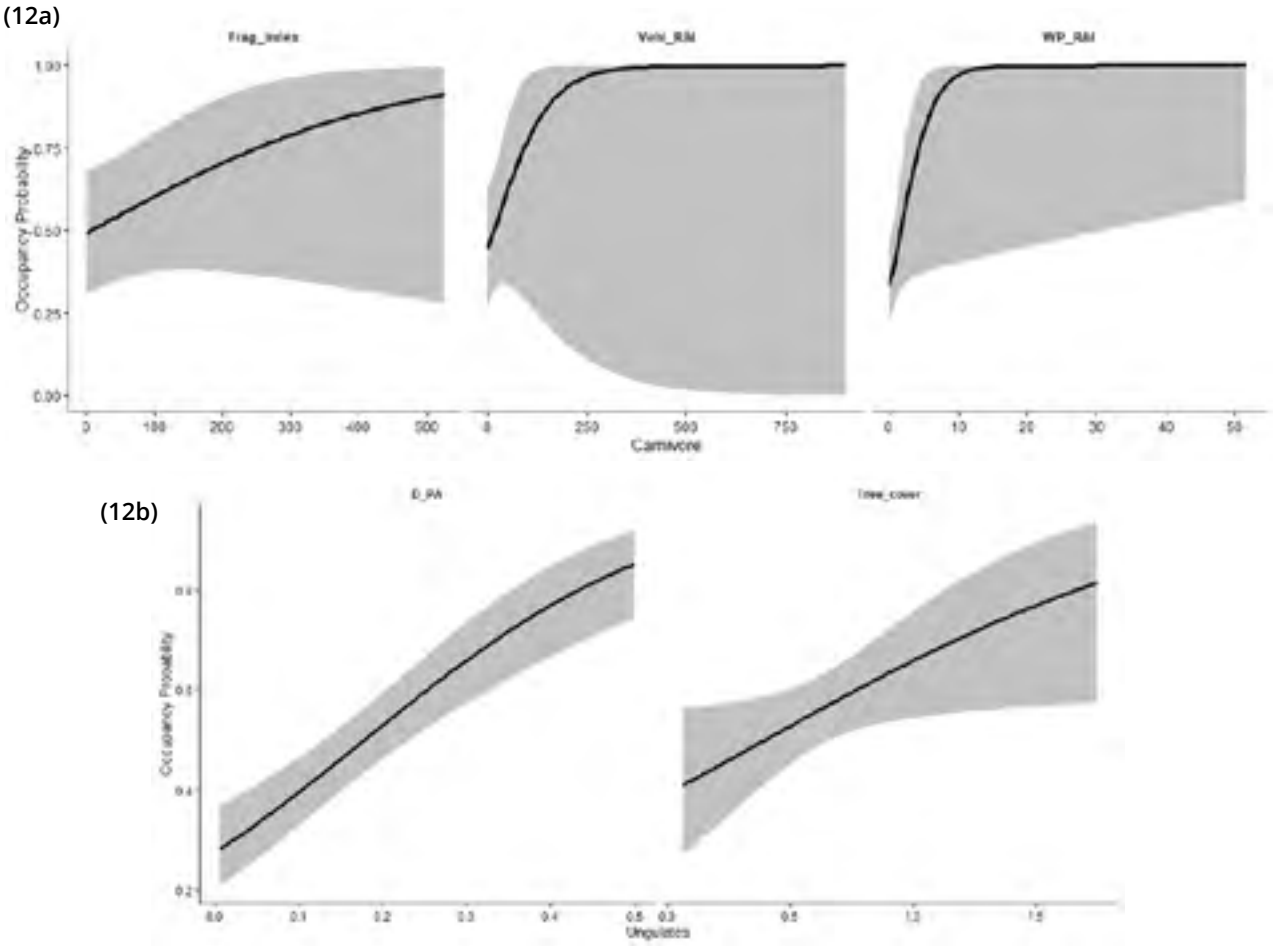

Figure 12: Response curves from the top-ranked carnivore and ungulate occupancy model illustrating the influence of fragmentation index, vehicle presence and wild prey abundance for carnivores (12a) and tree cover, distance to protected area for ungulate (12b) occupancy in the corridor

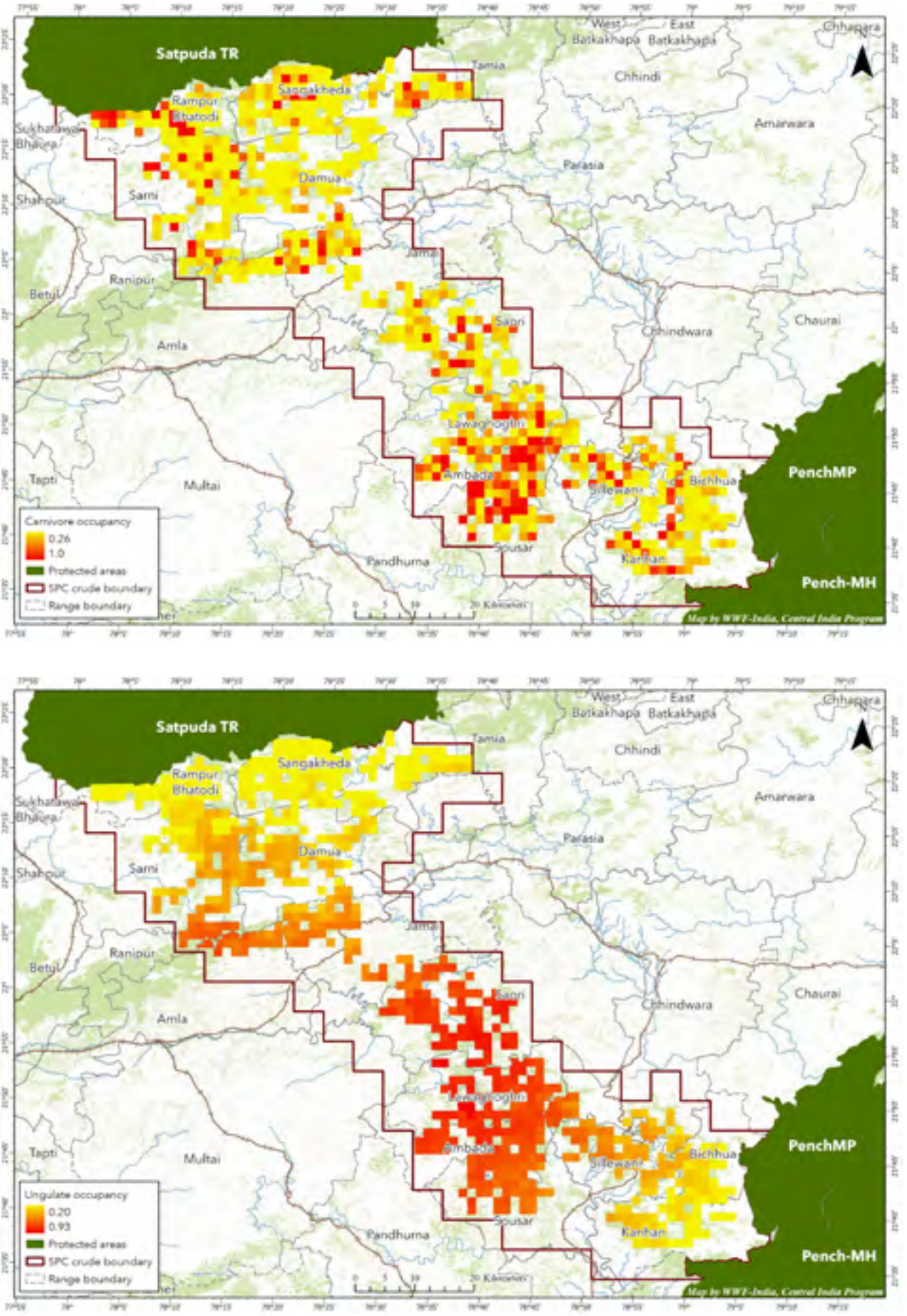

Figure 13: a) Predicted carnivore (left) and b) ungulate (right) occupancy probability across SPC based on the best-supported occupancy model

Table 4. Comparative summary of occupancy estimates, top-ranked models, and environmental drivers influencing occupancy of species

Species	Naïve occupancy	Model averaged habitat use / Occupancy (ψ)	Detection probability (p)	Top-ranked model (ΔAICc ≤ 2)	K	AICc	Model weight	Ecological interpretation
Leopard	0.129	0.467	0.016	WP_RAI (+1.51***), Tree_cover (+3.22**), Scrubs (+3.47)	5	1437.37	0.44	Occupancy was strongly influenced by prey availability and forest cover, indicating preference for habitats supporting abundant prey and structurally complex vegetation
Jungle cat	0.085	0.188	0.027	Dog_RAI (+0.013***), D_PA (+2.04), Nlight (−4.01), NDVI (−3.38)	6	1052.62	0.18	Occupancy was higher in less urbanised areas and landscapes were characterised by edge habitats, while increasing night-light intensity reduced occurrence
Nilgai	0.075	0.125	0.040	D_PA (+3.66**), NDVI (−17.36***), Scrubs (−220.74), Built_up (−553.88)	6	930.55	0.54	Occupancy was associated with open habitats near protected areas and declined with increasing vegetation density, scrub cover, and built-up land
Wild pig	0.274	0.497	0.036	D_PA (+3.30**), Tree cover (+1.49*), Dog RAI (+0.013), Bam_F (+2.09)	6	3006.95	0.15	Occupancy was positively associated with forested habitats near protected areas and bamboo-rich landscapes
Chowsingha	0.110	0.652	0.008	D_PA (+26.09), NDVI (−35.10), Hum_RAI (−0.01)	5	1064.03	0.18	Occupancy was highest in areas close to protected habitats and relatively open vegetation, while dense vegetation and human activity reduced occurrence

Note: ψ = occupancy probability; p = detection probability; D_PA = distance to protected area; WP_RAI = wild pig relative abundance index; Dog_RAI = domestic dog relative abundance index; NDVI = Normalised Difference Vegetation Index; Nlight = night-light intensity; Bam_F = bamboo forest cover. Asterisks indicate significance levels ($P < 0.05$ = *, $P < 0.01$ = **, $P < 0.001$ = ***).

