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LONG-TERM PERSPECTIVE PLAN

Mitigating Human–Elephant
Conflict in Rajaji Landscape
Uttarakhand



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Wildlife Institute of India

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Mitigating Human-Elephant Conflict in Rajaji Landscape Uttarakhand

Sub-component of the WII-UKFD collaborative project on "Mitigation of Human-Elephant Conflict in and around Rajaji Tiger Reserve with emphasis on mitigation strategies during Kumbh 2021"



भारतीय वन्यजीव संस्थान
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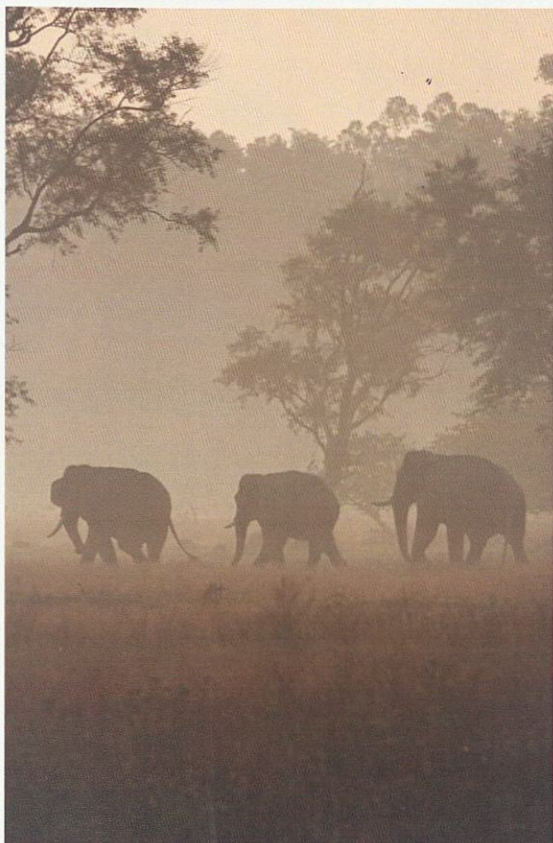
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Long-Term Perspective Plan

Mitigating Human-Elephant Conflict in Rajaji Landscape, Uttarakhand



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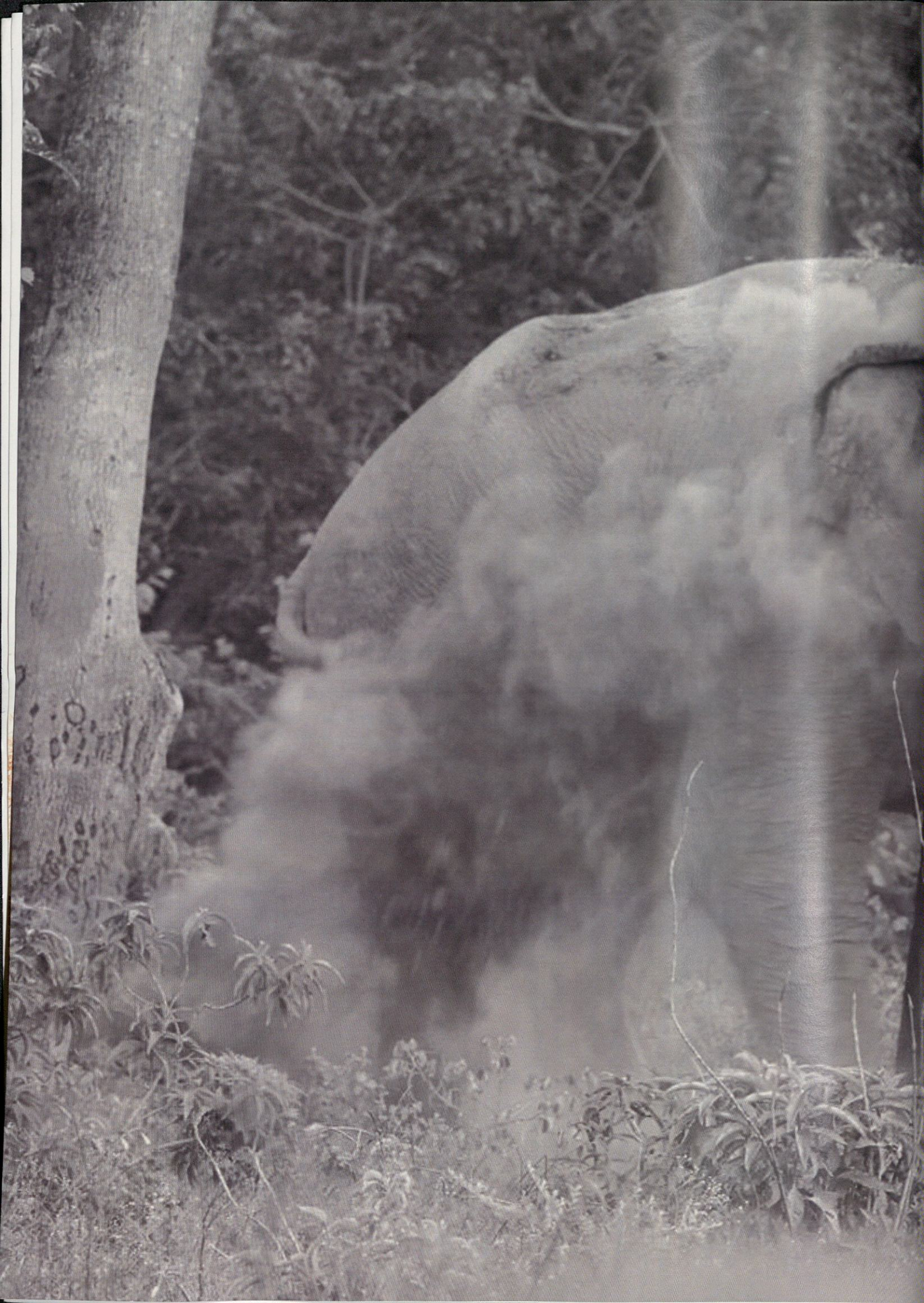
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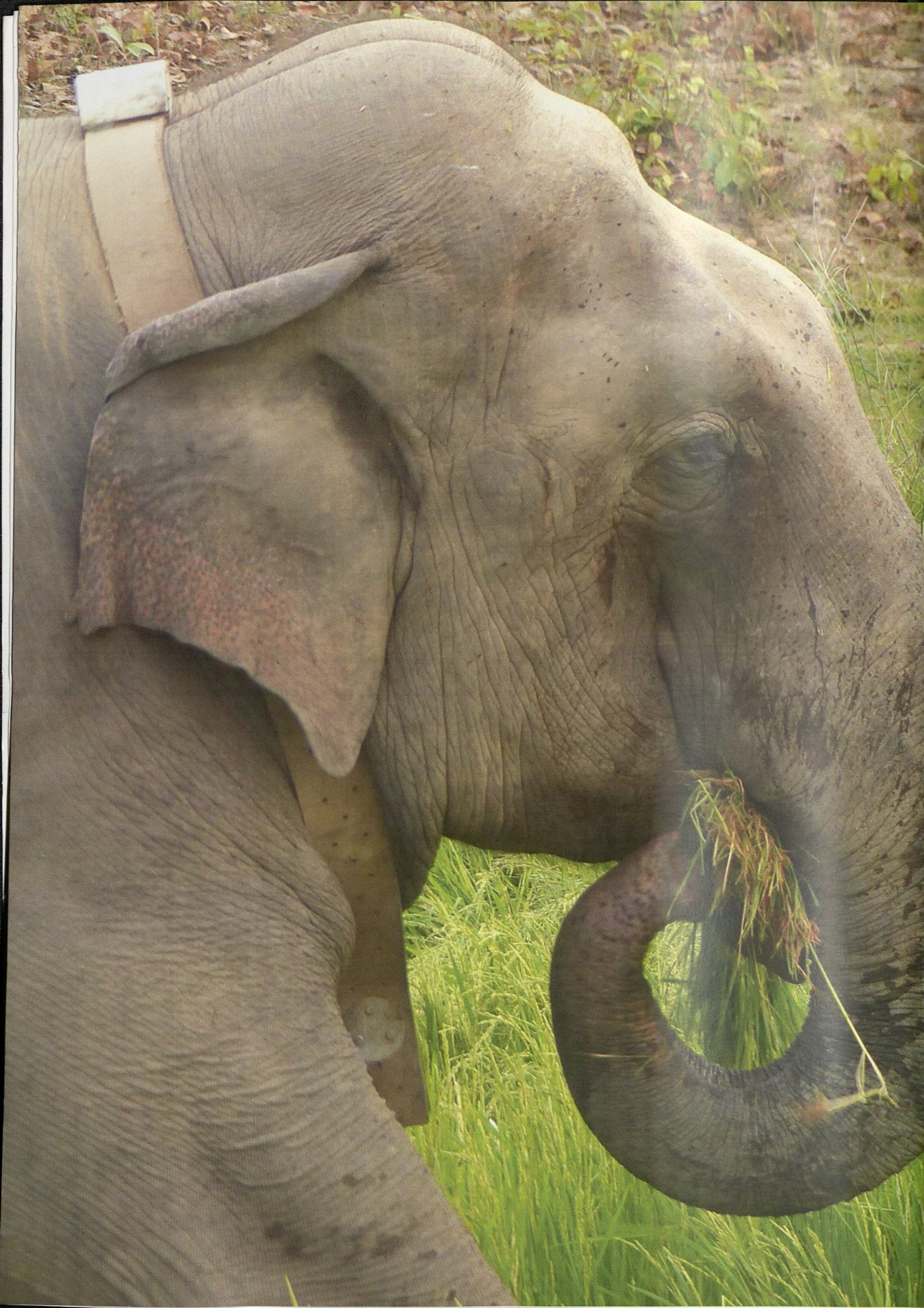
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Executive Summary

1. The Rajaji Landscape comprising of the Rajaji Tiger Reserve, and the adjoining Forest Divisions of Dehradun, Haridwar and Lansdowne in the state of Uttarakhand (henceforth, The Rajaji landscape) supports a population of about 550 elephants (*Elephas maximus*) as estimated by the Uttarakhand Forest Department during 2015. Thus, the Rajaji landscape holds nearly 31% of the elephant population occurring in Uttarakhand.
2. The elephant population in Uttarakhand including that of the Rajaji landscape has been relatively stable and even witnessed marginal growth. However, with growing human population and associated impacts on elephant habitats such as increased resource demands and rapid expansion of physical infrastructure, there has been an increase in the human–elephant conflict (henceforth, HEC). Early detection of the problem and addressing its root causes would be an important conflict resolution strategy.
3. As part of the preemptive conflict management strategy in the Rajaji landscape, a perspective plan has been envisaged. The overarching objective of the perspective plan is to synthesize available information on the existing HEC in the Rajaji landscape, draw broad inferences on the trends and patterns, and deliberate on different approaches that are appropriate for mitigating HEC. As HEC mitigation strategies are both short- and long-term, the perspective plan is drafted for a reasonably long period of 10 years spanning 2023 to 2033.
4. The drafting of the perspective plan did not involve any primary background research. However, the plan was prepared using information available in the literature; existing data on elephant movement, home range and conflict collected as part of the WII-UKFD collaborative project (Nigam et al. 2022), and data obtained from the Project Elephant. Further to this, extensive field visits were carried out to corroborate on the important findings obtained from other studies. Furthermore, the plan also draws heavily on other policy documents as elaborated in the report.
5. As elucidated by the first steering committee report of the Project Elephant (Gajatame, 1993), conservation and management of elephants in the Rajaji landscape calls for harboring “viable elephant populations”



in “viable elephant habitats”. Often, human–elephant conflict and elephant habitat conditions are intricately linked. In areas where elephant habitat quality is optimal, intensity of human–elephant conflict in the landscape would be comparatively low. Considering this, the perspective plan places emphasis on improving habitat conditions for elephants.

