*Indian Forester,* **151** (8) : 707-714, 2025
DOI: 10.36808/if/2025/v151i8/170891

ISSN: 0019-4816
eISSN: 2321-094X

# Emergence of a Resident Asian Elephant Population in Himachal Pradesh: Assessing Possibilities and Challenges in a Non-traditional Range

***The State of Himachal Pradesh is situated in Northern Himalayan landscape of India. Sporadic annual movement of elephants has been reported historically from Rajaji National Park, Uttarakhand to Col. Sherjung National Park, contiguous to Paonta Sahib in Himachal and adjoining Kalesar National Park, Haryana. Presence of resident population in this area however is a recent phenomenon since the last few years. Presently, a resident population of 14-16 Asian elephants (Elephas maximus) has established in Sal forests of Paonta Sahib Forest Division, in a non-traditional range, highlighting adaptability to fragmented landscapes. This has enhanced cases of human-elephant conflict (HEC) with increased crop raid, damage and human fatality. Efforts have been made by Forest Department with financial assistance under Project Elephant in taking the conversation from conflict to co-existence. The article offers a case study for managing small, isolated herds to balance conservation and coexistence in a human-dominated landscape.***

***Key words:*** Asian Elephant, Himachal Pradesh, Human-elephant conflict, Shiwalik range, Range expansion.

*Population and distribution of elephants in a non-traditional range in sal forests of Paonta Sahib Forest Division, Himachal Pradesh.*

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*Received April, 2025*
*Accepted August, 2025*

## Introduction

Historically, the exploratory population of Asian elephants (*Elephas maximus*) with source population in Rajaji National Park enter Himachal Pradesh from Uttarakhand, crossing River Yamuna and Kalesar (Haryana) through Behral, Satiwala, Batamandi beats of Majra Range in Paonta Sahib Forest Division (Fig. 1). Paonta Sahib is the southernmost region of Himachal Pradesh at Western Himalayan foothills sharing boundaries with three states and lies contiguous to two protected areas. The movement pattern of elephants has witnessed significant increase in movement over the last decade. This has further led to the establishment of resident elephant population in core-habitat of Col. Sherjung National Park's eco-sensitive zone area in last 4 years, more significantly since 2023. This small group of resident elephants is similar to other such populations in the larger landscape of elephant in Northwest particularly in Terai elephant reserve in Uttar Pradesh (Johnsingh *et al*., 2006).

The present resident population indicate adaptation to habitat fragmentation, using functional and extended elephant corridors and exploring new habitats and thus leading to greater HEC and incidents of crop raids (Goswami and Vasudev, 2017; Pandey *et al*., 2024). It is therefore important to have a realistic assessment of population distribution, nature of conflicts and habitat suitability for framing a multi-dimensional strategy for co-existence and conservation in a human dominated landscape which this study aims to encapsulate.

## Study Area

Paonta Sahib shares boundaries with three states namely Haryana, Uttarakhand and Uttar Pradesh and lies contiguous to Kalesar National Park, Haryana and Col. Sherjung National Park, Himachal. The eco-