Table 5. Occupancy model results for carnivore and ungulate guilds

Guild	Species included	Top-ranked model (ΔAICc ≤ 2)	Covariate effects (β)	AICc	ΔAICc	AICc weight	Estimated occupancy (ψ)	Detection probability (p)
Carnivores	Tiger, leopard, wolf, wild dog	WP_RAI + Frag_ Index + Vehi_RAI	Intercept = -1.0248***; WP_RAI = +0.4189*; Frag_Index = +0.0045 (ns); Vehi_RAI = +0.0144 (ns)	1904.87 (AIC = 1904.791)	0.00	0.38	0.428	0.024
		WP_RAI + Vehi_RAI	WP_RAI (+), Vehi_RAI (+)	1906.28	1.41	0.19	0.428	0.024
		WP_RAI + Frag_ Index + Tree_ cover + Vehi_RAI	WP_RAI (+), Frag_ Index (+), Tree_ cover (+), Vehi_RAI (+)	1906.61	1.74	0.16	0.428	0.024
Ungulates	Chital, sambar, chinkara, chowsingha, wild pig, nilgai	D_PA + Tree_ cover	Intercept = -1.68***; D_PA = +5.43***; Tree_ cover = +1.09*	4461.65 (AIC = 4461.594)	0.00	0.19	0.556	0.053
		D_PA + Tree_ cover + Frag_ Index	D_PA (+), Tree_ cover (+), Frag_Index (+)	4462.19	0.55	0.14	0.556	0.053
		D_PA + Bam_F	D_PA (+), Bam_F (+)	4463.30	1.66	0.08	0.556	0.053
		D_PA + Bam_F + Frag_ Index	D_PA (+), Bam_F (+), Frag_Index (+)	4463.33	1.68	0.08	0.556	0.053
		D_PA + Tree_ cover + Hum_RAI	D_PA (+), Tree_cover (+), Hum_RAI (+)	4463.44	1.79	0.08	0.556	0.053

Note: Significance markers are based on the top-model summaries: * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$; ns = not significant. For the top carnivore model, WP_RAI was positive and significant ($\beta = 0.4189$, $p = 0.0408$), whereas Frag_Index and Vehi_RAI were not significant. For the top ungulate model, D_PA ($\beta = 5.43$, $p = 1.85 \times 10^{-8}$) and Tree_cover ($\beta = 1.09$, $p = 0.0331$) were significant. The exact AIC values from the summaries are 1904.791 and 4461.594, respectively.

Caveats

1. The guild occupancy analysis is based on pooled detections of multiple species, with a site considered occupied if at least one species was detected. This approach is useful for assessing overall corridor use by carnivores, particularly when detections of individual species are limited. However, it may not accurately represent any individual species. The approach assumes a common ecological response among all pooled species, potentially obscuring species-specific relationships with habitat characteristics and anthropogenic pressures and hence the results should not be interpreted as representing occupancy or habitat preferences of any individual species.

2. Our inferences are based on a single-season camera-trap survey and may not fully capture temporal variation in habitat use or movement patterns. The functionality of a wildlife corridor is best evaluated using repeated surveys across multiple seasons and years to determine whether it consistently facilitates animal movement and connectivity.

3. The RAI maps should not be interpreted as a direct estimate of abundance; rather, they indicate areas with a relatively higher detection, irrespective of the number of individuals present.

Despite these limitations, the study provides the first landscape-scale assessment of wildlife occurrence and habitat use and identifies priority areas for conservation planning and future monitoring. Continued multi-season monitoring will further improve understanding of corridor functionality and wildlife responses to landscape change.

3.2.2 Movement of large carnivores

Tiger distribution and connectivity

Tiger detections were concentrated in a few localised areas within the corridor, particularly around Rampur Bhatodi, Lawaghoghri, Sausar, and the eastern portions adjoining Pench Tiger Reserve (*see Figure 5a*). Relative Abundance Index (RAI) values suggest that tiger activity is highest in habitat patches located near the protected area boundaries and along forested movement routes. A total of eight individuals were identified from matching one-sided flanks.

Leopard distribution and movement patterns

Leopards were recorded extensively throughout the corridor and were the most widely detected large carnivores during the survey. A minimum of 49 unique individual leopards were identified within

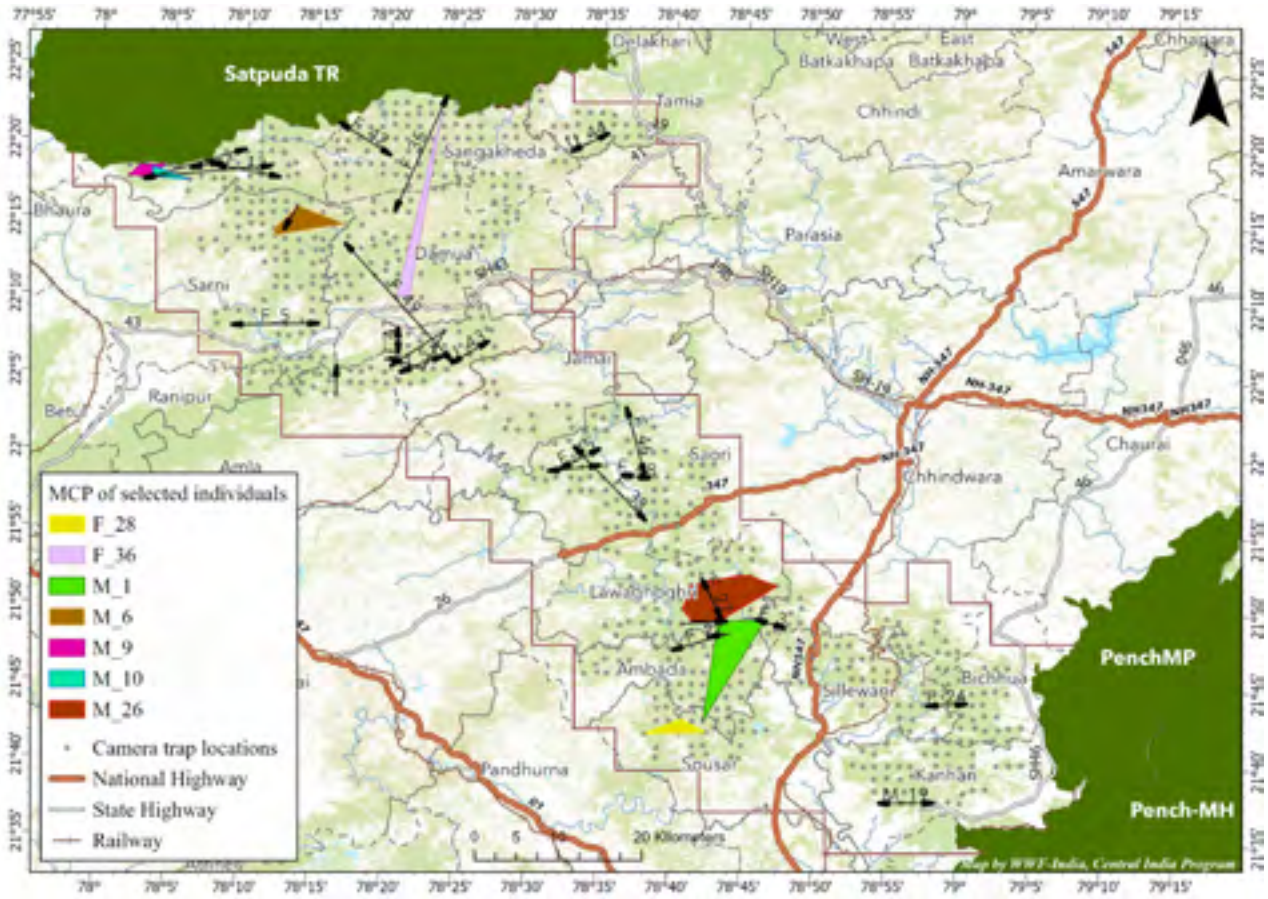

Figure 14: Individual leopard movement and selected MCPs. Here,leopard movement is shown using one flank only, as individuals were counted using a single flank



Figure 15: a) Left: M_26, photo captured during WWF-India 2021 CT survey, b) Right: M_26, photo-captured during current 2024–2025 CT survey

the corridor with confirmed identification of 25 females and 11 males. Minimum Convex Polygon (MCP) analyses of selected individuals revealed substantial movement distances between camera-trap locations, demonstrating the permeability of the corridor and the ability of leopards to utilise habitat patches across a broad geographic extent (*see Figure 14*). The identified individuals exhibited a range of movement distances, from localised movements of approximately 5 km to long-distance movements exceeding 49 km. The longest movement was recorded for female F_36, which traversed nearly 25 km in the northern section of the corridor between the Sangakheda and Damua landscapes, indicating extensive use of habitat patches across the corridor. In the southern section, male M_1 and M_26 exhibited movements of approximately 24 km and 21 km, respectively, within the Lawaghoghri-Ambada-Sausar landscape, while other individuals such as M_6, M_9, M_10, and F_28 showed more localised movement patterns.

Notably, several movement trajectories occurred in proximity to major linear infrastructure, including NH 347, NH 547, SH 43, and railway lines. Although leopard detections were recorded on both sides of these features, no individual was documented crossing them over long distances. This absence of observed crossings suggests that major highways and railways may influence movement routes and reduce landscape permeability. The Damua-Jamai forest block and the Lawaghoghri-Ambada region appear to function as critical stepping-stone habitats that facilitate movement between the Satpura and Pench landscapes.

Furthermore, the recapture of leopard M_26, previously photographed during the WWF-India monsoon camera-trap survey in 2021 (*see Figure 15a and 15b*), provides evidence of long-term occupancy and use of the corridor. Together, records of male and female leopards moving together at several camera-trap locations, along with the detection of a female accompanied by a cub, indicate that the corridor supports a resident breeding population and functions not only as a dispersal pathway but also as an important habitat for sustaining leopard populations.

3.2.3 Effect of anthropogenic pressure on connectivity

The present study did not explicitly quantify the influence of anthropogenic activities on wildlife connectivity through a dedicated connectivity model. Nevertheless, several field observations indicate that human disturbance may adversely affect wildlife movement within the corridor. During the survey, multiple camera traps were stolen or damaged at different locations, reflecting a substantial level of human presence and interference in forested areas (*see Figure 16*). In addition, evidence of hunting and poaching activities, including hunting camps, snares, and signs of illegal resource extraction, was recorded at several sites across the corridor.

3.3 STATUS OF FERAL AND DOMESTIC ANIMALS

Domestic livestock, including cattle, buffalo, goats, and sheep, were frequently detected throughout the corridor. Relative Abundance Index (RAI) values for livestock (*see Figure 17a*) varied considerably among ranges—from 103.46 to 4517.81—indicating substantial spatial heterogeneity in grazing pressure. The highest livestock activity was recorded in the Saori, Sausar, Damua, and Sangakheda regions, reflecting the strong dependence of local communities on forest and fringe habitats for grazing. Extensive livestock use within wildlife habitats may increase



Figure 16: Map depicting locations of cameras being damaged/stolen, and camera-trap images of timber extractors. bushmeat hunting, and men with guns

resource competition, habitat degradation, and the risk of disease transmission to wild ungulates.

Feral dogs were also widely distributed across the corridor (*see Figure 17b*). The RAI map revealed their presence across nearly all forest ranges, indicating that feral dogs are well established throughout the corridor landscape. Several high-abundance clusters were observed throughout the corridor where proximity to human settlements likely provides access to food subsidies and shelter. Feral dog presence correlates with jungle cat and wild pig occupancy in the corridor, showing they share the same niche.