6. It has been observed that owing to adequate protection and voluntary relocation of Van Gujjars from the National Park areas, it is certain that habitat quality from wildlife point of view had improved in select areas within Rajaji National Park. However, the highly productive critical ecotone habitats (located in the ecotone of Bhabar and Terai tracts) in Shyampur and Chidiyapur Forest Ranges of Haridwar Forest Division have suffered major habitat degradation owing to Gujjar settlement in the area and corresponding resource extraction pressures.
7. While the forest cover did not change much in Rajaji Landscape during the period 1985 to 2022, the land-use outside forests have changed substantially. The urban built-up area in particular has mushroomed all around with long-term implications for elephant movement, dispersal and HEC management as well. Unlike in rural areas, Managing HEC in urban areas is far more challenging due to crowd factor. The potential of invoking provisions of Ecologically Sensitive Zone area under Environmental Protection Act, 1986 to disallow urban expansion close to forest boundary need to be explored.
8. Critical corridors like the Chilla – Motichur remained non-functional for a long period. This had resulted in isolation of elephant populations on either side of river Ganga with long-term effects on dispersal, migration and demography of elephants. Nevertheless, huge efforts were invested by the Uttarakhand Forest Department due to which the Chilla – Motichur corridor has been mostly restored. The other critical corridors like the Motichur – Gohri corridor along the Song River would require renewed focus so that this vital corridor can be recovered on time. The Rajaji landscape had also lost a corridor that connected Ramgarh range of the National Park with the Lacchiwala range of the Dehradun Forest Division across Susua river near Dudhli. This was lost largely due to lack of focus as the corridor was not recognized.
9. In the Rajaji Landscape, the natural grasslands along the river Ganga had either been lost (due to human occupation) or degraded. While it would be impossible to recover the once expansive and productive



grasslands along Ganga, it certainly is critical to restore Chilla, Kunaon, and Dassowala grasslands for elephants. Riverine grasslands were important dry-season habitats for elephants in the past. Recovering critical grasslands and restoring their quality would enhance the inherent carrying capacity of Rajaji Landscape to support elephants. Addressing human–elephant conflict in Rajaji Landscape would also be dependent on recovering and restoring habitat in Shyampur and Chidiyapur Forest Ranges.

10. Linear infrastructure expansion including upgradation of existing village roads and district roads in addition to the Highways and concurrent with rapid increase in the vehicular traffic along these roads pose a major long-term threat of habitat fragmentation. Implementing ecofriendly green infrastructure by ensuring habitat permeability would be critical in the Rajaji Landscape to prevent isolation of elephant populations. Isolated elephant populations are predisposed to cause high levels of human–elephant conflict.

11. Physical barriers that separate elephants and people along the forest interface would be crucial to achieve co-existence in the landscape. Without physical barriers at strategic locations, addressing elephant conflict would be difficult. The barriers currently built by the Forest Department along the forest-agriculture interface pose no threat to habitat connectivity. Limitations and opportunities of implementing physical barriers have been elaborated in the report

12. There are 77 places of religious worship inside Rajaji Landscape that draws over 10000 pilgrims every year. Places of religious worship are located in 18 (58%) ranges of 5 (83%) Forest Divisions in the Rajaji Landscape. While religious tourism has the potential to reinforce cultural underpinnings of nature conservation as practiced in India besides enabling public appreciation of nature, unregulated pilgrimage in wildlife habitats can pose a challenge to elephant conservation as elephants can abandon habitats with chronic biotic pressure resulting in surfacing of human–elephant conflict. Measures to minimize the threats posed by places of religious worship are deliberated.

13. Further, solutions for the sites used for Kumbh mela for festival related activities were also used extensively by elephants as detailed in the report. Hitherto, the temple committees and other religious institutions have not proactively engaged with the forest department in regulating pilgrims and maintaining the integrity of local ecology. Forest



department with lean headcount of staff cannot be expected to regulate pilgrims and their activities. Given the huge biotic imprint of places of religious workshop on wildlife habitats in Rajaji Landscape, the perspective plan favors vesting substantial responsibility and sharing of resources by committees of the religious worship to maintain the integrity of forests as envisaged by NTCA guidelines issued during 2012.

14. The indiscriminate use of forest roads and trails by tourists visiting places of religious worship poses a huge risk of fatal encounters with wildlife. The situation calls for regulating/restricting use of forest roads and trails by tourists. There are also instances of forest trails being used as roads by clearing vegetation, which need to be curtailed.
15. Finally, the perspective plan favors active dialogue, and engagement with the communities of the Van Gujjars that live alongside elephant habitats. Partnering with local communities and involving them in implementing conflict mitigation strategies would improve the efficacy of the current efforts of Uttarakhand Forest Department.



CHAPTER-1

General Introduction

1.1 Background

Asian Elephant (*Elephas maximus*), once distributed across Asia are presently confined to ca. 5% of its historical range (Leimgruber et al. 2003) with an estimated population of about 50,000 individuals across 13 countries (Williams et al., 2020). Elephants have suffered major range contraction along with corresponding reduction in the populations throughout Asia (Leimgruber et al. 2003). Outside India and Sri Lanka, the status of elephant populations continues to be alarming. India harbours more than 60% of Asia's wild elephant population and therefore, plays a crucial role in long-term conservation of the species (Rangarajan et al. 2010).

In India, elephants occur in four distinct populations viz. (1) North-west population covering the states of Uttarakhand, Uttar Pradesh, Bihar and lately, splinter groups of elephants expanding their ranges into Himachal Pradesh and Haryana across Yamuna river (2) East-central population covering the states of Odisha, Jharkhand, Chhattisgarh, Bihar, Madhya Pradesh, south West Bengal and north east Andhra Pradesh (3) North-eastern population covering all seven states and include north West Bengal (4) The southern population covering Karnataka, Kerala Tamil Nadu, and Andhra Pradesh. The Southern region supports the largest elephant population, followed by North-eastern region and East-central region respectively. The smallest of the four regional populations occur in the Northwestern region.

Elephant habitat in India is interspersed with human habitations and agriculture, and constitutes about 4 – 5 % of the country's landmass. The present distributional range of elephants in India is about 1,25,000 km². Of this distributional range, nearly 30% of the area falls within the Protected Area (PA) network and over 70% of the area fall outside of PA network. However, it may be noted that more than 85% of the elephant range occurs within forested habitats.



Given that elephants are long ranging animals with relatively large home ranges spanning 50 – 3000-km², human–elephant interactions in the interface zones are inevitable. This is particularly true in the Indian context as remnant elephant habitats are small relative to the scale of elephant home ranges. Further to this, the remnant elephant habitats, particularly those that occur outside of the PA network are under myriad forms of habitat threats resulting in reduced carrying capacity of the habitats to support elephant populations. Furthermore, many elephant corridors that essentially link otherwise disjunct elephant habitats continue to be under severe threat as corridors outside of forests do not have legal protection (Menon et al. 2017). Loss of corridors and connectivity could result in isolation of elephant populations with long-term implications for elephant conservation and human–elephant conflict management.

In addition to the aforementioned threats, the elephants suffer due to linear infrastructure, degradation and fragmentation of elephant habitats. These cumulative threats to elephant habitats are often the primary triggers for human–elephant conflict (HEC) (Balasubramaniam et al. 1995).

As HEC can erode public support and participation; elephant conservation rests on effective and timely resolution of HEC. However, addressing HEC is seldom easy as it involves reconciliation between local livelihood needs and elephants' large habitat requirements. The HEC is extensively researched in India and the prevailing general understanding, regarding, indicates that HEC is a complex interplay of (i) habitat factors (ii) elephant demography and behavioral ecology (iii) human demography, land use and resource dependence and (iv) Societal attitudes and perceptions towards conservation (Sukumar, 1994, Desai & Riddle 2015). At the ground level, managing HEC would be dependent on fine-scale assessment of the problem at the site level so that mitigation strategies that are appropriate to the site can be developed.

1.2 Human–Elephant Conflict in India: A Synthesis

In India, all the four regional elephant populations suffer from different levels of human–elephant conflict. Among the four regional populations, severity of human–elephant conflict is highest in the East-central region (in terms of conflict incidences proportional to the elephant population size), while the Northwestern region suffers the lowest. Overall, about 2,381 people and 490



elephants have died in India from 2015 to 2018 (MoEF&CC, 2018) due to such conflicts (Figure-1.1). Nearly 5 lakh families reportedly suffer elephant-related crop losses every year in India.

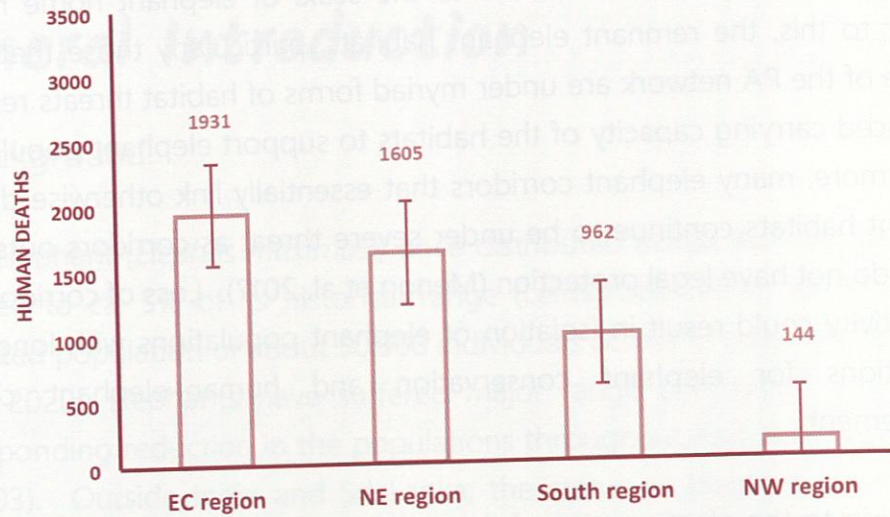


Figure-1.1: Reported HEC-related human deaths in India during the period 2010-2020 (source: Project Elephant Division, MoEFCC)

In spite of multi-pronged efforts taken by the Government and other agencies in India, conflict between elephants and people continues to intensify. There is now an increased recognition that conflict resolution cannot be a one-off effort, but a continuous and sustained endeavor of learning and implementing different strategies over longer period of time. Although human–elephant conflict is a relatively well researched topic in both conservation biology and management in India, many questions beg satisfactory answers so as to devise lasting solutions to the problem. There are also new challenges like elephant dispersal into human-dominated areas.