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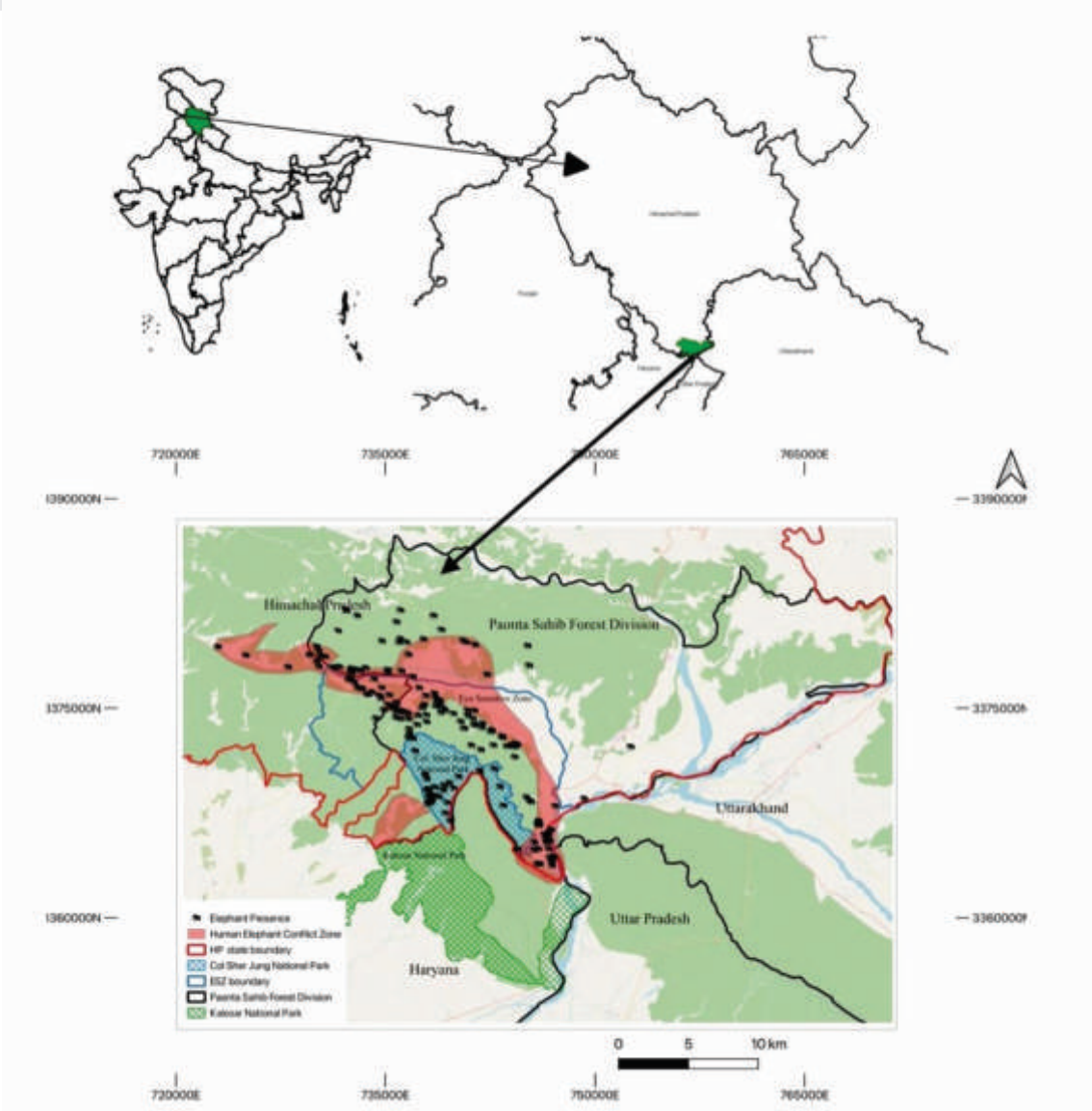


**Fig. 1:** Location map and elephant presence depicting conflict areas

sensitive zone tract of the latter with elephant presence ranges from plains covering Doon Valley to undulating hilly tracts of Shiwalik Himalayas and a narrow fertile valley, 'Kiarda' in between (Raj, 2025). Moist Bhabbar-Dun deciduous forests are home to one of the most intact Sal (*Shorea robusta)* forests and associate tree species occasional scrublands and grasslands, supported by an average annual rainfall of 1424 mm and an extension typical of Rajaji Sal forest landscape. Around 20 seasonal and perennial *nalas/khols*/streams draining into Bata and Yamuna rivers lead to several eco-tone areas and host a diverse mammalian, reptilian and avian species population. These include Tiger (*Panthera tigris)*, Leopard (*Panthera pardus)*, Sambar (*Cervus unicolor)*, Jungle cat (*Felis chans)*, Barking deer (*Muntiacus muntjak)* etc. (Raj, 2023, Working Plan for Paonta Sahib Division). The elephant movement has been analysed in this region focusing on the eco-sensitive zone of Col. Sherjung National Park where they reside currently.