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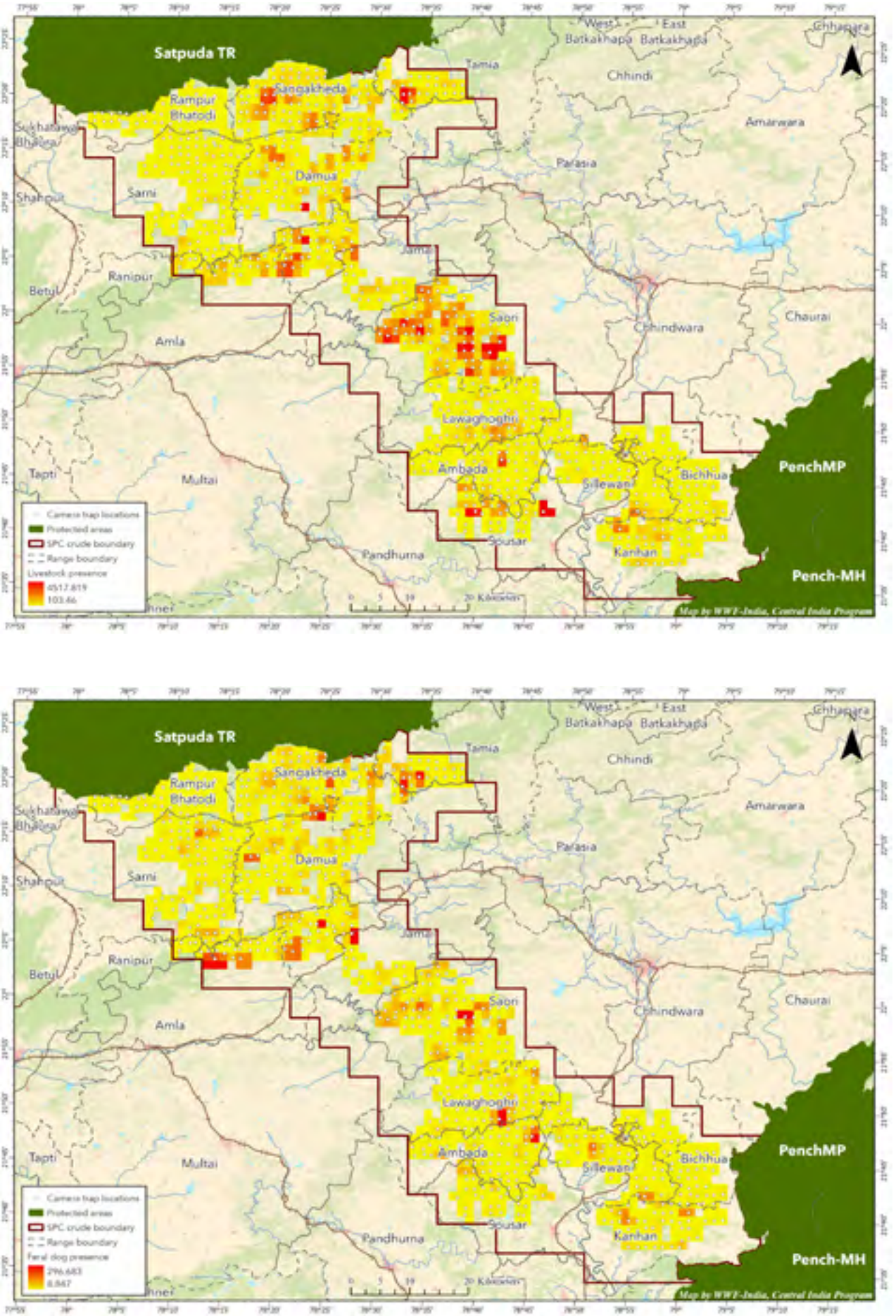

Figure 17: Livestock (17a) and feral dog (17b). Relative Abundance Index maps showing the intensity and range of presence in Satpura–Peench Corridor (SPC)



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4. DISCUSSION

This report provides new insights into wildlife occurrence within the Satpura–Pench Corridor (SPC), which connects two major source populations in Madhya Pradesh. The detection of 26 terrestrial mammal species, along with eight individual tigers and 49 individual leopards, highlights the corridor's importance in conserving biodiversity and providing space for dispersal and movement from adjacent protected areas (PAs). The widespread distribution of leopard, chowsingha, and wild pig across the corridor reflects their generalist habitat use, while rhesus macaque and Indian gray langur were also widely recorded throughout the landscape. A minimum of 49 individual leopards were identified within the corridor, indicating its importance in sustaining a resident and dispersing population. Higher detections of tigers and leopards near PAs likely reflect population spillover from adjacent source populations that support high densities of these species. A similar pattern was observed for sloth bears, with higher detections in the corridor sections adjoining Satpura Tiger Reserve.

4.1 CORRIDOR FUNCTIONALITY AND WILDLIFE USE

The combined evidence from occupancy modelling and Relative Abundance Index (RAI) maps indicates that the corridor continues to function as a movement landscape and habitat-use area for multiple species, including wide-ranging carnivores. However, species habitat use is highly heterogeneous and concentrated in forested stepping stone patches with lower human disturbance. The detection of tigers at a few locations within the corridor (*see Figure 5a*), albeit at low relative abundance, aligns with previous studies demonstrating dispersal from Satpura Tiger Reserve and Pench Tiger Reserve (Sharma et al., 2013; Yumnam et al., 2014; Thatte et al., 2018). The presence of tigers close to PAs only suggests dispersal rather than residency, reinforcing the corridor's role as a movement pathway rather than a core breeding habitat for tigers. In contrast, leopards were found to be resident and breeding in the corridor. The photo recapture of a male leopard at the same location approximately four years later indicates long-term use of the area. The carnivores exhibited widespread occupancy across the corridor (*see Figure 18*), including forested patches embedded within agricultural and human-dominated matrices. This pattern is consistent with the species' ecological plasticity and tolerance of modified landscapes documented in Central India (Athreya et al., 2013; Joshi and Pariwakam, 2017). The widespread detection of meso-carnivores and herbivores further indicates that the corridor retains sufficient ecological permeability to support multi-trophic movement.

The relatively higher capture rates of ungulates such as wild pig, nilgai, chowsingha, and sambar in several forest-agriculture interfaces underscore the importance of matrix habitats in facilitating corridor use (*see Figure 18*). As demonstrated in other Central Indian corridors, agricultural lands, particularly those interspersed with remnant forest patches and riparian vegetation, can function as semi-permeable movement zones rather than absolute barriers (Thatte et al., 2020).

4.2 SPATIAL HETEROGENEITY AND CRITICAL BOTTLENECKS

The results highlight substantial spatial heterogeneity in corridor quality. High carnivore and herbivore occurrence along the Kanhan River and adjoining forests, particularly in the Lawaghoghri, Sausar, and Ambada ranges, highlights the importance of riparian systems and relatively contiguous forest cover in maintaining functional connectivity. The high herbivore occurrence in these areas also supports a resident leopard population by providing an adequate prey base. Leopards were detected throughout the corridor, with the exception of the Navegaon–Junnardeo gap. The limited forest cover in this section resulted in fewer sampling grids, and if leopards use the intervening agricultural landscape only during infrequent dispersal events, the camera-trap sampling period may not have been sufficient to detect such movements.

The Navegaon–Junnardeo gap (*see Figure 19*) represents a convergence of multiple stressors, including fragmented forest cover, agricultural intensification, and multiple layers of linear infrastructure. Such bottlenecks are disproportionately important for corridor integrity because even localised habitat degradation can sever landscape-scale connectivity (Bennett, 2003; Thatte et al., 2018). The low number of carnivore detections in this zone does not necessarily indicate complete abandonment but rather suggests elevated resistance, with movement potentially restricted to rare or nocturnal dispersal events that are difficult to detect. The proposed Neemdhana–Hirdagarh–Navegaon–Bordehi Road (39.35 km) is likely to further increase resistance within this already fragile section of the corridor.

Despite intensive sampling, wildlife detections were generally low, limiting species-specific analyses of habitat use across the corridor. Consequently,

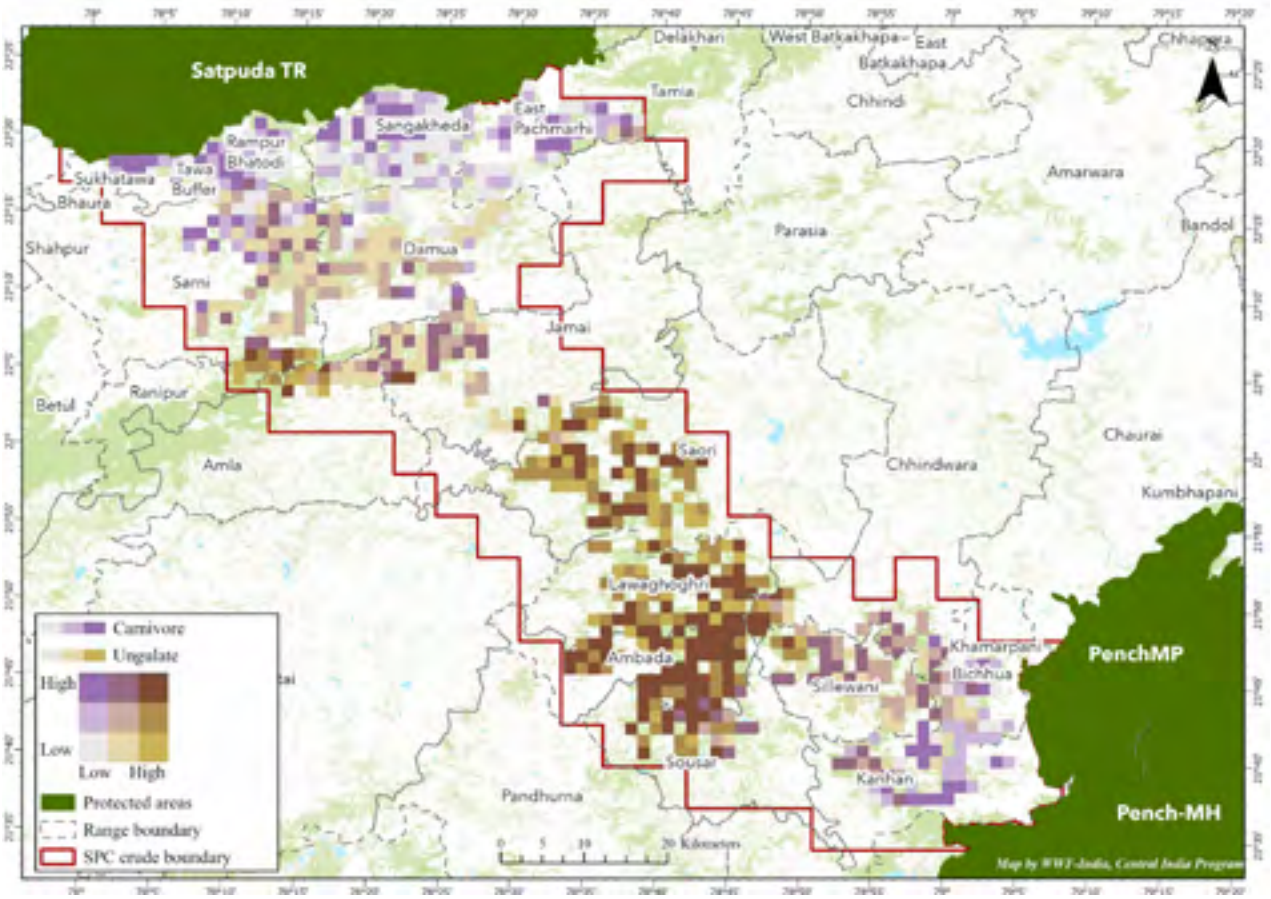


Figure 18: Species occupancy map showing the occurrence of carnivores and ungulates in the corridor