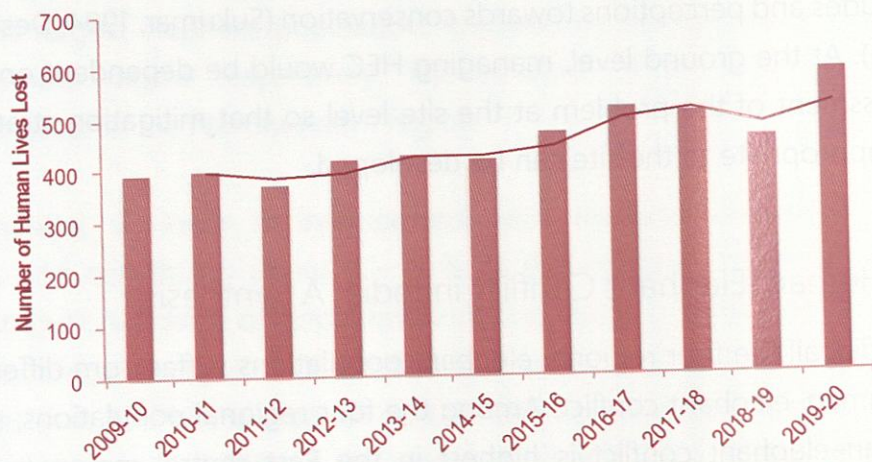


Figure-1.2: Annual reported HEC-related human deaths in India (Source: Project Elephant Division, MoEFCC)



Since HEC is dynamic, there is a need for any conservation and management mitigations to minimize the effect, should also be dynamic, whether is short or long term. This report is an attempt to synthesize the available information and knowledge to prepare a Long-Term Perspective Plan (LTPP) towards mitigation Human-Elephant Conflict in the Rajaji Tiger Reserve Landscape in Uttarakhand.

Given that mitigation of HEC is a continuous process, having a long-term perspective plan is crucial. Ideally, the perspective plans are to be prepared for a larger landscape so that the elephants' entire annual home range can be considered. Perspective plans provide direction and continuity to conflict mitigation efforts and thus paves way for properly documenting measures that either worked or failed. Thus, many state Forest Departments embark on preparing long-term perspective plans for managing human–elephant conflict. The current effort involving preparation of long-term perspective plan for Rajaji landscape was envisioned by Uttarakhand Forest Department, which manages the largest Asian elephant population in the northwest region.

1.3 Rationale

The 1st Project Elephant Steering Committee constituted during the year 1992 by the Ministry of Environment and Forest, Government of India emphasized on maintaining “viable elephant populations in viable landscapes”. Feeding from this clearly laid out prescription for elephant conservation in India, this perspective plan for mitigating HEC underscores the importance of population and landscape viability both for elephant conservation and management of HEC as both are intertwined.

In comparison to other three regional populations, the intensity of HEC in the northwest population including that of Uttarakhand is low. Yet, there are indications that HEC has been increasing during the last few years, and seems to correspond with landscape-level changes to habitats and areas surrounding them (Natarajan et al. 2021). The two PAs of Rajaji and Corbett National Parks along with the connected territorial forest divisions harbor more than 50 to 60% of the elephant population occurring in Uttarakhand (Project Elephant, MoEFCC, 2017). Therefore, evaluating HEC in both Corbett landscape (located in the Kumaon region) and Rajaji Landscape (located in the Garhwal region) with an objective of advancing conflict mitigation strategies would be paramount.



The "Rajaji Landscape" includes Rajaji Tiger Reserve (RTR) and the adjoining Haridwar and Dehradun Forest Divisions along with small portions of Mussoorie, Narendra Nagar and Lansdowne Divisions. The Rajaji landscape supported a sub-population of about 350 elephants during early 1990s, which subsequently increased to about 525 elephants during 2015 (Wild Asiatic Elephant Population Estimation Uttarakhand 2015, PE Division, Govt. of India 2017). While the population status of elephants in Rajaji landscape, which had shown marginal increase during the last two decades calls for jubilation, addressing HEC has become complex and challenging. One of the main challenges facing elephants in Rajaji landscape is the weak connectivity between eastern and western Rajaji across River Ganga. Further, in certain pockets of the landscape, the elephant habitat has suffered degradation due to resource extraction pressures from local communities; incompatible land-use along the forest interface and rapid expansion of linear infrastructure (Nigam et al., 2021).

In addition to the HEC pertaining to loss of cultivated crops and occasional human lives, pilgrimage-related conflict is another form of conflict that is becoming difficult to manage in the Rajaji landscape. It is timely to assess the potential conflict between elephants and pilgrims in the landscape and devise long-term conflict mitigation strategies. It is noteworthy that a large number of pilgrims gathers in and around Rajaji landscape once in every 12 years during the Maha Kumbh celebrations. Nigam et al (2022) found high overlap between sites demarcated for Maha Kumbh and elephant range areas. The situation thus calls for holistic assessment of places of religious worship in the Rajaji Landscape and come up with practical strategies to ameliorate potential conflict.

1.4 Scope

The perspective plan is limited to Rajaji landscape that supports a population of about 525 elephants (PE Division, Government of India, 2017). The UKFD with a foresight towards long-term elephant conservation and management of human–elephant conflict in the Rajaji landscape had envisioned drafting a perspective plan with technical support from the Wildlife Institute of India.

Given that the Rajaji landscape is one of the strongholds for elephants of the northwest regional elephant population, maintaining the habitat integrity of the landscape so as to ensure conservation of viable population of elephants



in viable habitats while at the same time keeping human–elephant conflict at socially acceptable limits assumes critical importance. The latter – that is, the viable habitat is often the key for achieving the former (i.e., viable population). Although elephant population trend is a critical metric that need to be monitored, equal emphasis needs to be placed on the health of habitat as well.

With the aforementioned preface, the perspective would be a reference document that identifies major drivers of HEC in the Rajaji landscape and also discusses possible approaches to deal with conflict. For managing HEC, the perspective plan attempts to provide a general approach rather than providing fine-scale details at the site level as would be done in a typical management plan of Protected Areas. Site-specific details on HEC management can only from intensive site-specific studies and hence, not the focus of the perspective plan. Rather, the perspective plan focusses on general aspects of HEC and its management in the Rajaji landscape. Specifically, it (i) provides historic perspective of both the landscape as well as elephant populations in the Rajaji landscape by highlighting both the tacit form of habitat loss and degradation of elephant habitats overtime (ii) presents broad spatio-temporal trends in HEC in the Rajaji landscape and also discusses about potential drivers of HEC (iii) provides a list of short- and long-term HEC mitigation strategies appropriate for the landscape. Additionally, the perspective plan also elaborates about the religious places of worship in and around Rajaji landscape with potential for managing human–elephant interactions therein.

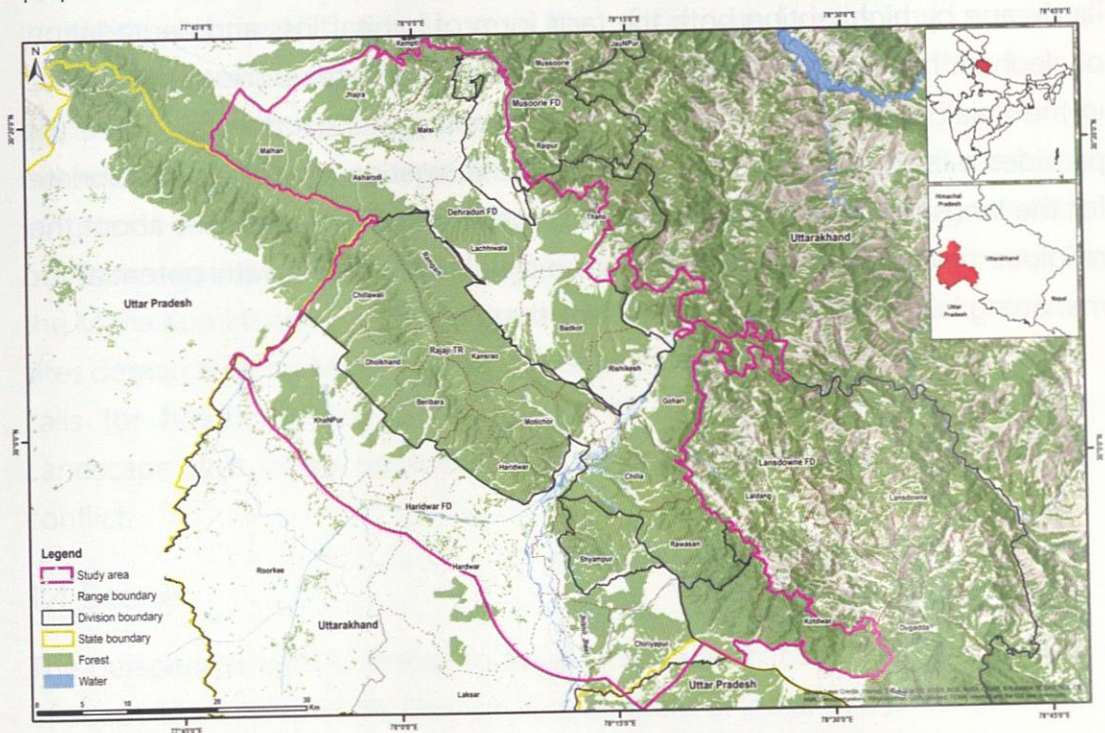


CHAPTER-2

Rajaji Landscape: Status of Habitat and Elephant Populations

2.1 The Rajaji landscape

The Northwest regional elephant population extends from forests on flat to gentle topography of Himachal Pradesh adjoining the western bank of Yamuna River to Terai Bhabar grasslands including the Shivalik mountains till River Sharda along the Indo-Nepal border (Singh, 1969,1995). This tract of elephant habitat includes the Shivalik Elephant Reserve that harbors the entire elephant population comprising about 1800 elephants in Uttarakhand.



Map 2.1 Rajaji Landscape along with a buffer area for managing Human-Elephant Conflict

Elephant habitat in Uttarakhand occurs between Yamuna and Sarada rivers encompassing an area of about 10,000 km² (Johnsingh et al. 2006). Uttarakhand's elephant habitats extend eastwards into Uttar Pradesh and Bihar



in India, and also into neighboring Nepal. Westward of Uttarakhand, elephants also range into Kalesar Wildlife Sanctuary of Haryana and the Simbalbara Wildlife Sanctuary of the Himachal Pradesh across river Yamuna. However, such westward movements are highly infrequent and may involve a few individual elephants only. The altitude in the elephant habitats of Uttarakhand ranges from about 200 m to 1000 m. Average annual precipitation in the landscape is about 1500 mm with mean annual temperature ranging from 0°C during winters (December to February) to 40°C during the summer months (May to July). The vegetation community found within elephant habitats predominantly comprise of extensive Sal (*Shorea robusta*) dominated mixed forests and pockets of grasslands (Harihar and Pandav 2012).