**Observations and Data Collection**

Population size estimation was made from direct sightings, footprint analysis, and dung counts by Forest Department field staff during 2021-2024 using GPS coordinates during regular patrols and tracking across Majra and Girinagar ranges of the Division (Raj, 2025) as well as in Nahan and the National Park. For the analysis of corridor connectivity, use of historical movement records and secondary data on Shiwalik

corridor (Project Elephant, MoEF&CC, Government of India, 2023) was used, particularly to delineate extension of corridor and cross-border transitions from Rajaji National Park.

The elephant landscape of resident population across the region is spread over 13005 ha out of which 9777 ha area falls in Majra Range of Paonta Division and remaining Kolar Range of neighbouring Nahan Division. It includes presence of 30 villages having 9495 households with a population of around 44,000 in the area. Agriculture dependence is high among locals growing wheat, paddy, sugarcane and maize. Forest dependence is also high, with 21 villages having fuel-wood and other forest-dependent rights inside ESZ area. 67 Gujjar and Gaddi graziers, nomadic pastoralists with grazing right permits have settlements in fringe forest areas, making them vulnerable to HEC (Raj, 2025).

HEC data were compiled from 2021-2024 from logs of the staff available in the forest division and the same was categorised in to crop damage, property destruction, and human fatalities. Area under conflict was identified using actual forest beat level records of conflicts kept by the Forest department based on GPS tracking and sightings. Trap cameras were used and images of two elephants from the herd have been captured recently (Fig. 2). Data were summarized descriptively, triangulated with community reports and regional literature (Pandey *et al*., 2024). The habitat suitability model for elephant was developed using MaxEnt software, which employs a maximum entropy approach to predict species distribution based on presence-only data (Phillips *et al*., 2006). A comprehensive dataset was compiled from the GPS tracking data of Forest Department, incorporating environmental variables categorized into bioclimatic, topographical, vegetation-related and anthropogenic factors (Sharma, 2024). Presence locations of elephants were collected through field surveys and historical records to train the model. These data were spatially correlated with environmental layers using GIS tools to ensure accuracy. MaxEnt output was visualized with warmer colours indicating higher suitability, blue regions denoting unsuitable areas, model performance was evaluated using metrics like AUC (Area Under the Curve), (Pearce and Ferrier, 2000) to ensure reliability.

## Results

### *Distribution*

The combined day-wise elephant movement data for Paonta Sahib Division, neighbouring Nahan Division and National Park recorded annually has been summarised in Fig. 3.

The graph shows a drastic increase in movement over the years for the herd to establish as a resident population. The resident population of 14-16 Asian elephants has stabilized in the Behral and Majra blocks of Majra Range of Paonta Sahib Division since 2023. Sighting data 2022 onward revealed Majra Range comprised 53% of total direct/indirect sightings,

**Fig. 2:** Trap Camera capture in Satiwala beat, Majra Range

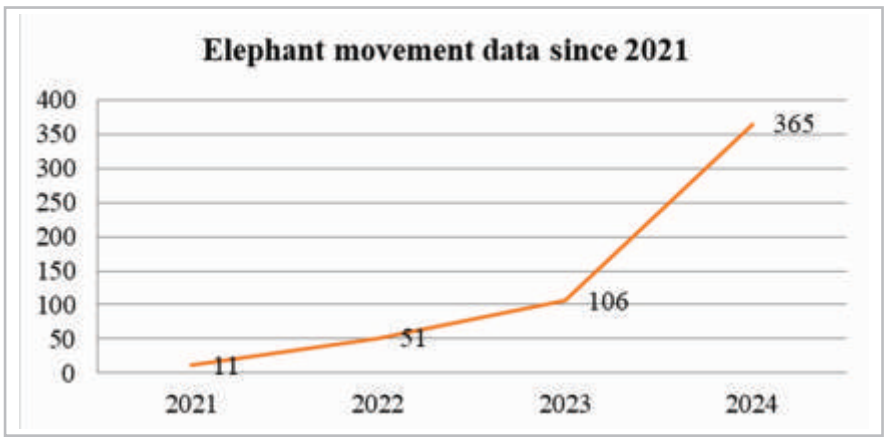


**Fig. 3 :** Annual elephant movement data since 2021

Girinagar 22%, National Park 15% and Nahan Division 10%, depicting intermittent movement from Majra into other ranges criss-crossing habitation and linear infrastructure. Sighting data reveal both adults and juveniles. The herd is led by an adult female elephant. Sub-adults have also been seen in the herd along with two calves. Age/sex data are to be concisely determined based onelephant profiling in the near future. Presence of two adult males has also been observed in addition to the present herd. Results show major concentration of resident population of elephants confined to Majra forests, primarily accounting for movements at forest-farmlands interface in 8 forest beats (Fig. 1).