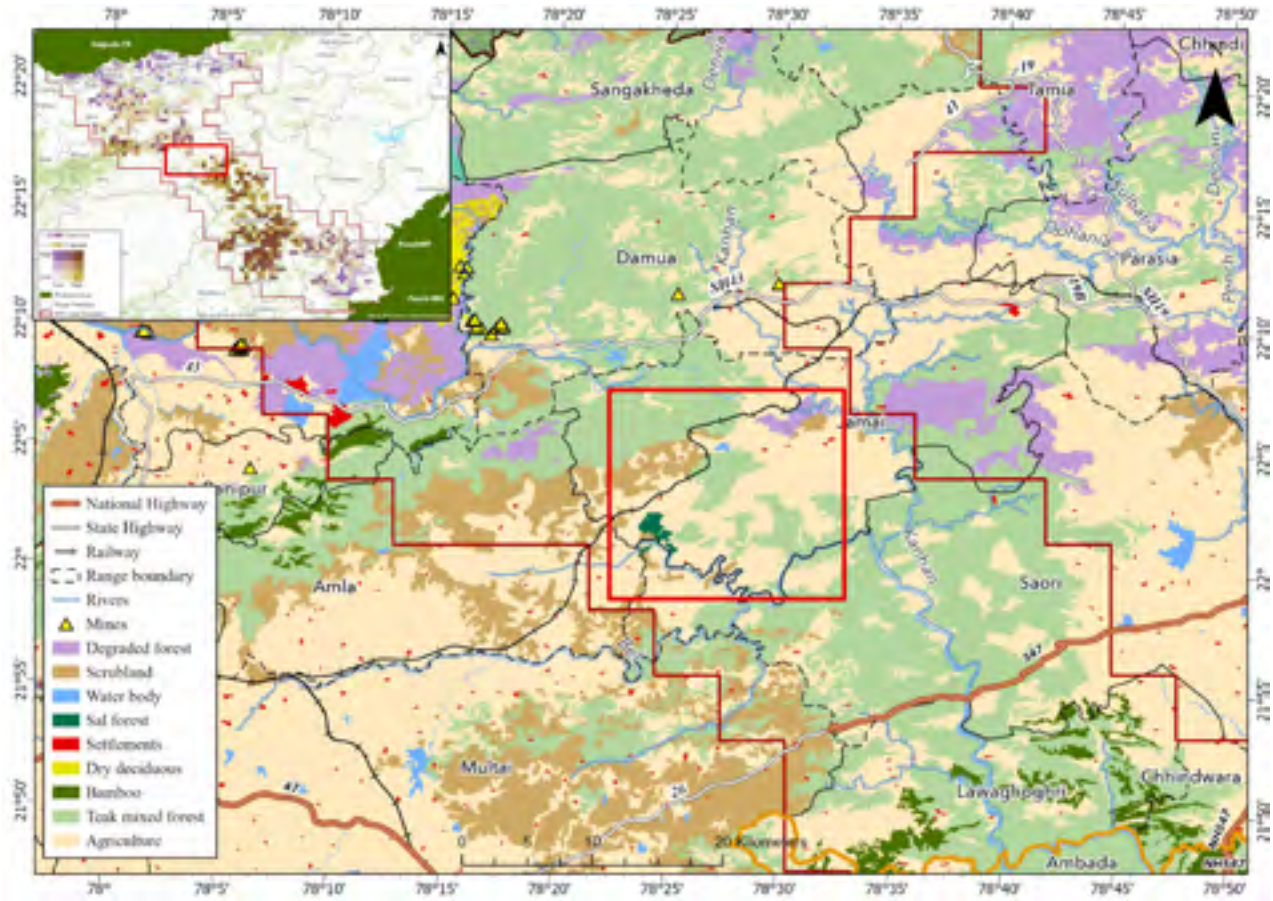


Figure 19: Navegaon–Junnardeo gap highlighted by the red box (Roy et al., 2015), showing land use types and forest cover layer. This is identified as a bottleneck area

none of the occupancy models identified strong or consistent effects of roads, railways, mines, agriculture, or built-up areas on species occurrence, and most models showed high uncertainty in the influence of individual predictors. However, the absence of significant effects on occurrence should not be interpreted as evidence that anthropogenic factors do not influence wildlife. These factors are more likely to affect movement and local population density, particularly for wide-ranging large carnivores, than site use estimated from camera-trap detections.

4.3 EFFECTS OF MINING

Tiger detections in the Sarni Range (North Betul Division), including a sub-adult male recorded approximately 5.22 km from the proposed Gandhigram underground coal mine, highlight the potential risk that future mining activities pose to tiger dispersal in the area. The restored Kothideo open-cast mine (Damua Range) recorded leopard and jackal detections, suggesting some potential for post-mining habitat usage. However, active mines (e.g., manganese mines in Kacchidhana and Rampur underground mine) and the proposed Gandhigram project intersect areas currently used by dispersing carnivores. In addition, biomedical waste dumping observed at Kothideo highlights the need for effective post-restoration monitoring and management. Mining and associated land-use change further exacerbate these pressures. Documented losses of dense and open forest cover to mines over the past two decades highlight increasing corridor degradation (Banerjee et al., 2020).

4.4 DIRECT THREATS TO WILDLIFE

Illegal activities also emerged as a concern during the survey. Several camera traps were stolen, while some of the cameras also captured evidence of hunting and poaching, particularly in the South Chhindwara and North Betul Forest Divisions. These activities pose a direct threat to wildlife populations and can contribute significantly to reducing their numbers.



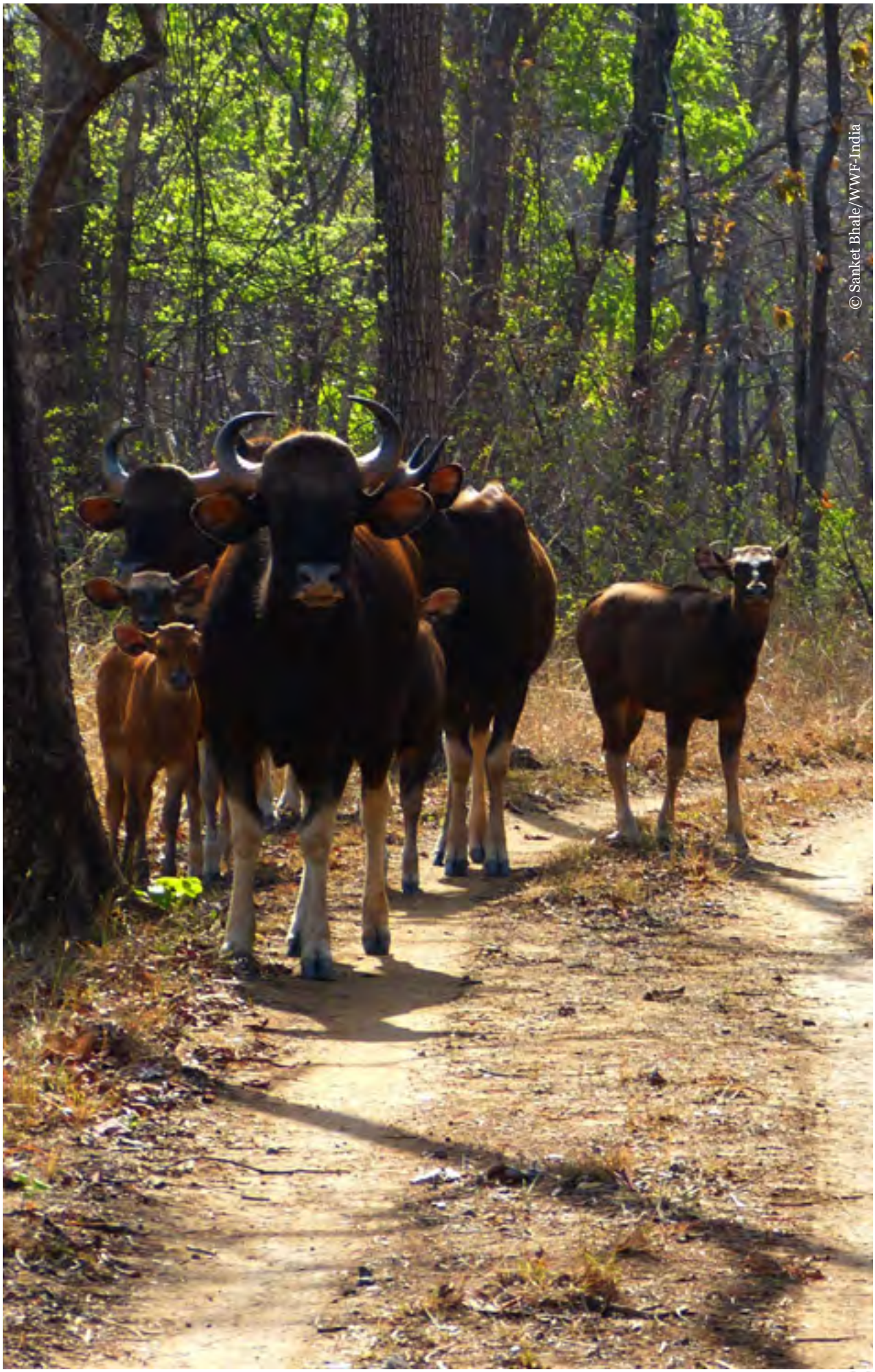
Figure 20: Leopard capture in restored Kothideo mine

4.5 FERAL SPECIES

Feral dogs were recorded across almost all corridor ranges, indicating a widespread potential threat to wildlife. Their occurrence overlapped with both jungle cats and herbivores, suggesting frequent overlap of habitat use. Feral dogs can prey on juvenile and small ungulates, harass wildlife, scavenge carnivore kills, compete with native carnivores for resources, and act as reservoirs for diseases that can be transmitted to wild carnivores and other wildlife.

Livestock presence was also widespread and abundant, particularly in the South and West Chhindwara forest divisions, indicating consistent grazing pressure within wildlife-use areas. Such overlap increases the likelihood of competition with wild herbivores for forage, habitat degradation, and carnivore depredation events.