Rajaji landscape (Map- 2.1) is also part of the Shivalik Elephant Reserve. In the Rajaji landscape, the major vegetation comprises of tropical dry and moist deciduous forests, scrub vegetation, alluvial grasslands and forest plantations primarily of *Tectona grandis* and *Eucalyptus* spp (Champion & Seth, 1968; Johnsingh et al. 2004). Vegetation communities include (i) Sal (*Shorea robusta*) dominated forests along with its associates (ii) Sal-mixed forests of *Shorea robusta* – *Mallotus philippensis* – *Lagerstroemia parviflora* series (iii) riverine forests of *Acacia catechu* – *Dalbergia sisoo* – *Syzygium cumuni* series (iv) mixed forests of *Lagerstroemia parviflora* – *Holoptelea integrifolia* – *Ehretia laevis* – *Adina cordifolia* – *Anogeissus latifolia* series (v) forest plantations (Johnsingh et al, 2004).

Major occupation of local communities dwelling in the landscape includes pastoralism and agriculture. Crops grown in the area includes sugarcane (*Saccharum officinarum*), paddy (*Oryza sativa*), wheat (*Triticum aestivum*), maize and a few varieties of millets. Rajaji Tiger Reserve is a Protected Area (PA) with relatively high degree of legal protection. In the territorial Forest Divisions, the habitat conditions for elephants are often sub-optimal owing to resource-dependence related pressures (fodder and firewood collection), forest fires, and impacts of physical infrastructure development.

2.2 The Elephant populations

2.2.1 Historic Perspective

The northwestern elephant population was discontinuously spread across foot hills of the Himalayas in the Uttarakhand, northern Uttar Pradesh, northern



Bihar and contiguous with elephant habitats in the neighboring Nepal. Progressively, the habitat contiguity was broken, mostly along the rivers and elephant populations started getting fragmented along with the habitats (Johnsingh et al. 2004; 2006). The population estimation of elephants in Uttarakhand (and erstwhile Uttar Pradesh) is available from the year 1966 onwards (Box 2a).

Box 2a: Elephant census as carried out in the erstwhile Uttar Pradesh

During early 1960s, an undated report claimed that about 1200 to 1600 elephants occurred in the erstwhile Uttar Pradesh and also reported conflicts with people. During 1963, the Government issued permits for the removing elephants following public demand that resulted in culling of 27 elephants and 12 were wounded.

Following this, there was an elephant census, which was conducted based on representation made by environmentalists to the Government of Uttar Pradesh. The census operations conducted during the years 1966 and 1967 concluded that elephant population was not likely to be more than 400.

After a decade, another elephant census carried out during the year 1976. This census showed that the elephant population had increased to just over 525. Additionally, it was observed that natural elephant habitats were being replaced by monoculture plantations that was causing displacement of elephants in areas that they did not occur earlier. The subsequent third census conducted between 1976 to 1986 showed that the elephant population had increased to 750. Lansdowne Division (part of Kotdwar region) harboured 309 elephants and Dehradun region supported 116 elephants. During the 10 years from 1976 -1986, it was established that about 70% of the elephant population was confined between Chilla Wildlife Sanctuary (subsequently amalgamated with Motichur sanctuary to form Rajaji National Park) and Corbett National Park.

All three census operations indicated a population growth rate of 3% during 1967-1976 and 5% during 1976-1986 with the population almost doubling from 400 to 750, in two decades. This doubling was possible as the population was relatively small and even marginal increase could result in doubling of the populations. The calving percentage in Lansdowne Division during the period 1967-76 was reported to be 4.2%. This increased to 4.8% during 1976-1986. Further, although 32 calves were trapped (as part of population control) during 1976-1986, it did not seem have an effect on the overall population growth, as the percentage of calves increased from 20% of the population to 25%.

Source: Singh V.B. 1969, 1978a, 1978b, 1986



2.2.2 Recent Trends on Elephant Population

Based on the elephant census figures collated for the period 2001 to 2017, it can be said that the elephant population in Uttarakhand has marginally increased. Nevertheless, the observed increase cannot be as such interpreted as population growth. Across the Himalayan foothills and Terai in India and Nepal, there was significant loss of habitat for elephants (particularly in Nepal as shown by Ram et al 2021). For a long-lived species like elephants that are legally protected, such habitat losses would potentially result in compression of elephants into smaller habitat blocks.

As per the latest population estimation carried out by Uttarakhand Forest Department during the year 2015, the Rajaji landscape had about 520 elephants (Uttarakhand FD, 2015). This forms nearly 30% of the total elephant population of Uttarakhand.

Table: 2.1 Population trends of elephants in Uttarakhand (2001 to 2017)

S.No	Year	Source of Information	Approach Followed	Population Size
1	2001	Uttarakhand FD	Direct count	1507
2	2003			1582
3	2005			1510
4	2007			1346
5	2012	Varma & Sukumar, Asian Natural Conservation Foundation	Sampling	Mean = 1415 (CI = 1244 – 1586)
6	2015	Wildlife Preservation Organization, Uttarakhand FD	Direct count	1797
7	2017	Project Elephant, Government of India	Direct count	1839

2.2.3 Sex Ratio

The northwest population is characterized by favourable sex-ratio with an almost identical male to female numbers in the adult segment (William et al. 2005). In most other elephant populations, the sex ratio is skewed towards females (Daniel et al. 1987, Sukumar 1991, 2003). Williams (2005) estimated the adult sex ratio (male to females) of elephants as 1: 1.2. This indicates a relatively high density of elephant bulls in the population. From elephant conservation standpoint, less skewed sex ratio is definitely a desirable population trait.



However, as bulls have high propensity to be involved in human–elephant conflict, managing a population of large number of bulls can be a challenge requiring intensive monitoring of population in general and the male segment in particular.

2.2.4 Inter-Calving Period

For long-lived mammals such as elephant's population parameters, especially, length of reproductive lifespan (or age at reproductive senescence), juvenile mortality, adult survival and mean fertility are important in determining population growth of the species (Dobson & Oli, 2008). Inter-calf interval (time interval between two calves) can be a surrogate for population growth in elephants. Williams et al (2005) reported an inter-calf interval of 4.23 years for the Western Rajaji complex. Joshua (unpublished report of WII, 1994) reported an inter-calf interval of 3.1 based on a sample of individually monitored elephants. The observed inter-calf interval of 3.1 was one of the lowest recorded for Asian elephants. However, the observation was limited to just one sample and thus, cannot be extrapolated for the population. By comparing with the inter-calf interval reported from other landscapes (Sukumar, 1985; Tiwari, 2002, Arivazhagan & Sukumar, 2005), it can be concluded that inter-calf interval observed in Rajaji landscape reflects a growing population. Even a nominal growth in elephant population over a period of next ten years and corresponding habitat fragmentation and degradation need to be considered together. The two-way process of (i) nominal population growth & (ii) declining habitat quality can perpetuate conflict in new areas as there are numerous patches of forests around Rajaji Landscape where elephants can potentially disperse resulting in potential spread of conflict.

2.3 Contemporary Status of Elephant Habitats

2.3.1 Variations in Habitat Quality Over Time

Habitat quality and quantity are the major factors that overwhelmingly determine elephant home ranges. The habitat needs to be intact and with high ecological potential both in terms of quality and quantity. In general, the Shivalik-Bhabar-Terai complex of habitats is highly conducive for elephants and other large herbivores due to luxuriant vegetation, ample water resources, and year-round habitat productivity. During the pre-independence era, the elephant habitat was contiguous and large. Owing to habitat contiguity, the elephant populations remained intact and genetically robust. This was the case



within present-day Uttarakhand too with elephant populations remaining as one unit between River Yamuna in the west to River Sarada in the east, and beyond into neighboring country of Nepal as well. In fact, elephants occupied an altitudinal gradient of habitat ranging from sub-montane tract (>1000m) to the *Tera*i tract located at 200-m elevations.

Overtime, there has been a considerable pressure on this elephant habitat in the form of developmental projects aimed at improving irrigation system, enhancing power generation, and massive colonization of people in the river basins that were once rich in productive grasslands (Singh, 1995). This has been the case throughout the elephant habitat in present-day Uttarakhand. Even in the Rajaji Landscape, threats to elephant habitat post-independence were manifold and illustrated by the following:

- Before 1960s, the river Ganga was intact and there were no irrigation/power canals. Hence, the grasslands along the river were maintained productively through the natural process of monsoonal flooding and inundation.
- During 1947 to 1992, an area of 21,623 ha of forestland – part of potential elephant habitat was diverted for non-forestry development projects, that are mentioned below. This led to large-scale fragmentation of the once extensive and contiguous elephant habitat
- A large chunk of “miscellaneous forest” of Virbhadra block (Dehradun Division) located along the west bank of River Ganga was felled during 1964-65 and Hindustan Antibiotics was established at the site
- During 1970s construction of 14 km Chilla Power channel on the eastern bank of river Ganges for the hydel power project was undertaken. This led to deforestation in Johra and Raiwala blocks and various obstructions for elephant movement were created on either side of Ganga from Kunao barrage to Bhimgoda barrage (Singh, 1995)
- During the construction of the power channel and the barrages, two of the productive grasslands namely Chilla *Chaur* and Kunao *Chaur* located between the western side of the power channel and eastern bank of Ganga, which served as important feeding grounds for elephants during dry season previously, were diverted for agriculture and human settlement. This not only resulted in loss of crucial habitat for elephants, but also resulted in fragmentation of habitat connectivity between Chilla and Motichur (Singh 1978, 1986)



- Presently, most of the grasslands along the east bank of River Ganga have been converted into agriculture around the Ganga Bhogpur, Talla and Malla villages, which were primarily established right in the grasslands. The remnant grasslands too in Kunao and Chilla areas have been invaded by unpalatable weeds.
- During the late 1970s, there was also indiscriminate lopping and grazing in many parts of the elephant habitat, and in the process, natural vegetation was degraded. The habitat quality was further degraded due to establishment of plantations of teak, *Tectona grandis* and *Eucalyptus spp* (Singh K.N. 1995).

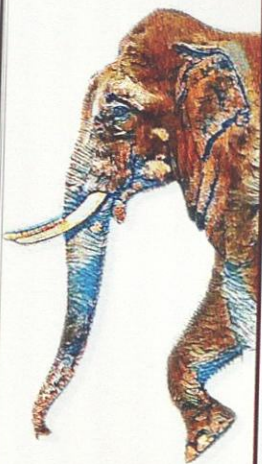
Thus, as could be surmised from the above, fragmentation and corresponding negative effects on the elephant habitats were significant since 1990s.



The Chilla canal from Kunoun barrage to Chilla power house passing through Rajaji National Park

2.3.2 Habitat Degradation

Habitat degradation is a tacit form of habitat loss for elephants. The effect of habitat degradation on elephants is similar to that of habitat loss. For elephants, habitat availability is as important as habitat quality and absence of either can be a trigger for long-term HEC. Habitat degradation is often a result of pressures on habitat that causes overall reduction in habitat productivity (in



terms of biomass) and forage base for elephants thereby reducing the inherent capacity of the habitat to sustain elephant populations. Indices of habitat degradation include proliferation of invasive plants and corresponding depletion of fodder and water resources for elephants. A qualitative account of habitat degradation in Rajaji landscape is summarized below:

- Being a braided river marked by seasonal flooding, grasslands were once abundant all along River Ganga and its major tributaries flowing within Rajaji Landscape. Such grasslands were favourite summer habitats for elephants. After construction of Kunaon and Bhimgoda barrages and the canal systems large fraction of such productive grasslands were completely lost. The remnant grasslands were invaded by invasive plants due to changes in hydrology and desiccation.