**Area Suitability:** The MaxEnt model revealed (Fig. 4) that most suitable habitats for elephants in the area are concentrated in the Majra range as indicated by warmer

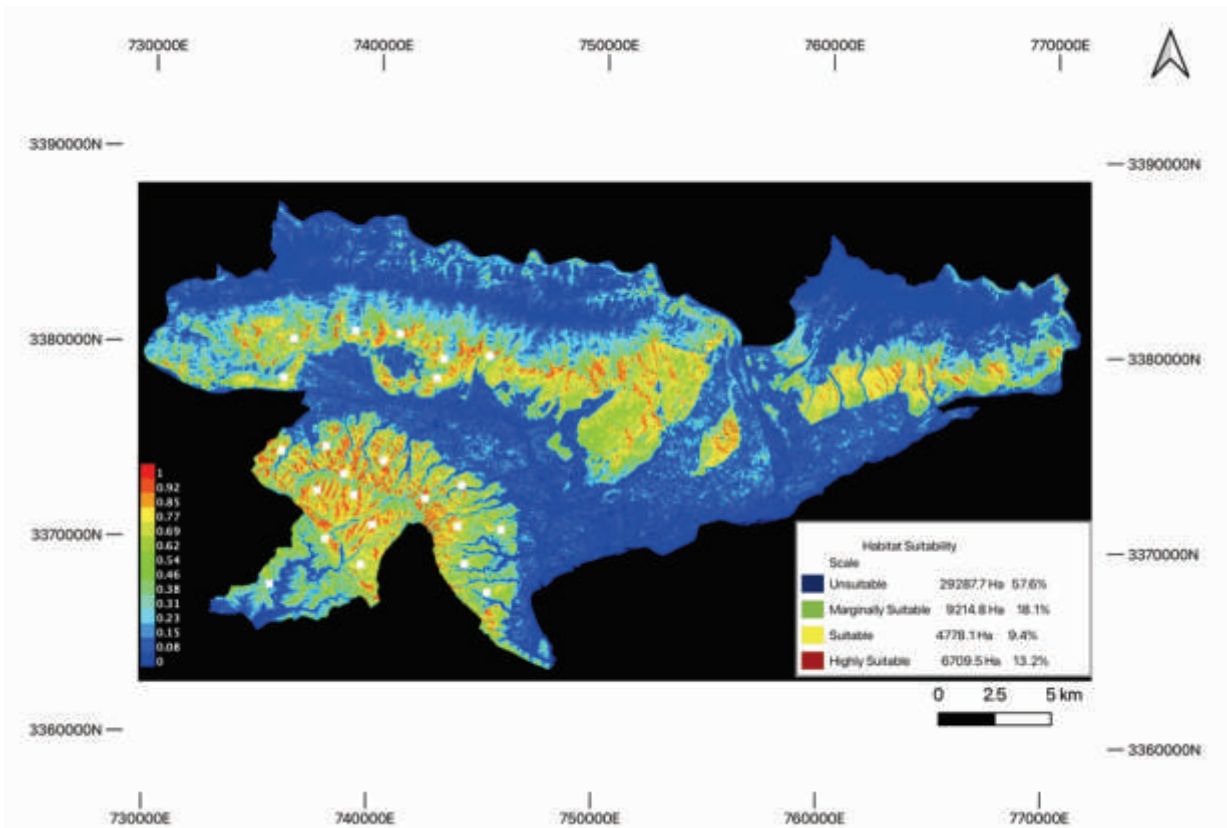


**Fig. 4:** Habitat Suitability in Paonta Sahib Forest Division

colours in the output map, in line with the field observations of elephant presence and movement. A total of 6709.5 ha in Paonta Division have been found to be highly suitable for elephants but fragmentation observed owing to habitations in between. GPS locations of elephant presence data taken from the Paonta Sahib Forest Division are depicted in white colour on the habitat suitability map generated by Maxent. The model also identified overlaps between suitable elephant habitats and agricultural lands, consistent with Sukumar (1990), noting elephants' tendency to raid crops like rice, wheat, sugarcane and cultivated grasses to meet nutritional demands. Blue regions, marking unsuitable areas, were typically associated with high human activity or unfavourable topography. The model's high AUC score confirmed its predictive accuracy, highlighting Majra range as a critical conservation priority while underscoring the need to mitigate human-elephant conflict in adjacent agricultural zones.

**Connectivity:** A 2 km² bottleneck near Sainwala, caused by roads and settlements, restricts connectivity in the Shiwalik corridor. Figure 5 depicts the corridor that connects Rajaji to Mohand Range to Shakumbri Range to Barkala Range of Shivalik Division in Uttar Pradesh to Kalesar with 32 km length and 23 km width, and extending further upto Paonta Sahib and Col. Sher Jung National Park in recent times. (Project Elephant, MoEF&CC, Government of India, 2023)

**HEC incidents:** The total conflict zone spans over app. 9090 ha comprising Majra (entirely), Girinagar and Kolar ranges (Fig. 1). Major HEC conflicts coincide with sugarcane, paddy and wheat harvesting periods, and peaking during monsoons, and were seasonal until 2022. Two elephant fatalities had occurred prior in 2021