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5. CONCLUSION

From a landscape perspective, the Satpura–Pench Corridor (SPC) functions as a keystone linkage within the Central Indian tiger landscape, connecting not only Satpura and Pench Tiger Reserves but also facilitating broader east–to–west dispersal towards Melghat and Kanha through interconnected corridors (Dutta et al., 2015; Thatte et al., 2018). Even low-frequency dispersal through the SPC can provide disproportionate genetic and demographic benefits by buffering source populations against inbreeding and local extinctions (Mondol et al., 2013; Wilting et al., 2015). The continued use of degraded and human-modified habitats by wildlife observed in this study highlights both resilience and vulnerability. While species are currently adapting to landscape change, this should not be interpreted as evidence of long-term persistence. Instead, it highlights a narrowing window for proactive conservation action before functional connectivity is lost.



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6. RECOMMENDATIONS AND INSIGHTS

SECURING THE NAVEGAON–JUNNARDEO BOTTLENECK

It is evident from the data that the Navegaon–Junnardeo gap (*see Figure 19*) is restricting the movement of large carnivores. Given the high landscape resistance resulting from the loss of structural connectivity, wildlife movement through this section is likely to be limited to occasional dispersal events. This is primarily driven by habitat fragmentation, forest degradation, and agricultural intensification. To secure the bottleneck, we have the following recommendations:

(i) Halting further forest diversion within this bottleneck

(ii) Active restoration work using CAMPA funds in the forested patches

(iii) Promotion of wildlife-friendly agriculture, agroforestry practices and cropping patterns in the private lands, with specific easements and compensations to the farms to keep their land barrier free

(iv) Promotion of plantations and horticulture on government land

CONSERVING THE KANHAN RIVER

The Kanhan River (*see Figure 2*) is a lifeline for the corridor and a major driver of biodiversity in the landscape. This study further highlights its importance in facilitating wildlife movement and dispersal, with several wildlife hotspots identified along the river, which indicates intensive use of the riparian habitat. However, the river catchment is under increasing pressure from unregulated sand mining and excessive water abstraction for agriculture, which may have contributed to the transition of the river from a perennial water source to a seasonal system. Restoration of degraded riverbanks through native species plantation, protection of riverine forests, and regulation of sand mining should be prioritised to maintain the ecological integrity of this natural corridor. In addition, a detailed assessment of the river's hydrology and the impacts of anthropogenic activities is needed to guide long-term conservation and management.

MITIGATING IMPACTS OF LINEAR INFRASTRUCTURE

It is evident that linear infrastructure causes high resistance to movement when mitigation measures are not strategically placed (Habib et al., 2022). In accordance with the recommendations of the National Tiger Conservation Authority (NTCA) and Ministry of Environment, Forest and Climate Change (MoEFCC), all existing and proposed linear infrastructure intersecting the corridor should implement corridor-sensitive planning and mitigation measures. This includes the identification of wildlife crossing zones using scientific data and the installation or retrofitting of appropriately designed underpasses and overpasses.

The documentation of wildlife road mortality and high animal movement near highways emphasises the need for immediate traffic-calming measures and, in the longer term, the construction of wildlife crossing structures along the roads cutting through the SPC. Wildlife warning signage, speed-calming structures, and night-time speed restrictions should be implemented on highways intersecting forested and riparian sections of the corridor. These measures are particularly critical near identified bottlenecks and high-use wildlife zones. Further evidence of this need comes from the road ecology survey conducted by WWF-India along NH 547 between December 2025 and January 2026, which documented multiple wildlife crossings, roadkill incidents, and highway sections that are frequently used by wildlife moving between habitat patches (*see Figure 21*). The survey highlighted several stretches where animal movement coincides with high vehicular traffic, increasing the risk of wildlife mortality and potentially reducing corridor functionality (*see Figure 22*). These findings emphasise the importance of integrating wildlife-friendly mitigation measures, into future highway management and expansion plans to maintain ecological connectivity across the corridor.

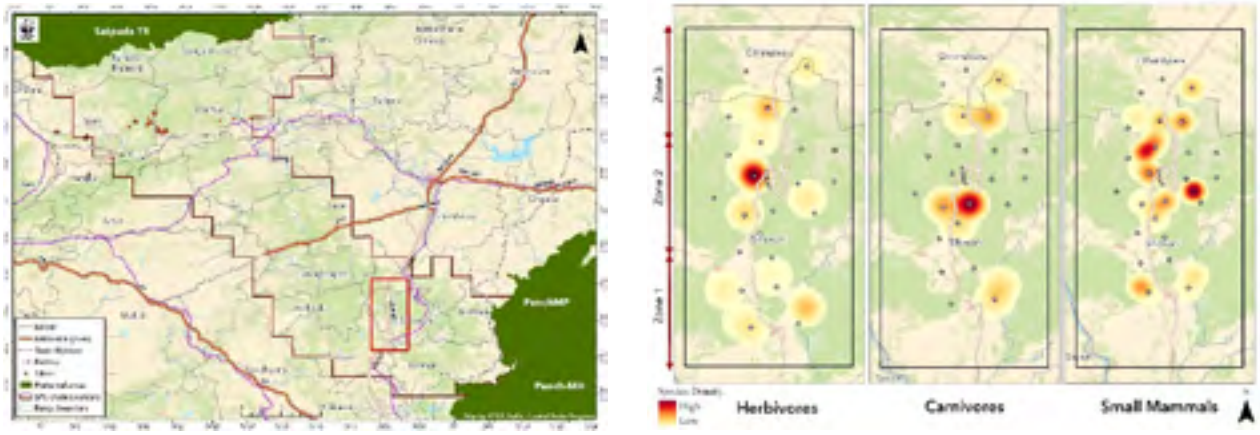

Figure 21: Road ecology study conducted in the sensitive part of NH 547, which is proposed for expansion, bisecting the corridor showing species density across the highway



Figure 22: (Left) A roadkill of a small Indian civet on NH 347 (Multa–Chhindwara Highway) near Morghat, Lawaghoghri Corporation (Chhindwara Corporation Division). (Right) Leopard captured during NH 547 survey

ENGAGING THE COMMUNITY

The corridor is a mosaic of agricultural land, forests, and built-up areas. Therefore, human-wildlife interactions are inevitable. The spatial overlap of livestock and large carnivores across the corridor indicates a high potential for future human-wildlife conflict. To reduce the risk of retaliatory actions and promote coexistence, an effective rapid response mechanism that compensated affected livestock owners should be established. Similarly, given the high occurrence of nilgai and wild pig, both of which are known crop-raiding species, an efficient crop damage compensation mechanism should be implemented.

Communities whose livelihoods depend on the collection of non-timber forest products (NTFPs) should be encouraged to adopt sustainable harvesting practices. WWF-India's initiative to help local communities secure better market prices for sustainably harvested food-grade mahua flowers provides a model that can be scaled up across the landscape. Such initiatives can also help reduce forest fires incidents. In addition, a coordinated fire management strategy, including early fire detection and community-managed fire lines, should be implemented. Effective waste management, led by local communities, should also be ensured during large religious and cultural gatherings within forested landscapes.

The presence of feral dogs throughout the corridor is a direct threat to wildlife in the corridor. Feral dog populations should be managed in and around wildlife corridors through coordinated, humane, and science-based interventions, including sterilisation, vaccination, responsible pet ownership, and improved waste management. Such measures can reduce predation, resource competition, and disease transmission to native wildlife while minimising negative interactions at the human–wildlife interface.

The forest department currently engages local communities through Joint Forest Management Committees (JFMCs) and Van Samiti. Strengthening these committees and enhancing community role as decision makers in their governance would be critical for their effective functioning. These committees should have adequate representation and participation in accordance with the working plan guidelines. Further, community rights (CRF

and CFRR) holders under the FRA, 2006, should be encouraged to undertake community-led conservation. Conservation NGOs should be roped in to play a facilitatory role in the development and implementation of the CFR management plans.

MINIMISING THE IMPACTS OF MINING AND ALLIED ACTIVITIES

The proximity of tiger detections to the proposed Gandhigram mine highlights the need for spatially explicit safeguards. At a minimum, an ecological buffer should be delineated around documented tiger-use areas in the Sarni Range to minimise disturbance and maintain habitat connectivity. Operational guidelines must include restriction of heavy vehicular transport during nocturnal peak wildlife activity, installation of movement-sensitive lighting rather than continuous illumination, and independent biodiversity audits at fixed intervals. Restoration of decommissioned mines, as demonstrated by the Kothideo site, should be institutionalised as a mandatory post-closure requirement to enhance habitat recovery and reuse by wildlife. For restored sites such as Kothideo, periodic ecological assessment (camera traps and prey surveys) should be institutionalised to prevent secondary degradation and waste dumping.

STRENGTHENING PATROLLING AND ANTI-POACHING EFFORTS

The camera-trap detection of hunters and armed individuals near roads and wildlife-rich areas indicates threat of exploitation of accessible forest patches. Intensified patrolling in road-adjacent forests, strategic placement of check-posts, and strengthened law enforcement monitoring are recommended. Given that armed individuals were mostly detected near roads, patrolling intensity should be strategically increased in beats intersected by highways, particularly in Pandhurna, West Chhindwara and North Betul. Awareness campaigns about legal provisions against wildlife hunting and the Firearms Act should be conducted jointly with the police department to inform citizens from nearby villages. Simultaneously, socio-economic assessments should be undertaken to design targeted livelihood diversification and nutritional programmes in vulnerable areas with due support from the district administration.

INSTITUTIONALISING LONG-TERM CORRIDOR MONITORING

A standardised, corridor-wide monitoring protocol should be established combining camera trapping, grazing surveys, fire mapping, roadkill documentation, and socio-economic assessments. Monitoring must be seasonally replicated to capture variation in wildlife movement and disturbance intensity. Given staff shortages in certain divisions, strengthening frontline workforce capacity is essential for sustaining monitoring efforts. Data generated should feed into an adaptive management plan at the landscape scale to continuously refine interventions in structurally weak and high-risk segments of the Satpura–Pench Corridor.