A degraded patch of forest in Western Rajaji National Park

- The territorial divisions surrounding Rajaji National Park continue to face myriad threats from livestock grazing, firewood and fodder collection that resulted in rapid proliferation of invasive plants throughout the landscape (Johnsingh et al. 2014).
- The relatively flat and highly productive *terai* habitats within Rajaji Landscape occur only in Shyampur and Chidiyapur Ranges of Haridwar



Forest Division. Since the year 2000, these two ranges suffered loss and degradation of habitats owing to multitude of factors (Box-2a).

- Based on qualitative observations, the bamboo thickets and tall grass habitats in Haridwar Forest Division that were formerly abundant (Singh, 1969) have been significantly reduced due to lopping, and other forms of pressure posed by the Van Gujjars resettled in the area.



A Gujjar settlement in Haridwar forest division

The aforementioned points illustrate that the quality as well as extent of elephant habitat has decreased from what it was a few decades ago. Particularly in the territorial forest divisions adjoining Rajaji National Park, the process of degradation continues (Box 2b). Thus, it is important to enhance the quality and quantity of the habitat in the Rajaji Landscape. The degraded areas need to be mapped (this itself would be a separate task involving field sampling) and habitat restoration plans need to be chalked out towards restoration and reclamation of habitat for not only increasing the potential of the habitat for elephants, but also to minimize HEC.



Box-2b: Degradation of Elephant Habitat in Shyampur and Chidiyapur Ranges of Haridwar Forest Division

The Shyampur and Chidiyapur Ranges located between *Shivalik* and *Terai* were productive for herbivores due to numerous streams and *raus* from the outer Himalayan range bringing in adequate silt and water, that maintain luxuriant grasslands and grass glades. These ranges constituted optimal habitats for elephants in the Rajaji landscape as is evident by relatively high elephant densities that occurred throughout the year.

The habitat condition in these ranges started deteriorating following settlement of Van Gujjars, who were resettled here from the core areas of Rajaji National Park. The Van Gujjar settlements have led to heavy degradation of the elephant habitat, mainly due to continuous lopping of trees for fodder, grazing and browsing by livestock.

This area had luxuriant vegetation comprising of rank growth of nutritious bamboo (*Dendrocalamus strictus*) and palatable grasses. A study on movement and habitat utilization of elephant in Chilla, part of Rajaji National Park, between 1989 to 1993 carried out by WII, reported that a minimum of 18 female group of elephants using Shyampur and Chidiyapur ranges, and also the adjoining Forest Ranges in Bijnor Forest Division of the neighboring Uttar Pradesh. In such areas earlier used by elephants, many families of Van Gujjars, who were not part of the early 2000 resettlement that was made in the Ghaindikatha forest block along the southern fringe of the Chiriyapur range in the Haridwar forest division, settled themselves in the Shyampur range along the fringes of northeastern boundary after Rajaji NP (final notification in April 2013) was declared as Tiger Reserve in the year 2015.

Further to this, during the 1980s and 1990s, only solitary bulls and that too rarely crossed Ganga to raid crops on the west bank where there are no forests. More importantly, it may be noted that during 1980s, the female herds had unhindered access to Ganga, although they were never observed to cross the river to raid crop fields along the west bank.

In the present, the female herds have totally stopped coming to Ganga due to enormous disturbances that have effectively blocked elephant movement. The bulls do come to Ganga in two different areas namely Dasowala and Anjani in the Shyampur and Rasiyabad ranges of Haridwar Forest Division. Bachelor herds of elephant bulls crossing river Ganga to raid crop fields in the west bank of the river has become a regular phenomenon in the present. Even during peak monsoon, when the river flows from bank to bank in spate, the elephant bulls cross the river for raiding crops. Most of these bulls that cross Ganga regularly are sub-adults.



The changes observed in the elephant movement patterns were further corroborated by the local people who were interviewed from Anjani Chaur, Dassowalla, Peeli, Shyampur, Chiriyapur Jhilmiljheel in the east and areas of Laksar, Bishanpur, Devpura athmal, Pathri, Jiya Pota, Jamalpur Kalan in the west of Ganges. Overall, they respondents reported increase in crop damage by elephants.

A possible reason for the straying of young bulls could be due to presence large number of adult bulls that possibly occupy the ideal habitats. The sub-adult bulls (15 – 25-year-old bulls that are sexually mature, but socially not dominant) seem to use the small and degraded patches of Anjani Chaur, Dassowalla Chaur, Chiriyapur, Jhilmil Jheel, and the remnant islets of Ganges and raid crops frequently.

2.3.3 Feeding and Forage Selection

There are evidences to show that the food habits of elephants have gradually changed over the decades. For example, elephants in this landscape did not feed on *Mallotus philippensis* during 1920s (Champion 1927), but started feeding on it and even reported as a favoured food species after 1960s (Singh 2002). The observations made by Singh (2002) indicates that the frequency of elephants feeding on *M. philippensis* had possibly increased owing to decline in availability some other preferred food species or increase in the availability of *M. philippensis*. During 1967 to 1976, it was reported that in addition to reduction in the overall elephant habitat, there was also decrease in elephant food plants (Singh, 1986).

Studies conducted during 1980s to 2000 revealed that *M. philippensis* and other browse formed important part of the elephant diet in this landscape. The present observations (WII, Elephant Project Field Assistants pers. com.) suggest that elephants have started feeding on *Tectona grandis* (teak) and *Haplophragma adenophylla*. However, the extent of feeding on these novel plants has not been adequately investigated. Thus, it is important to initiate focussed studies on elephant foraging behaviour in the Rajaji Landscape.

2.4 Elephant Corridors and Habitat Connectivity

The overall integrity of the elephant population in the Rajaji landscape is maintained by a network of wildlife corridors. Among them, the Gajah report (Rangarajan et al 2010) has recognized four corridors namely (1) Chilla – Motichur, (2) Rawasan – Sonanadi (via Lansdowne), (3) Kansrau – Barkote and (4) Rawasan – Sonanadi (via Bijnor). Among these corridors, the Kansrau –



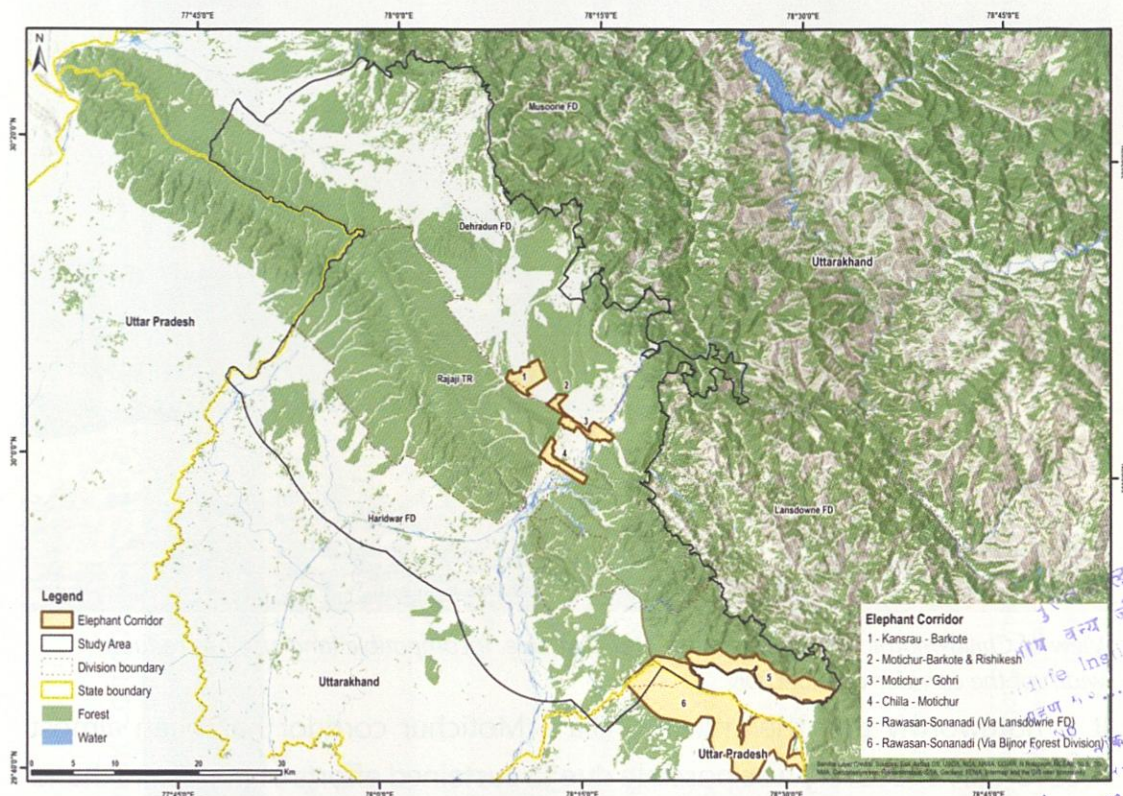
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Barkote corridor functions as two different corridors namely the Teenpani and Lal Thappar. Similarly, the two Rawasan – Sonanadi corridors (upper arm and lower arm) that connect Rajaji and Corbett TRs have numerous bottleneck areas that can qualify as corridors.



Map 2.2 Elephant corridors in Rajaji Landscape

In addition to these corridors that have been recognized in the Gajah or literature (including Right of Passage by WTI), there is an important corridor that connects Lachiwala range of Dehradun FD with the Ramgarh range of the Rajaji TR across Susua river. This corridor has been neglected for long despite periodic elephant movement. Although still functional, the corridor has become extremely weak. The Dehradun – Haridwar highway passing through Lachiwala has already also broken the earlier habitat contiguity between Lachiwala and Thanu Ranges. All of these corridors are vulnerable to degradation, encroachment and human occupation. In particular, the Gohri – Motichur corridor along the Song river is presently very weak and may get severed permanently if immediate steps are not taken. The present status and details of four of the important elephant corridors have been provided in the Table 2.2. The essentials of recovering and restoring these elephant corridors have been highlighted frequently through various publications and reports (Johnsingh et al. 2004; 2006; Harihar & Pandav, 2012; Menon et al. 2017).



Improving overall resilience of Rajaji Landscape for elephants would be conditional on restoring these three corridors at the earliest. Improving habitat resilience would be the key for managing human–elephant conflict as well.



View of Chilla-Motichur corridor from Motichur side. Incompatible land-use has reduced width of the corridor considerably

It is noteworthy that the critical Chilla – Motichur corridor has been almost recovered. Its recovery was possible due to sustained efforts of the Uttarakhand Forest Department for a long period. Challenging tasks like village relocation, prevention of encroachment along the Motichur rau, monitoring revenue lands along the river Ganga, monitoring railway line passing through the corridor and lastly, shifting the road traffic over flyover were carried out to recover this crucial corridor.