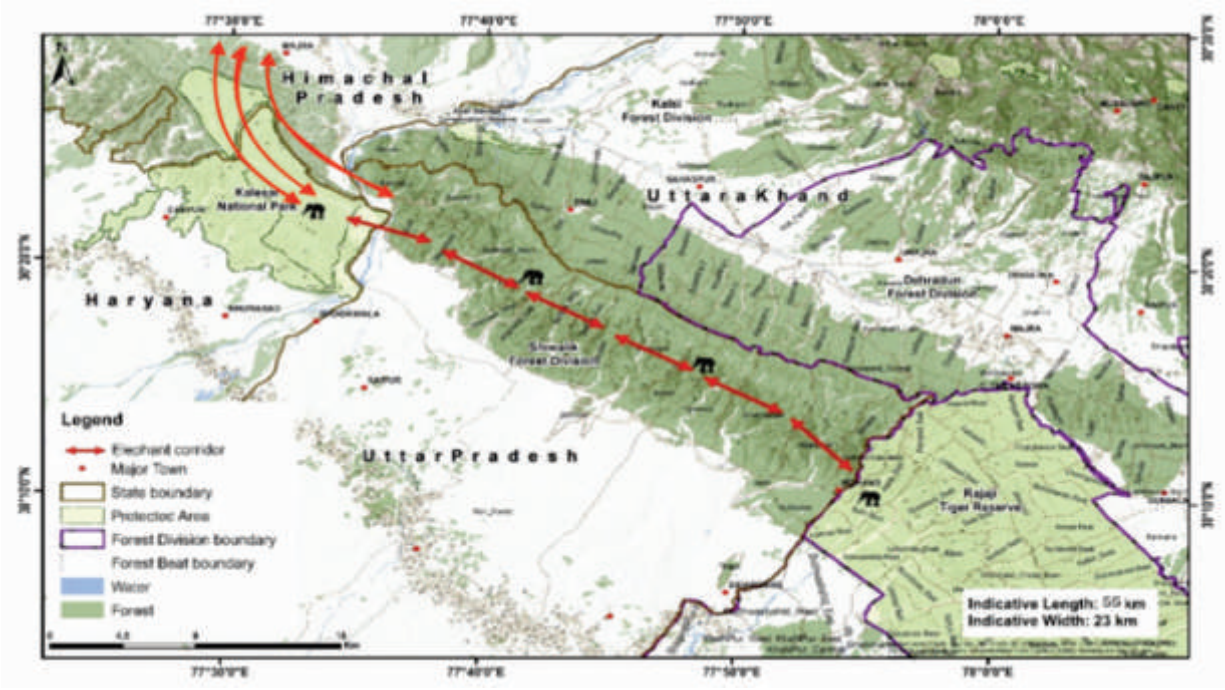


**Fig. 5:** Expanding Shivalik Elephant corridor

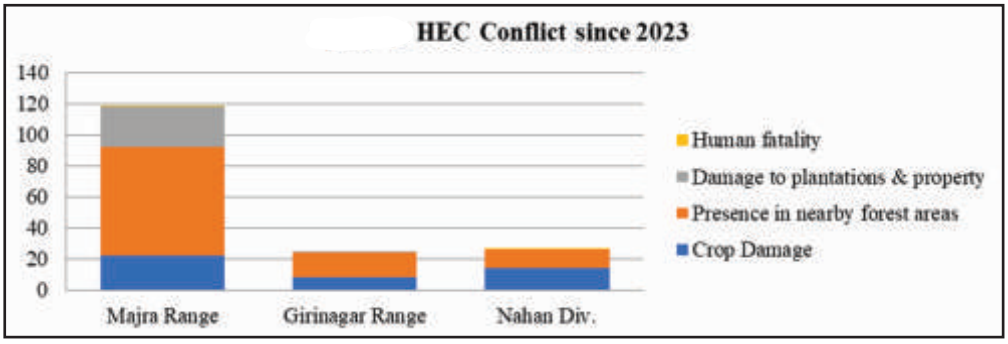


**Fig. 6 :** HEC Conflict since 2023 (Numbers)

& 2022. HEC in numbers since 2023 has been depicted in Fig. 6.

HEC data analysis since 2023 reveals 83.04% of total encounter events occur in agriculture fields and near farmland-forest interface. The conflict is persistent, with 45 crop raids, 26 plantation and property damages, one human fatality each in Paonta, Nahan and another 98 instances of elephant encounters in forests near human-dominated landscapes. More than 85% of crop raid events occurred during late night time, and the conflict peaked in August-September and March. The occurrences concur that one of the most pressing challenges in wildlife conservation is the human-wildlife conflict, with Asian elephants being particularly prone to conflicts (Acharya *et al*., 2016).

**Discussions, Challenges and Way Forward:** The results reveal a similar pattern in conflicts and disruptions as for any new exploratory movement of elephants keeping in view existing land-use. The elephant population establishing in a non-traditional range also marks a new frontier in conservation management, where ecological and social strategies have to be integrated using a multi-pronged approach, targeting habitat restoration, securing connectivity & HEC management vis-a-vis conservation zones inside forests and co-existence zones at forest-farmland interface.

As analysed, participatory approaches provide conservationists the tools they need to identify the particular costs and benefits salient to communities (Usongo and Nkanje, 2004). Emerging from a stage of total hostility and outrage till two years ago, when locals were not familiar with sighting of elephants in their close vicinity, the conversation is now seeing a perceptible attitudinal shift to acceptance of a new normal i.e. 