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7. सिफारिशें एवं प्रमुख निष्कर्ष

नवेगांव–जुन्नारदेव अवरोधक क्षेत्र (BOTTLENECK) को सुरक्षित करना

अध्ययन के आँकड़ों से स्पष्ट है कि नवेगांव–जुन्नारदेव गैप बड़े मांसाहारी वन्यजीवों की आवाजाही में बाधा उत्पन्न कर रहा है। इस क्षेत्र में वनों की संरचनात्मक संपर्क या बनावटी जुड़ाव (Structural Connectivity) कम होने के कारण परिदृश्य में प्रतिरोध (Landscape Resistance) बढ़ गया है, जिससे वन्यजीवों की आवाजाही संभवतः केवल कभी-कभार होने वाले विस्थापन (Dispersal) तक सीमित रह गई है। इसका मुख्य कारण वन आवास का विखंडन, वनों का क्षरण तथा कृषि का तीव्र विस्तार है।

इस महत्वपूर्ण अवरोधक क्षेत्र को सुरक्षित करने के लिए निम्नलिखित उपाय सुझाए जाते हैं–

- इस क्षेत्र में वन भूमि के किसी भी अतिरिक्त डायवर्जन (Forest Diversion) पर रोक लगाई जाए।
- CAMPA निधि का उपयोग करते हुए वन क्षेत्रों तथा राजस्व भूमि पर स्थानीय प्रजातियों के साथ सक्रिय पुनर्स्थापन (Restoration) एवं पौधारोपण किया जाए।
- निजी कृषि भूमि पर वन्यजीव-अनुकूल कृषि (Wildlife-friendly Agriculture), कृषिवानिकी (Agroforestry) तथा उपयुक्त फसल प्रणाली को बढ़ावा दिया जाए। किसानों को आवश्यक प्रोत्साहन तथा मुआवज़ा उपलब्ध कराया जाए, ताकि उनकी भूमि वन्यजीवों की आवाजाही में बाधा न बने।
- सरकारी भूमि पर वृक्षारोपण एवं बागवानी (Horticulture) को प्रोत्साहित किया जाए।

कन्हान नदी का संरक्षण

कन्हान नदी इस कॉरिडोर की जीवनरेखा है तथा पूरे परिदृश्य की जैव विविधता का प्रमुख आधार है। इस अध्ययन से यह भी स्पष्ट हुआ कि कन्हान नदी वन्यजीवों की आवाजाही और प्रसार में महत्वपूर्ण भूमिका निभाती है। नदी के किनारे कई ऐसे वन्यजीव हॉटस्पॉट (Wildlife Hotspots) पाए गए हैं, जो दर्शाते हैं कि नदी तटीय आवास (Riparian Habitat) का वन्यजीवों द्वारा व्यापक उपयोग किया जा रहा है।

हालाँकि, नदी का जलग्रहण क्षेत्र (Catchment) अनियंत्रित रेत खनन तथा कृषि के लिए अत्यधिक जल दोहन के कारण बढ़ते दबाव में है। इन कारणों से संभवतः यह नदी, जो पहले बारहमासी (Perennial) थी, अब कई स्थानों पर मौसमी (Seasonal) स्वरूप लेती जा रही है। इस प्राकृतिक कॉरिडोर की पारिस्थितिक अखंडता (Ecological Integrity) बनाए रखने के लिए निम्न कार्यों को प्राथमिकता दी जानी चाहिए–

- स्थानीय प्रजातियों के माध्यम से क्षतिग्रस्त नदी तटों का पुनर्स्थापन।
- नदी तटीय वनों (Riverine Forests) का संरक्षण।
- रेत खनन का प्रभावी नियमन।

इसके अतिरिक्त, नदी के जल प्रवाह (Hydrology) तथा मानवीय गतिविधियों के प्रभावों का विस्तृत अध्ययन किया जाना चाहिए, ताकि दीर्घकालिक संरक्षण एवं प्रबंधन के लिए वैज्ञानिक आधार उपलब्ध हो सके।

रेखीय अवसंरचना (LINEAR INFRASTRUCTURE) के प्रभावों को कम करना

अध्ययन से स्पष्ट है कि यदि सड़क, रेल अथवा अन्य रेखीय अवसंरचना परियोजनाओं में उचित स्थानों पर शमन उपाय (Mitigation Measures) नहीं किए जाते, तो वे वन्यजीवों की आवाजाही में गंभीर बाधा उत्पन्न करती हैं (Habib et al., 2022)। राष्ट्रीय बाघ संरक्षण प्राधिकरण (NTCA) तथा पर्यावरण, वन एवं जलवायु परिवर्तन मंत्रालय (MoEFCC) के दिशा-निर्देशों के अनुसार, वन्यजीव गलियारों (कॉरिडोर) से होकर गुजरने वाली सभी वर्तमान एवं प्रस्तावित रेखीय अवसंरचना परियोजनाओं की योजना वन्यजीव संपर्क को ध्यान में रखकर बनाई जानी चाहिए। इसके अंतर्गत वैज्ञानिक आँकड़ों के आधार पर वन्यजीव पारगमन स्थलों (Wildlife Crossing Zones) की पहचान की जाए तथा उपयुक्त आकार के अंडरपास (Underpasses) और ओवरपास (Overpasses) बनाए जाएँ अथवा मौजूदा संरचनाओं में आवश्यक सुधार किए जाएँ।

सड़कों पर वन्यजीवों की मृत्यु (Roadkill) तथा राजमार्गों के आसपास वन्यजीवों की अधिक आवाजाही यह दर्शाती है कि तत्काल यातायात नियंत्रण उपायों की आवश्यकता है। साथ ही, भविष्य में कॉरिडोर से होकर गुजरने वाली सड़कों पर वन्यजीव पारगमन संरचनाओं का निर्माण किया जाना चाहिए।

वन क्षेत्रों एवं नदी तटों से होकर गुजरने वाले राजमार्गों पर निम्न उपाय लागू किए जाएँ–

- वन्यजीव चेतावनी संकेत (Wildlife Warning Signage)
- गति नियंत्रण संरचनाएँ (Speed-calming Measures)
- रात्रिकालीन गति सीमा

ये उपाय विशेष रूप से उन स्थानों पर आवश्यक हैं जहाँ वन्यजीवों की आवाजाही अधिक है या जहाँ महत्वपूर्ण अवरोधक (Bottlenecks) स्थित हैं।

इस आवश्यकता की पुष्टि WWF-India द्वारा दिसंबर 2025 से जनवरी 2026 के बीच राष्ट्रीय राजमार्ग 547 (NH-547) पर किए

गए रोड इकोलॉजी सर्वेक्षण से भी हुई है। इस सर्वेक्षण में अनेक वन्यजीव पारगमन स्थल, सड़क दुर्घटनाओं में वन्यजीवों की मृत्यु तथा ऐसे राजमार्ग खंड दर्ज किए गए जिनका वन्यजीव नियमित रूप से उपयोग करते हैं (चित्र 15)। अध्ययन से यह भी पता चला कि कई स्थानों पर वन्यजीवों की आवाजाही और भारी यातायात एक ही क्षेत्र में केंद्रित है, जिससे वन्यजीवों की मृत्यु का खतरा बढ़ जाता है तथा कॉरिडोर की कार्यक्षमता प्रभावित हो सकती है।

इसलिए भविष्य में राजमार्गों के प्रबंधन एवं विस्तार की योजनाओं में वन्यजीव-अनुकूल उपाय, जैसे समर्पित पारगमन संरचनाएँ, उपयुक्त स्थानों पर फेंसिंग, बेहतर संकेतक तथा यातायात नियंत्रण उपायों को अनिवार्य रूप से शामिल किया जाना चाहिए, ताकि कॉरिडोर की पारिस्थितिक संपर्क क्षमता बनी रहे।

समुदाय की भागीदारी

यह कॉरिडोर कृषि भूमि, वन तथा मानव बस्तियों का मिश्रित परिदृश्य है। इसलिए मानव–वन्यजीव संपर्क और संघर्ष की संभावना स्वाभाविक है।

कॉरिडोर में पशुधन और बड़े मांसाहारी वन्यजीवों की व्यापक उपस्थिति भविष्य में मानव–वन्यजीव संघर्ष की संभावना को बढ़ाती है। प्रतिशोधात्मक घटनाओं को रोकने और सह-अस्तित्व को बढ़ावा देने के लिए WWF-India की अंतरिम राहत योजना (Interim Relief Scheme) जैसी त्वरित सहायता व्यवस्था लागू की जानी चाहिए।

इसी प्रकार, नीलगाय एवं जंगली सूअर की अधिक उपस्थिति को देखते हुए, फसल क्षति के लिए प्रभावी मुआवज़ा व्यवस्था विकसित की जानी चाहिए।

गैर-काष्ठ वन उत्पाद (NTFP) एकत्र करने वाले समुदायों को टिकाऊ (Sustainable) संग्रहण पद्धतियाँ अपनाने के लिए प्रोत्साहित किया जाना चाहिए। WWF-India द्वारा स्थानीय समुदायों को खाद्य-गुणवत्ता (Food-grade) वाले महुआ फूलों के बेहतर बाज़ार मूल्य उपलब्ध कराने की पहल एक सफल उदाहरण है, जिसे पूरे कॉरिडोर में विस्तारित किया जा सकता है। ऐसी पहलें वनाग्नि की घटनाओं को कम करने में भी सहायक हो सकती हैं।

इसके अतिरिक्त, निम्न उपाय अपनाए जाने चाहिए–

- प्रारंभिक वनाग्नि पहचान प्रणाली (Early Fire Detection)
- समुदाय आधारित फायर लाइन प्रबंधन
- वन क्षेत्रों में होने वाले बड़े धार्मिक एवं सांस्कृतिक आयोजनों के दौरान समुदायों की भागीदारी से प्रभावी कचरा प्रबंधन

कॉरिडोर में बड़ी संख्या में पाए जाने वाले आवारा कुत्ते वन्यजीवों के लिए प्रत्यक्ष खतरा हैं। इनके प्रबंधन के लिए नसबंदी, टीकाकरण, जिम्मेदार पालतू पशु प्रबंधन तथा बेहतर कचरा प्रबंधन जैसे वैज्ञानिक एवं मानवीय उपाय अपनाए जाने चाहिए। इससे शिकार, संसाधनों की प्रतिस्पर्धा तथा वन्यजीवों में रोगों के प्रसार को कम किया जा सकेगा और मानव–वन्यजीव संपर्क क्षेत्र में नकारात्मक प्रभाव भी घटेंगे।

खनन एवं संबंधित गतिविधियों के प्रभावों को कम करना

प्रस्तावित गांधीग्राम खदान के निकट बाघों की उपस्थिति यह दर्शाती है कि इस क्षेत्र के लिए विशेष स्थान-आधारित (Spatially Explicit) संरक्षण उपाय आवश्यक हैं।

कम-से-कम सारनि रेंज में उन क्षेत्रों के चारों ओर एक पारिस्थितिक बफर (Ecological Buffer) निर्धारित किया जाना चाहिए जहाँ बाघों की नियमित उपस्थिति दर्ज की गई है, ताकि व्यवधान कम हो और आवास की संपर्क क्षमता बनी रहे।

खनन संचालन के लिए निम्न दिशा-निर्देश अपनाए जाएँ–

- रात्रि में वन्यजीवों की अधिक सक्रियता के समय भारी वाहनों की आवाजाही सीमित की जाए।
- लगातार प्रकाश व्यवस्था के स्थान पर गतिविधि-आधारित (Movement-sensitive) प्रकाश व्यवस्था अपनाई जाए।
- निर्धारित अंतराल पर स्वतंत्र जैव विविधता मूल्यांकन (Biodiversity Audit) कराया जाए।

कोठीदेव जैसी बंद खदानों के सफल पुनर्स्थापन के अनुभव को सभी बंद खदानों के लिए अनिवार्य बनाया जाना चाहिए।