Table 2.2: Status and details of the Elephant Corridors in the Rajaji Tiger Reserve Landscape

Corridor	Kansrau-Barkote	Motichur-Barkote & Rishikesh (Tinpani Corridor)	Motichur – Gohri (Binj-Rau)	Motichur Range with Chilla Range of Rajaji Tiger Reserve	Rawason – Sonanadi (Lansdowne Division) Rajaji-Corbett Corridor	Rawason – Sonanadi (Bijnor Forest Division) Rajaji-Corbett Corridor
Connectivity	Kansrau Range of Rajaji Tiger Reserve with Barkote Range of Dehradun Division	Rajaji TR and Dehradun Division	Motichur and Gohri Ranges of Rajaji Tiger Reserve	Motichur Range with Chilla Range of Rajaji Tiger Reserve	Rajaji Tiger Reserve and Corbett Tiger Reserve	Rajaji Tiger Reserve and Corbett Tiger Reserve
Ecological Priority	High	High	Medium	High	High	High
Conservation Feasibility	High	High	Medium	High	Medium	Medium
Length and Width	4 km and 0.9- 2.2 km	1.5 km and 2 km	5 km & 1-0.3 km	4 km and 1 km	21 km and 1-2 km	28 Km and 0.1-11 km
Geographical coordinates	30° 4' 27"- 30° 6' 39" N 78° 8' 49"- 78° 11' 34" E	30° 3' 14"-30° 4' 34" N 78° 11' 44"-78° 13' 17" E	30° 1' 39"-30° 3' 19" N 78° 12' 40"-78° 16' 45" E	29° 59' 3"-30° 1' 24" N 78° 11' 16"-78° 14' 46" E	29° 45' 25"-29° 48' 32" N 78° 22' 46"-78° 33' 27" E	29° 40' 46"-29° 48' 9" N 78° 19' 31"-78° 31' 38" E
Legal status	Reserve Forest	Reserved Forest	Rajaji Tiger Reserve, Revenue Land	Revenue Land, Reserve Forest and Tiger Reserve	Reserve Forest & Revenue Land	Reserve Forest, Patta Land
Major land use	Forest	Forest, Settlement, River & Road	Forest, Settlements, Agriculture Land and River	Forest, agriculture, human settlements, road, railway line, river, and power canal	Forest, settlements, and agriculture land	Forest, settlements, and agricultural land
Major habitation/settlements	Nil	None	Tehri Farm, Gohri Maphi (part) and Gangabhogpur	Nil; (Khandgaon-III relocated to Lalpani)	Various Gujjar deras (settlements)	Gujjar Basti, Devennagar, Shankerpur, Chatruwala
Forest type	Tropical dry deciduous forest with plantation of <i>Acacia catechu</i> , <i>Tectona grandis</i> and <i>Eucalyptus</i> sp	Tropical dry deciduous mixed forest & Teak plantation	Tropical dry deciduous forest, Aal & Teak plantation	Tropical dry deciduous sal forest & teak plantation	Tropical dry deciduous sal forest	Tropical dry deciduous forest
Frequency of Usage	Bulls & Small Groups of 10-12 elephants	Mostly Bulls - Occasional	Rare; bulls and small herds	Regular; throughout the year	Regularly, Both Bulls and herds use this corridor	Occasional (Solitary and Herd)

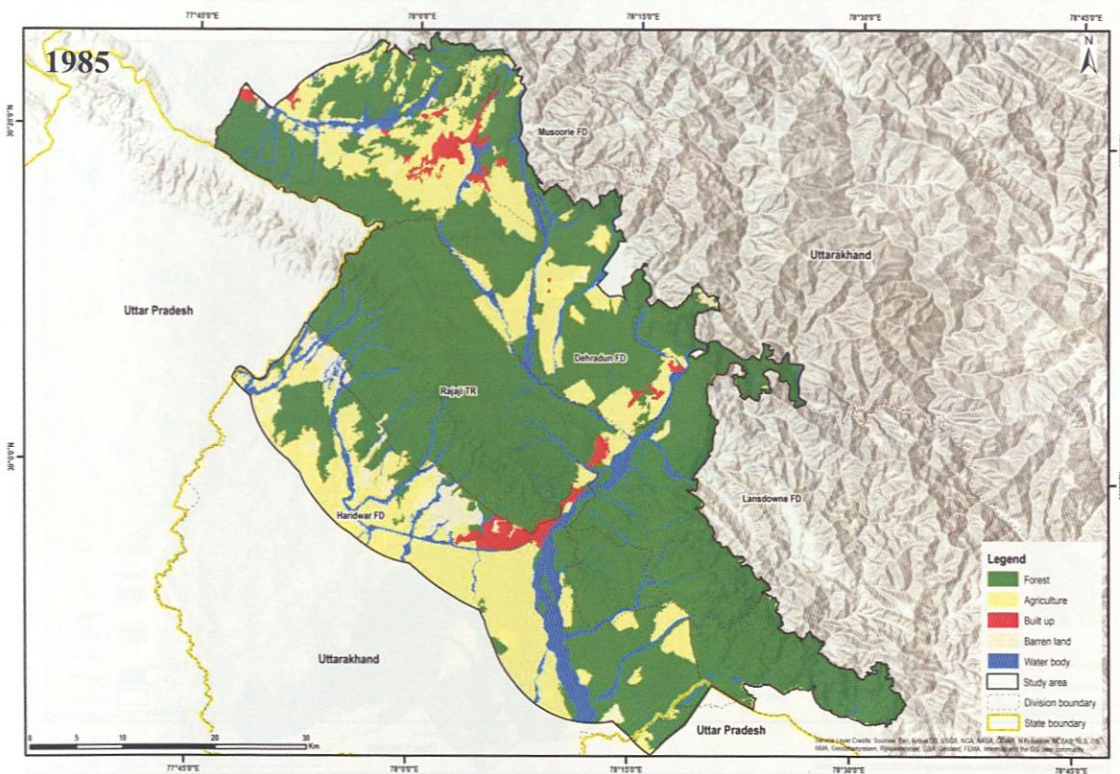
Corridor	Kansrao-Barkote	Motichur-Barkote & Rishikesh (Tinpani Corridor)	Motichur - Gohri (Binj-Rau)	Motichur Range with Chilla Range of Rajaji Tiger Reserve	Rawason - Sonanadi (Lansdowne Division) Forest	Rawason - Sonanadi (Binjor Forest Division) Rajaji-Corbett Corridor
Threat	<ol style="list-style-type: none"> NH 72 Highway traffic day & night. Fire wood Collection & Grazing, tree cutting - Lal Thappar, Chandhi, Chiddarwala and Sergarh villages. Two high-tension power lines on either side of Jakhn River. 	<ol style="list-style-type: none"> Settlement & Biotic Pressure: Sahab Nagar, Khairi Kalan and Khairi Khurd collect fuelwood and non-timber Produce Forest (NTEP). NH 72 Highway traffic day & night, & expansion. A high-tension electric line passes through Suswa 5 Block of the Motichur Range & Gola 6b Block of Rishikesh Range. Boundary wall & canteen building in Tinpani park - Golatappar 7b Block) 	<ol style="list-style-type: none"> NH 72 Highway heavy traffic day & night' Railway line: Haridwar to Rishikesh Settlements: Tehri Farm, Gohri Maphi and Ganga Bhogpur - Physical barrier & anthropogenic pressure. Chilla power canal - traffic movement & narrow bridge across canal. Satyanarayan Temple: - hinder movement Satyanarayan Forest Rest House - inside corridor 	<ol style="list-style-type: none"> Anthropogenic Pressure fringes villages (Khandgaon-II and III and Haripurkalan). NH72 Highway heavy traffic day and night Railway line (Haridwar-Dehradun) Chilla power canal - cemented embankment, narrow bridges, traffic between Rishikesh and Chilla Army ammunition dump 	<ol style="list-style-type: none"> Large number of settlements along southern side of corridor and anthropogenic pressure - dependency for forest resources. Heavy traffic on NH119 (Lansdowne - Pouri) both day and night Encroachment in the Malan River area near Karalghati, Laldhang and Kotdwar areas is another problem - people depend on corridor. 	<ol style="list-style-type: none"> Human Settlement Gujjar within corridor and along periphery Jaspurchamaria and Laldhang villages - dependency for forest resources Boulder mining is also an issue in the area. Heavy traffic on NH119 (Nagibabad - Kotdwar stretch) both day and night. Najibabad-Kotdwar Railway Track - Zafrabad (mainly from Compartments 2, 2B, 2A & 9) in the kaurlya. Shankerpur Farm located in the corridor
Village located inside	No village inside		Tehri Farm, Ganga Bhogpur, Gohri Maphi			Gujjar Basti, Devnagar, Shankerpur, Chatruwala
Villages along fringe	Lal Thappar, Chandhi, Chiddarwala & Sergarh	Khairikalan, Khairi Khurd and Sahab Nagar		Khandgaon II & Haripurkalan	Settlements along southern side of corridor	Jaspurchamaria and Laldhang
Conflict	High - Crop Predation: Chandhi, Chiddarwala	Crop raiding intensifies Cropping season - fringe villages	Injury/livestock death/crop damage/property loss due to conflict	Human Death (3 persons 2010)	76 human injury/death between 2007-2012 - Lansdowne division,	
Source: Menon et al., 2017						