'living with elephants', with varied management interventions and persistent community engagement. These include quick response by Anti-Depredation Squads, regular meetings with all panchayats and fringe settlements, announcements and traditional acoustic methods, IEC activities with schools etc., and apiary training with livelihood linkages. Social affiliation among inhabitants through livelihood creation to engage youth as *Gaj Mitras* (primary responders) is being developed, affirming the finding by Arjunan *et al*. (2006) that younger individuals are more likely to show strong support for wildlife conservation. The conservation activities as mentioned are supported under Project Elephant which are depicted in Fig. 7.


**Fig. 7 :** Activities undertaken under Project Elephant; **1:** Solar fencing in Dhaulakuan Beat, **2:** ANIDER early warning system, **3:** Community engagement in corridor and fringe areas, **4:** Crop damage assessment by field staff

The conservation management requires a robust compensation and ex-gratia mechanism for crop loss damage to property, for which active consideration in the State is need of the hour and is underway. Further various preliminary mitigation and preventive measures have been taken on pilot basis, ranging from solar fencing, bee-hive fencing, ANIDER early warning systems which are yielding desired outcomes reducing conflicts in those limited areas, but coverage is <10% and needs scaling up. The resident population's small size (14-16) raises genetic concerns, as small isolated population may pose a threat of inbreeding in long run if no genetic exchange is established due to fragmentation of habitat or loss of corridors (Minhui *et al*., 2025). The Shiwalik corridor is vital for gene flow, but its functionality is compromised by a 40% habitat loss since 2000 (Menon *et al*., 2017).