पुनर्स्थापित क्षेत्रों में नियमित कैमरा ट्रैप सर्वेक्षण तथा शिकार प्रजातियों का आकलन किया जाए, ताकि दोबारा आवास क्षरण या कचरा फेंकने जैसी समस्याओं को रोका जा सके। कॉरिडोर की सभी खनन पट्टों (Mining Leases) के लिए खनन बंद होने के बाद पारिस्थितिक पुनर्स्थापन (Post-closure Ecological Restoration) की एक समान कार्यप्रणाली विकसित की जानी चाहिए।

वन्यजीवों के लिए प्रत्यक्ष खतरे

सर्वेक्षण के दौरान अवैध गतिविधियाँ भी एक गंभीर चिंता के रूप में सामने आईं। कई कैमरा ट्रैप चोरी हो गए, जबकि कुछ कैमरों में शिकार (हंटिंग) एवं अवैध शिकार (पोचिंग) के प्रमाण भी दर्ज हुए, विशेष रूप से दक्षिण छिंदवाड़ा तथा उत्तर बैतूल वन मंडलों में। ये गतिविधियाँ वन्यजीवों की आबादी के लिए प्रत्यक्ष खतरा उत्पन्न करती हैं और उनकी संख्या में उल्लेखनीय कमी का कारण बन सकती हैं।

गश्त एवं अवैध शिकार-रोधी प्रयासों को सुदृढ़ करना

सड़कों तथा वन्यजीव-समृद्ध क्षेत्रों के समीप कैमरा ट्रैप में हथियारबंद शिकारियों की उपस्थिति यह संकेत देती है कि आसानी से पहुँच योग्य वन क्षेत्रों का योजनाबद्ध तरीके से दोहन किया जा रहा है। इसलिए सड़क से लगे वन क्षेत्रों में गश्त को अधिक सघन बनाने, रणनीतिक

स्थानों पर जाँच चौकियाँ (चेक-पोस्ट) स्थापित करने तथा कानून प्रवर्तन एवं निगरानी व्यवस्था को मजबूत करने की अनुशंसा की जाती है।

चूँकि सड़कों के निकट हथियारबंद शिकारी दर्ज किए गए हैं, इसलिए राजमार्गों से प्रभावित वन बीटों—विशेष रूप से पांढुर्णा, पश्चिम छिंदवाड़ा और उत्तर बैतूल—में गश्त की तीव्रता को रणनीतिक रूप से बढ़ाया जाना चाहिए। वन्यजीवों के शिकार पर लागू कानूनी प्रावधानों तथा शस्त्र अधिनियम (Firearms Act) के संबंध में पुलिस विभाग के सहयोग से आसपास के गाँवों में जन-जागरूकता अभियान चलाए जाने चाहिए, ताकि स्थानीय नागरिकों को संबंधित कानूनों की जानकारी मिल सके।

इसके साथ ही, शिकार में संलग्न परिवारों की पहचान के लिए सामाजिक-आर्थिक आकलन किया जाना चाहिए, ताकि जिला प्रशासन के सहयोग से उनके लिए वैकल्पिक आजीविका के अवसर विकसित करने हेतु लक्षित आजीविका विविधीकरण कार्यक्रम तैयार किए जा सकें।

कॉरिडोर की दीर्घकालिक निगरानी को संस्थागत रूप देना

पूरे कॉरिडोर के लिए एक मानकीकृत निगरानी प्रणाली (Standardised Monitoring Protocol) विकसित की जानी चाहिए, जिसमें—

- कैमरा ट्रैप सर्वेक्षण,
- चराई सर्वेक्षण,
- वनाग्नि मानचित्रण,
- सड़क दुर्घटनाओं में वन्यजीव मृत्यु का रिकॉर्ड,
- तथा सामाजिक एवं आर्थिक सर्वेक्षण को एक साथ शामिल किया जाए।

वन्यजीवों की आवाजाही तथा मानवीय दबाव में मौसमी बदलावों को समझने के लिए निगरानी प्रत्येक मौसम में दोहराई जानी चाहिए। कुछ वन मंडलों, जैसे रामपुर भटोड़ी, में कर्मचारियों की कमी को देखते हुए अग्रिम पंक्ति (Frontline Staff) के कर्मचारियों की संख्या तथा क्षमता बढ़ाना आवश्यक है।

निगरानी से प्राप्त सभी आँकड़ों का उपयोग अनुकूली प्रबंधन (Adaptive Management) के लिए किया जाना चाहिए, ताकि सतपुड़ा–पेंच कॉरिडोर के संरचनात्मक रूप से कमजोर एवं उच्च जोखिम वाले क्षेत्रों में संरक्षण उपायों को समय-समय पर अधिक प्रभावी बनाया जा सके।



References

1. Agarwal, S., Marathe, A., Ghate, R., Krishnaswamy, J., and Nagendra, H. (2017). Forest protection in Central India: Do differences in monitoring by state and local institutions result in diverse social and ecological impacts? *Biodiversity and Conservation,* 26(9), 2047–2066. https://doi.org/10.1007/s10531-017-1343-1

2. Banerjee, S., Kauranne, T., and Mikkilä, M. (2020). Land use change and wildlife conservation: Case analysis of LULC change of the Pench-Satpura wildlife corridor in Madhya Pradesh, India. *Sustainability*, 12(12), 4902. https://doi.org/10.3390/su12124902

3. Barceló, G., Donadio, E., Alldredge, M. W., et al. (2025). Human disturbance alters the foraging and spatiotemporal activity of a large carnivore. *Oecologia*, 207, 112. https://doi.org/10.1007/s00442-025-05752-x

4. Bennett, A. F. (2003). *Linkages in the landscape: The role of corridors and connectivity in wildlife conservation*. IUCN.

5. Bhattacharjee, S. (2017). *Forging habitat connectivity in a human-dominated tiger landscape: Case of the Satpura–Pench Corridor (Doctoral dissertation)*. School of Planning and Architecture, Bhopal.

6. Sharma, S., Dutta, T., Maldonado, J. E., Wood, T. C., Panwar, H. S., and Seidensticker, J. (2013). Spatial genetic analysis reveals high connectivity of tiger (P anthera tigris) populations in the S atpura–M aikal landscape of Central India. *Ecology and evolution*, 3(1), 48–60.

7. Burnham, K. P., and Anderson, D. R. (2004). Model selection and multimodel inference: A practical information-theoretic approach (2nd ed.). *Springer*.

8. Champion, H. G., and Seth, S. K. (1968). *A revised survey of the forest types of India. Government of India Press*.

9. *Corridor Coalition. (2022)*. Satpura–Pench corridor profile. Coalition for Wildlife Corridors.

10. DeFries, R., Hansen, A. J., Newton, A. C., and Hansen, M. C. (2005). Increasing isolation of protected areas in tropical forests over the past twenty years. *Ecological Applications*, 15(1), 19-26. https://doi.org/10.1890/03-5258

11. Dutta, S., and Krishnamurthy, R. (2024). Multiphasic movement and step-selection patterns of dispersed tigers in the central Indian landscape. *PLOS ONE*, 19(10), e0309517. https://doi.org/10.1371/journal.pone.0309517

12. Dutta, T., Sharma, S., McRae, B. H., and Roy, P. S. (2016). Connecting the dots: Mapping habitat connectivity for tigers in Central India. *Regional Environmental Change*, 16, 853-867. https://doi.org/10.1007/s10113-015-0877-z

13. Dutta, T., Sharma, S., and DeFries, R. (2018). Targeting restoration sites to improve connectivity in a tiger conservation landscape in India. *PeerJ*, 6, e5587. https://doi.org/10.7717/peerj.5587

14. EAC (Expert Appraisal Committee). (2023). *Minutes of the 45th meeting of the Expert Appraisal Committee (Sectoral)*. Ministry of Environment, Forest & Climate Change, Government of India.

15. Habib, B., Joshi, A., and Qureshi, Q. (2022). Linear infrastructure and tiger movement in Central India. *BiologicalConservation*,266,109456. https://doi.org/10.1016/j.biocon.2021.109456

16. Harihar, A., and Pandav, B. (2012). Influence of connectivity, wild prey, and disturbance on occupancy of tigers in the human-dominated western Terai Arc landscape. *PLOS ONE*, 7(7), e40105. https://doi.org/10.1371/journal.pone.0040105

17. Jayadevan, A., Nayak, R., Karanth, K. K., Krishnaswamy, J., DeFries, R., Karanth, K. U., and Vaidyanathan, S. (2020). Navigating paved paradise: Evaluating landscape permeability to movement for large mammals in India. *Biological Conservation*, 247, 108613. https://doi.org/10.1016/j.biocon.2020.108613

18. Jhala, Y. V., Qureshi, Q., and Gopal, R. (Eds.). (2020). *Status of tigers, co-predators and prey in India, 2018*. National Tiger Conservation Authority and Wildlife Institute of India.

19. Jhala, Y. V., Qureshi, Q., and Nayak, A. K. (Eds.). (2021). *Status of tigers in India 2018*. National Tiger Conservation Authority and Wildlife Institute of India.

20. Johnsingh, A. J. T., Ramesh, K., Qureshi, Q., et al. (2004). Conserving tigers in Central India. *Oryx*, 38(2), 133-141. https://doi.org/10.1017/

S0030605304000250

21. Joshi, A., Vaidyanathan, S., Mondol, S., Edgaonkar, A., and Ramakrishnan, U. (2013). Connectivity of tiger (Panthera tigris) populations in the human-influenced forest mosaic of central India. *PLOS ONE,* 8(11), e77980. https://doi.org/10.1371/journal. pone.0077980

22. Karanth, K. K., Nichols, J. D., Kumar, N. S., Hines, J. E., and Christensen, N. L. (2011). Monitoring tiger populations in the Indian subcontinent. In J. Seidensticker, S. Christie, and P. Jackson (Eds.), *Tigers of the World* (2nd ed.). Elsevier.

23. Lamichhane, B. R., Leirs, H., Persoon, G. A., et al. (2019). Factors associated with co-occurrence of large carnivores in a human-dominated landscape. *Biodiversity and Conservation*, 28, 1473-1491. https://doi.org/10.1007/s10531-019-01737-4

24. MacKenzie, D. I., Nichols, J. D., Lachman, G. B., Droege, S., Royle, J. A., and Langtimm, C. A. (2002). Estimating site occupancy rates when detection probabilities are less than one. *Ecology*, 83(8), 2248-2255.

25. Mahar, N., Habib, B., and Hussain, S. A. (2024). Do we need to unfriend a few friends? Free-ranging dogs affect wildlife and pastoralists in the Indian Trans-Himalaya. *Animal Conservation*, 27(1), 53-64. https://doi.org/10.1111/acv.12861

26. Matejcek, A., and Verne, J. (2021). Restoration-as-development? Contesting aspirational politics regarding the restoration of wildlife corridors. *European Journal of Development Research*, 33(4), 1022-1043.

27. Mondol, S., Bruford, M. W., and Ramakrishnan, U. (2013). Demographic loss, genetic structure and the conservation of Indian tigers. *PLOS ONE*, 8(4), e61344. https://doi.org/10.1371/journal. pone.0061344

28. National Tiger Conservation Authority. (2014). *Connecting tiger populations for long-term conservation: Central Indian landscape corridor report*. Government of India.