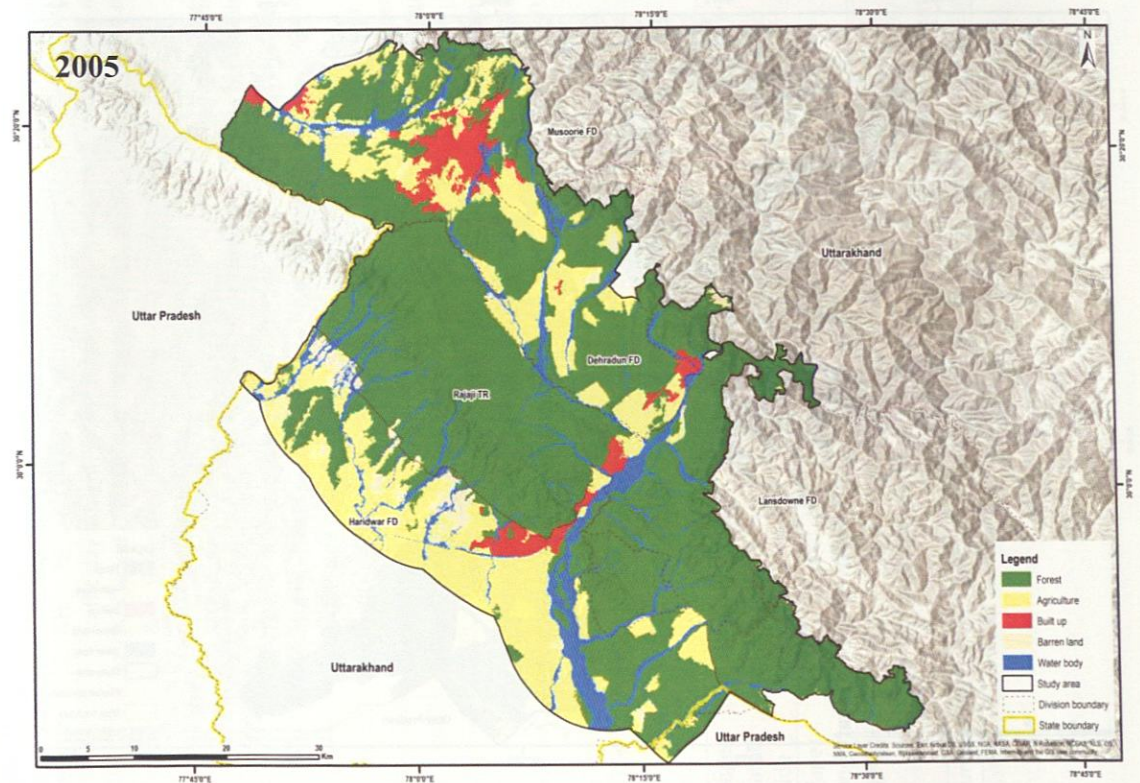
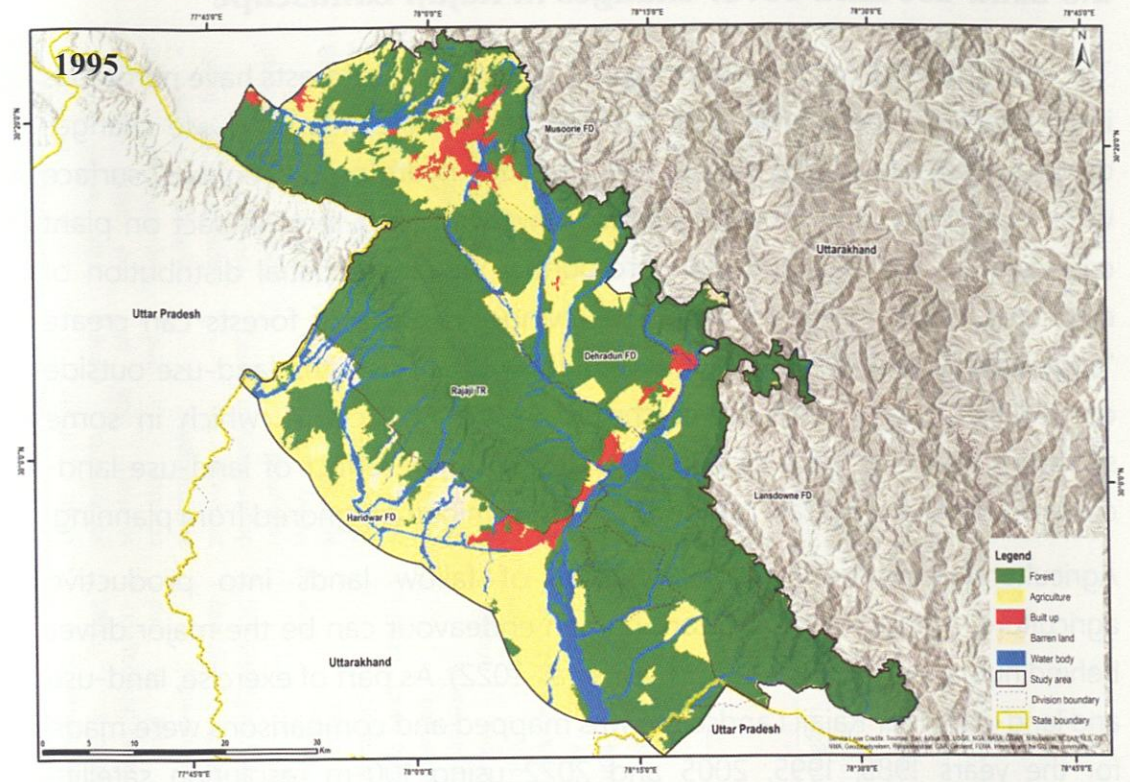
2.5 Land-use land-cover changes in Rajaji Landscape

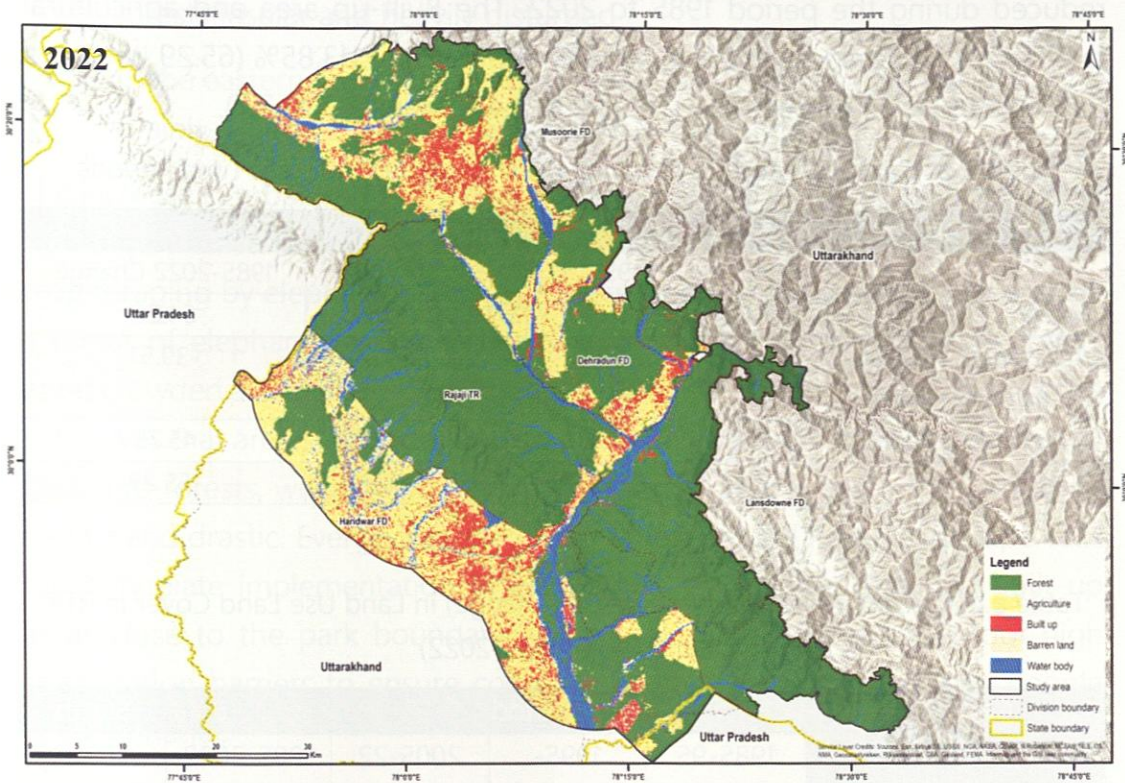
The land-use land-cover (LULC) changes in and around forests have numerous implications on the wildlife habitat (Neupane et al, 2017). Land-use changes occurring outside forests can potentially alter hydrological regimes, surface water availability, and biogeochemical flows with long-term impact on plant communities, which in turn can profoundly influence spatial distribution of elephants. Additionally, the land-use changes outside of forests can create “edge effects” and attract or repel wildlife. Furthermore, the land-use outside of wildlife habitats often forms the “zone of interaction”, which in some situations become “zone of conflict”. Therefore, the effect of land-use land-cover on elephant habitats can never be undermined or ignored from planning.

Agricultural expansion and conversion of fallow lands into productive agriculture – though an important human endeavour can be the major driver behind human–elephant conflict (Nad et al. 2022). As part of exercise, land-use and land-cover for Rajaji Landscape was mapped and comparisons were made for the years 1985, 1995, 2005 and 2022 using 100-m resolution satellite imagery. To evaluate land-use land-cover, a buffer of 10 km was created in GIS.

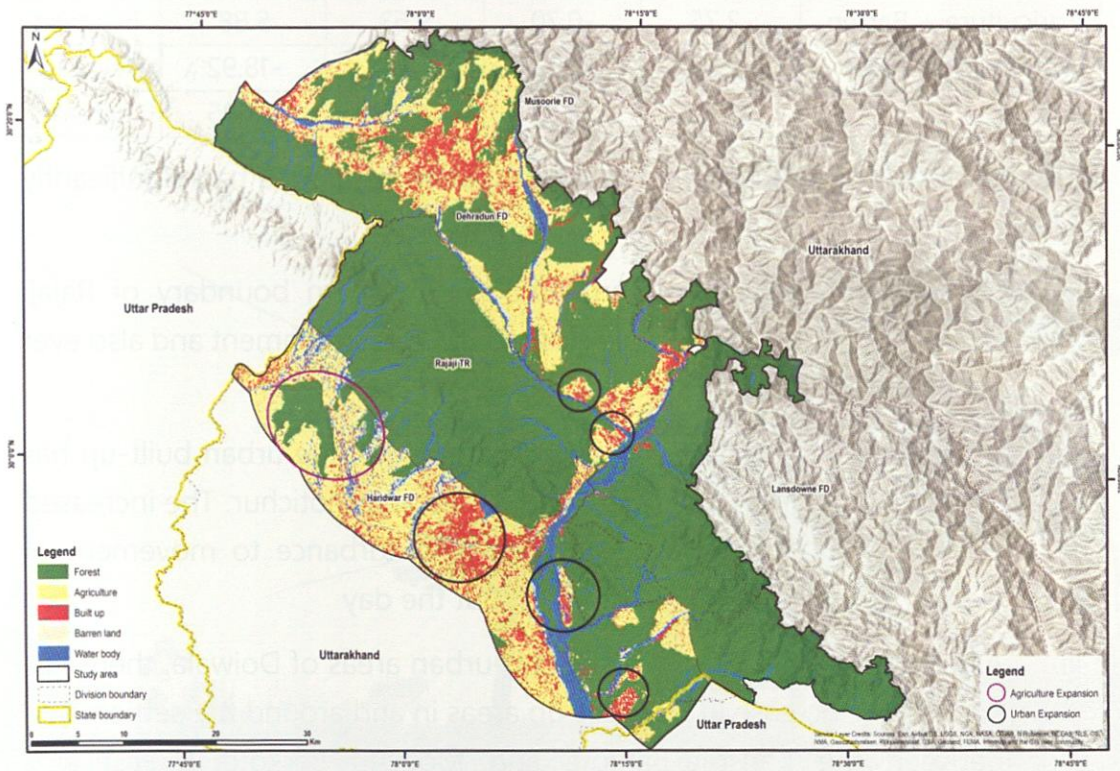


Perspective Plan to Manage
Human-Elephant Conflict in Rajaji Landscape
(2023 - 2033)





Map 2.3 to 2.7 Land use and land cover across different year Rajaji Landscape



Map 2.8 Urban and agricultural expansion in Rajaji Landscape



The results indicated that the extent of forests and water bodies marginally reduced during the period 1985 to 2022. The Built-up area and agricultural fallow had increased during the same time period by 113.85% (65.29 km²) and 5.88% (39.51 km²) respectively (Table 2.3, 2.4 & Maps 2.3 to 2.7).