Informed conservation strategies and integrating the area in elephant conservation priorities to limit infrastructure impacts (Rangarajan *et al*., 2010; Fernando and Pastorini, 2011) need to be ensured in meeting challenges posed by new resident elephant population in this non-traditional distribution range of elephants, along with implementation of Zonal Master Plan for protected areas eliciting concerted action by all stakeholders.

Immediate priority would be capacity building of field staff, developing them as Rapid Response Teams to provide quick response during conflicts. Use of trap cameras, night vision devices, drones and radio-telemetry coupled with scientific estimation of population using DNA data shall give a better result in understanding population profiles and behavioural dynamics in a non-traditional range. Whatsapp groups "*Gaj-Ghoshnas*" pre-warn locals about conflict and should look at AI-integration. Interstate coordination with Haryana and Uttarakhand leveraging facilities like Yamunanagar's rescue centre and local-level coordination with stakeholder departments under District Level Coordination Committee should be done.

In the long run, a landscape approach to conservation is the most appropriate strategy for integration of area development, while maintaining biodiversity values. With growing ecological evidence of new exploratory elephant movement, the Shiwalik elephant corridor has expanded (Fig. 5). The same should be updated in the next corridor evaluation studies. This integration towards harmonious coexistence would connect the protected areas with adjoining buffers into a greater sustainable landscape with mitigation adaptations, crucial for long-term conservation.

This population offers lessons for managing small population of Asian elephants in human-dominated landscapes, applicable to other range countries. Expansion of elephant corridor in future studies can help in exploring genetic structure and HEC trends to ensure adaptive landscape management, aligning with Project Elephant's goals (MoEFCC, 2023).

**हिमाचल प्रदेश में एशियाई हाथियों की आबादी का उदयः गैर-पारंपरिक दायरे में संभावनाओं और चुनौतियों का आकलन**

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**सारांश**

हिमाचल प्रदेश राज्य भारत के उत्तरी हिमालयी भूभाग में स्थित है। ऐतिहासिक रूप से उत्तराखण्ड के राजाजी राष्ट्रीय उद्यान से लेकर हिमाचल के पांवटा साहिब से सटे कर्नल शेर जंग राष्ट्रीय उद्यान और हरियाणा के कलेसर राष्ट्रीय उद्यान तक हाथियों की कभी-कभार वार्षिक आवाजाही की सूचना मिलती थी। हालाँकि, हिमाचल प्रदेश के शिवालिक-भाबर क्षेत्र में स्थाई आबादी की उपस्थिति पिछले कुछ वर्षों से एक हालिया घटना है। वर्तमान में, पांवटा साहिब वन प्रभाग के साल के जंगलों में 14-16 एशियाई हाथियों (*एलिफस मैक्सिमस*) की स्थाई आबादी स्थापित हो गई है, जो गैर-पारंपरिक क्षेत्र में इधर-उधर घूमते रहते हैं, जो खंडित भूभागों के अनुकूल होने की क्षमता को दर्शाता है। इसने फसलों पर हमले और क्षति के साथ मानव-हाथी संघर्ष (एचईसी) के मामलों में वृद्धि की है। वन विभाग द्वारा वर्ष 2024 से प्रोजेक्ट एलीफेंट के क्रियान्वयन के साथ बातचीत को संघर्ष से सह-अस्तित्व ओर मोड़ने के प्रयास किए गए हैं, हालांकि अभी भी एक लंबा रास्ता तय करना है। अध्ययन पत्र मानव-प्रधान परिदृश्य में संरक्षण और सह-अस्तित्व को संतुलित करने के लिए छोटे, परिधीय झुंडों के प्रबंधन के लिए एक केस अध्ययन प्रस्तुत करता है।

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