29. Parivakam, H., Godawatta, A., and Menon, V. (2018). Wildlife crossings in a fragmented landscape: A case study of the Kanha-Pench corridor. *Tigerpaper*, 45(1), 22-30.

30. Qureshi, Q., Jhala, Y. V., Sharma, S., et al. (2014). *Corridor functionality in Central India*. Wildlife Institute of India.

31. Ratnam, J., Bond, W. J., Fensham, R., et al. (2019). Re-imagining dry forests. *Science*, 364, eaaw4801. https://doi.org/10.1126/science. aaw4801

32. Ranjan, V., Badola, R., Hussain, S. A., et al. (2025). Assessing the implications of habitat transformations on human-large carnivore interactions outside protected areas. *Scientific Reports*, 15, 28784. https://doi.org/10.1038/ s41598-025-13808-4

33. Shanu, S., Idiculla, J., Qureshi, Q., Jhala, Y. V., and Bhattacharya, S. (2019). A graph theoretic approach for modelling tiger corridor networks. *Ecological Informatics,* 50, 76-85. https://doi.org/10.1016/j. ecoinf.2019.01.006

34. Sharma, S., Dutta, T., Maldonado, J. E., et al. (2013). Forest corridors maintain historical gene flow in a tiger metapopulation in the highlands of central India. *Proceedings of the Royal Society B*, 280(1767), 20130610. https://doi.org/10.1098/ rspb.2013.1506

35. Srivathsa, A., Athreya, V., Punekar, S., and Karanth, K. (2018). Occupancy and detectability modelling of large felids. *Biological Conservation*, 220, 245–255. https://doi.org/10.1016/j. biocon.2018.02.005

36. Gupta, R. (2021). Mapping the impact of coal mines and their closure: A case of Betul.

37. Thatte, P., Landguth, E. L., Ramakrishnan, U., et al. (2018). Maintaining tiger connectivity and minimizing extinction into the future. *Biological Conservation*, 218, 181–191. https://doi. org/10.1016/j.biocon.2017.12.022

38. Ganjapure, V. (2025). *PIL challenges state's move on tiger corridors in Vidarbha*. Times of India. https://timesofindia.indiatimes.com/city/nagpur/ pil-challenges-states-move-on-tiger-corridors-in-vidarbha/articleshow/122460818.cms

39. Wilting, A., Courtiol, A., Christiansen, P., et al. (2015). Planning tiger recovery: Understanding conservation units. *Scientific Reports*, 5, 12444. https://doi.org/10.1038/srep12444

40. Yumnam, B., Jhala, Y. V., Qureshi, Q., et al. (2014). Prioritizing tiger conservation through landscape genetics. *PLOS ONE*, 9(11), e111207. https://doi. org/10.1371/journal.pone.0111207

41. Hussain, Z., Kay, W., Börger, L., Ghaskadbi, P., Nigam, P., and Habib, B. (2025). Rest to roam: Behavioural adaptations of tigers in anthropogenically altered landscapes. *Movement Ecology*, 13(1), 61.

42. Bateman, P.W. and Fleming, P.A. (2012), Urban carnivores. J Zool, 287: 1-23. https://doi.

org/10.1111/j.1469-7998.2011.00887.x

43. Miller, J. R., Jhala, Y. V., and Jena, J. (2016). Livestock losses and hotspots of attack from tigers and leopards in Kanha Tiger Reserve, Central India. *Regional Environmental Change*, 16(Suppl 1), 17-29.

44. Meghwal, R. P. K., Sen, C. B., and Bhatnagar, C. (2016). Distribution and Habitat preference of four-horned antelope (Chowsingha) Tetracerus quadricornis in Kumbhalgarh wildlife sanctuary. *Rajasthan Ambient Sci,* 3(1), 38-42.

45. Uikey, S. K. (2019). Distribution And Habitat Use Of Four-Horned Antelope (Chowsingha) Tetracerus Quadricornis In Kanha National Park, Madhya Pradesh, India. *Int J Innov Res Adv Stud*, *6*(1), 89-95.



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Annexure



Tiger



Leopard



Asiatic wild dog



Indian wolf



Jungle cat



Rusty-spotted cat



Sloth bear



Honey badger



Gaur



Four-horned antelope (chowsingha) in Sausar Range



Sambar deer in Sarni Range



Species like the Indian pangolin which are highly prone to wildlife trafficking for their scales were also camera trapped in the corridor

Table for Annexure: Consolidated top-ranked multivariate occupancy models for all species

Species	Model ID/ Rank	Covariates	K	AICc	ΔAICc	Weight
Chowsingha	Model 6	D_PA + Hum_RAI + NDVI	5	1064.03	0.00	0.18
	Model 2	D_PA + NDVI	4	1064.45	0.42	0.14
	Model 15	D_PA + Hum_RAI + NDVI + TRI	6	1065.73	1.71	0.07
	Model 17	D_PA + Hum_RAI + NDVI + Scrubs	6	1065.82	1.79	0.07
	Model 16	D_PA + Hum_RAI + NDVI + Dog_RAI	6	1065.90	1.87	0.07
Leopard	Rank 1	WP_RAI + Tree_cover + Scrubs	5	1437.37	0.00	0.44
	Rank 2	WP_RAI + Tree_cover	4	1439.95	2.58	0.12
	Rank 3	WP_RAI + Tree_cover + Frag_Index	5	1440.88	3.51	0.08
	Rank 4	WP_RAI + Tree_cover + TRI	5	1441.44	4.07	0.06
	Rank 5	WP_RAI + Tree_cover + Built_up	5	1441.77	4.40	0.05
	Rank 6	WP_RAI + Tree_cover + D_mines	5	1441.82	4.45	0.05
	Rank 7	WP_RAI + Tree_cover + Agri	5	1441.91	4.54	0.04
Jungle Cat	mv28	Dog_RAI + D_PA + NDVI + Nlight	6	1052.62	0.00	0.18
	mv25	Dog_RAI + Hum_RAI + D_PA + Nlight	6	1053.24	0.62	0.13
	mv32	Dog_RAI + D_PA + NDVI + TRI + Nlight	7	1053.48	0.86	0.12
	mv21	Dog_RAI + NDVI + Nlight	5	1053.52	0.90	0.12
Nilgai	mv13	NDVI + D_PA + Scrubs + Built_up	6	930.55	0.00	0.54
	mv36	NDVI + D_PA + Scrubs + Bam_F + Built_up + Tree_cover	8	932.75	2.21	0.18
	mv31	NDVI + D_PA + Scrubs + Bam_F + D_wat + Built_up	8	934.16	3.61	0.09
	mv23	NDVI + D_PA + Scrubs + D_wat + Built_up	7	934.19	3.64	0.09
	mv39	NDVI + Scrubs + Bam_F + D_wat + Built_up + Agri	8	934.57	4.02	0.07
	mv8	NDVI + D_PA + Scrubs + Bam_F + TRI + Agri	8	937.12	6.57	0.02
	mv10	NDVI + D_PA + Scrubs + Bam_F + D_wat	7	939.65	9.10	0.01
	mv3	NDVI + D_PA + Built_up + Dog_RAI + D_LI + Agri	8	939.94	9.39	<0.01
	mv22	NDVI + D_PA + Scrubs	5	943.46	12.91	<0.01
	mv0	Null model	2	1013.65	83.10	<0.01
Wild Pig	mv6	D_PA + Tree_cover + Dog_RAI + Bam_F	6	3006.95	0.00	0.15
	mv36	D_PA + Tree_cover + Bam_F + Dog_RAI + Frag_Index	7	3007.68	0.73	0.10
	mv11	D_PA + Tree_cover + Dog_RAI + Bam_F + Frag_Index	7	3007.68	0.73	0.10
	mv15	D_PA + Tree_cover + Dog_RAI + Bam_F + Teak_F + Frag_ Index	8	3007.90	0.95	0.09
	mv14	D_PA + Tree_cover + Dog_RAI + Bam_F + Teak_F + Agri	8	3008.38	1.43	0.07
	mv10	D_PA + Tree_cover + Dog_RAI + Bam_F + Agri	7	3008.61	1.66	0.06
	mv35	D_PA + Tree_cover + Bam_F + Dog_RAI + Agri	7	3008.61	1.66	0.06
	mv12	D_PA + Tree_cover + Dog_RAI + Bam_F + Scrubs	7	3008.92	1.97	0.05

Note: D_PA = Distance to Protected Area; WP_RAI = Wild Pig Relative Abundance Index; Dog_RAI = Domestic Dog Relative Abundance Index; Hum_RAI = Human Relative Abundance Index; NDVI = Normalised Difference Vegetation Index; TRI = Terrain Ruggedness Index; Bam_F = Bamboo Forest; Teak_F = Teak Forest; D_wat = Distance to Water; D_LI = Distance to Linear Infrastructure; Nlight = Night-light Intensity; Frag_Index = Fragmentation Index.

Table for Annexure: Covariate dependency across all top-ranked multivariate occupancy models

Covariate	Chowsingha	Leopard	Jungle cat	Nilgai	Wild pig	Overall effect
D_PA	+	-	+	+	+	Most consistently positive predictor across herbivores and mesocarnivores
WP_RAI	-	+	-	-	-	Strongest predictor of leopard occupancy
Tree_cover	-	+	-	-	+	Positive influence on forest-dependent species
Dog_RAI	Present in competing models	-	+	Present in competing models	+	Positive association likely reflects shared habitat use
NDVI	–	-	–	–	-	Consistently negative effect, indicating preference for open habitats
Hum_RAI	–	-	Present in competing models	-	-	Weak negative effect
Nlight	-	-	–	-	-	Indicates avoidance of urbanised landscapes
Scrubs	Present in competing models	+	-	–	Present in competing models	Species-specific response
Built_up	-	Present in competing models	-	–	-	Generally negative effect
Bam_F	-	-	-	Present in competing models	+	Important habitat component for wild pig
Frag_Index	-	Present in competing models	-	-	Present in competing models	Secondary landscape influence
TRI	Present in competing models	Present in competing models	Present in competing models	Present in competing models	-	Weak terrain effect overall







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The Satpura–Pench Corridor is one of the most important wildlife linkages in Central India, connecting the Satpura and Pench Tiger Reserves and facilitating the movement and persistence of tigers and other large mammal metapopulations across the Central Indian landscape. Although habitat fragmentation, infrastructure development, mining, agricultural expansion and other human pressures are progressively altering the corridor, it continues to function as a vital movement and dispersal landscape for wildlife.

Drawing on the first comprehensive, corridor-wide assessment of wildlife occurrence across the landscape, *Connecting Habitats: Wildlife Occupancy Across the Satpura–Pench Corridor* presents the findings of an extensive camera-trap survey conducted between December 2024 and April 2025. The study documents wildlife occurrence, habitat use, and connectivity across the corridor, identifies critical bottlenecks and emerging threats, and provides data-driven management recommendations to support the long-term conservation of one of Central India's most important wildlife corridors.



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