Table 2.3: Land Use Land Cover of Rajaji Landscape in different Time Periods

Categories	Area in Km ²				
	1985	1995	2005	2022	1985-2022 Change
Forest	1773.4	1779.6	1771.3	1709.2	64.26
Agriculture + Barren (Agriculture Fallow)	672.5	654.1	649.5	712.1	-39.51
Waterbody + River	241.8	235.4	222.8	196.0	45.75
Built up	57.4	76.1	101.4	122.6	-65.29

Table 2.4: Percent increase and decrease (Change) in Land Use Land Cover in RTR Landscape (1985-2022)

Category	Time Period				Status
	1985-95	1995-2005	2005-22	1985-2022	
Forest	0.35	-0.46	-3.51	-3.62	Decrease
Agriculture + Barren	-2.75	-0.70	9.63	5.88	Increase
Waterbody + River	-2.63	-5.33	-12.04	-18.92	Decrease
Built up	32.63	33.33	20.93	113.85	Increase

From the above comparisons, it is evident that built-up area had significantly increase in:

- i. Haridwar along the southern and south-eastern boundary of Rajaji National Park (Western Rajaji) close to BHEL establishment and also ever expanding Haridwar city
- ii. In the already narrow Chilla-Motichur corridor, the urban built-up has further choked the corridor along Raiwala and Motichur. The increased built-up along Motichur causes severe disturbance to movement of elephants and other wildlife throughout the day
- iii. Along Dehradun city and in the sub-urban areas of Doiwala, there has been rapid increase in the built-up areas in and around the settlements between the Kansrau-Barkote and Motichur-Barkote & Rishikesh (Teenpani Corridor) located on the northern boundary of Rajaji tiger reserve



- iv. Along Rishikesh, the ever-increasing urbanization has already made forests insular and heavily disturbed
- v. In the eastern part of Rajaji tiger reserve also, built up area had increased mainly around Shyampur village and in the Chidiyapur area.

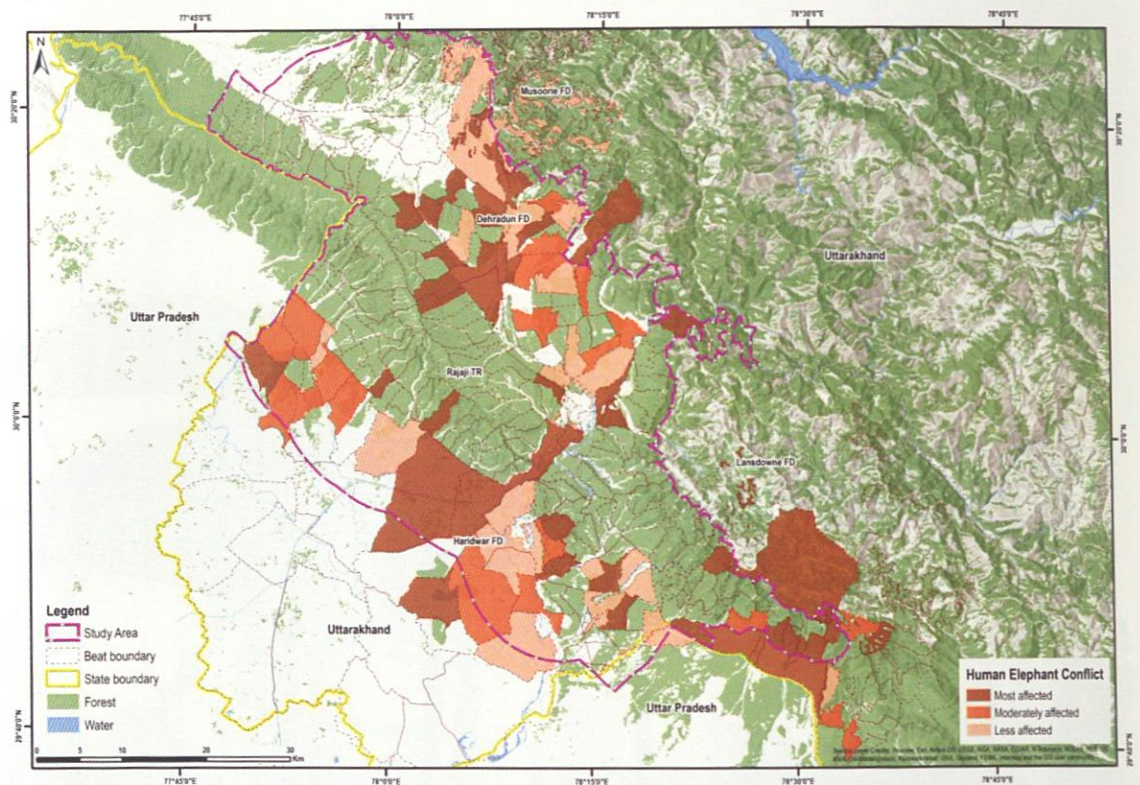
The increase in urban built-up along the forest boundary poses a different type challenge with respect to management of human–elephant conflict. Although crop foraging by elephants is not a problem as crops are sparse, there is often a threat of elephants entering densely crowded areas. Whenever elephants enter crowded areas, there is often a high chance of human fatality. Thus, unlike soft drives that are usually adequate to dissuade elephants from crop fields and back into forests, when elephants enter crowded places, the response has to be fast and drastic. Ever-increasing urbanization around Rajaji Landscape calls for immediate implementation of eco-sensitive zone that disallows built-up areas close to the park boundary and also construction of fool-proof high specification barriers to ensure complete spatial separation between people and elephants.



CHAPTER-3

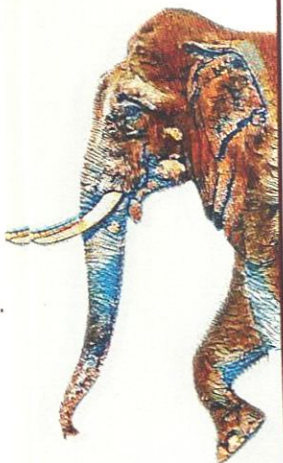
Human-Elephant Conflict in the Rajaji Landscape

Among the four regional elephant populations, intensity of human–elephant conflict is comparatively lower in the north-western region that harbours Rajaji elephant population as well. Therefore, from the face of it the human–elephant conflict situation in Rajaji Landscape appear better. The reasons for relatively low conflict in Rajaji Landscape include (i) rich habitat productivity including perennial water sources in the core areas, (ii) habitat contiguity to other elephant landscapes constituting a relatively large elephant landscape, (iii) adequate protection from anthropogenic threats, particularly in the protected areas for the last several decades and (iv) a favourable shape factor (area to perimeter ratio¹) of the protected area.



Map 3.1 Human Elephant Conflict in Rajaji Landscape

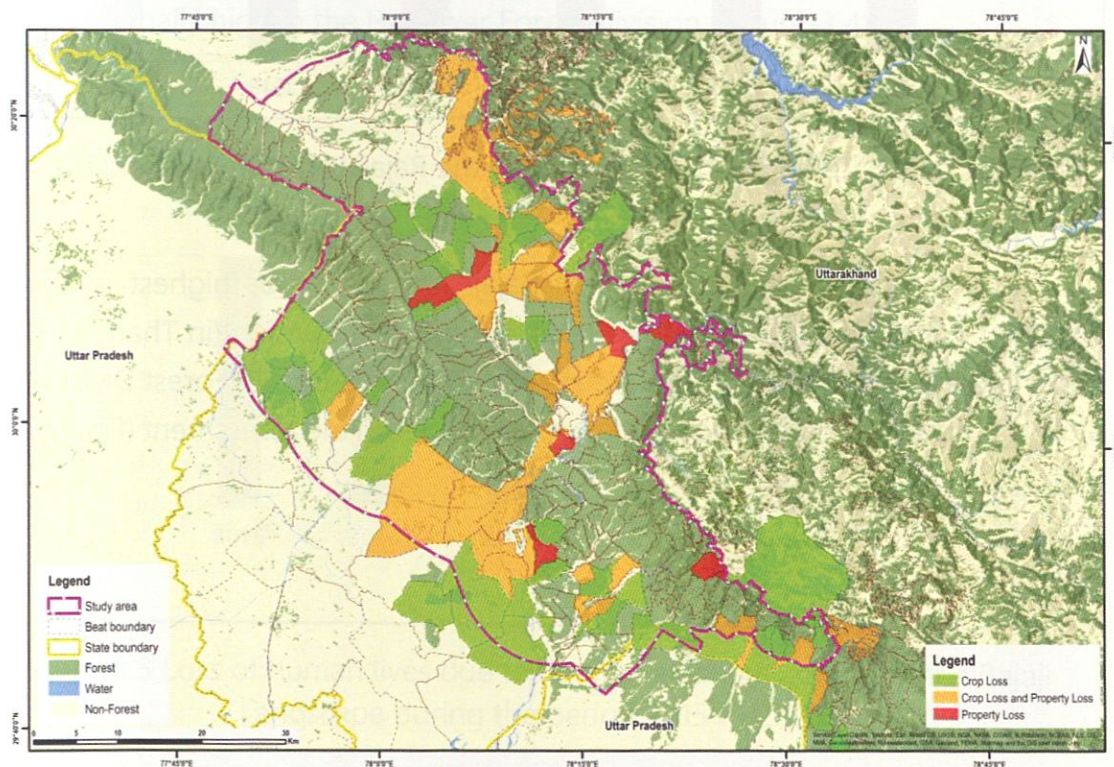
¹ Shape factor of the forest patch can play a critical role in determining conflict. If the perimeter of the patch is comparatively larger than the area, then the edge effect in terms of biotic pressure would be high on the patch. Therefore, in addition to size of the forest patch, the shape factor is also important.



Overall, the elephant density in Rajaji Landscape is also relatively low (< 0.5 elephants per km²) when compared to protected areas like Mudumalai, Bandipur and Nagarhole in the Western Ghats that support high density of elephants (>2.0 elephants per km²). Nevertheless, human–elephant conflict in the form of crop losses and occasional loss of human and elephant lives continue to be a challenge and by comparing the decadal trends of conflict, it appears almost certain that levels of human–elephant conflict in Rajaji Landscape is increasing (Map 3.1). Thus, it is important to take note of the situation and have long-term plans to deal with conflict/potential conflict in the landscape.

3.1 Crop losses

Crop damage by wild elephants is a major source of human–elephant conflict that affect local communities (Sukumar 2003, Rangarajan et al. 2010). Recurrent crop losses can directly affect local livelihoods and increase local antagonism towards conservation. Such antagonism can sometimes result in retaliatory killing of elephants. The primary form of human–elephant conflict in Rajaji Landscape is the crop losses caused by elephants. Crop losses caused by elephants are widespread across the landscape (Map 3.2). However, there are hotspots within the landscape that suffer disproportionately high levels of crop damage.



Map 3.2 Crop and property loss in Rajaji Landscape



From a recent assessment of crop loss records maintained by Forest Department, it is evident that an average of 460 (Std. Deviation \pm 44) incidences of crop losses were annually reported in the Rajaji landscape during 2015 to 2020 (Figure-3.1). A total of 93 villages were affected by crop losses by elephants during the period. Among the 93 villages, 30 villages were in the southern boundary of western Rajaji NP (Khanpur Range of Haridwar Forest Division), 30 villages were affected in the Haridwar Range, and 20 villages were affected in the Chidiyapur Range of Haridwar Forest Division. The crop loss incidences in Shyampur, Laksar, and Rasiyabad were mainly centred around the village enclaves that occur within the forests (Nigam et al, 2022).

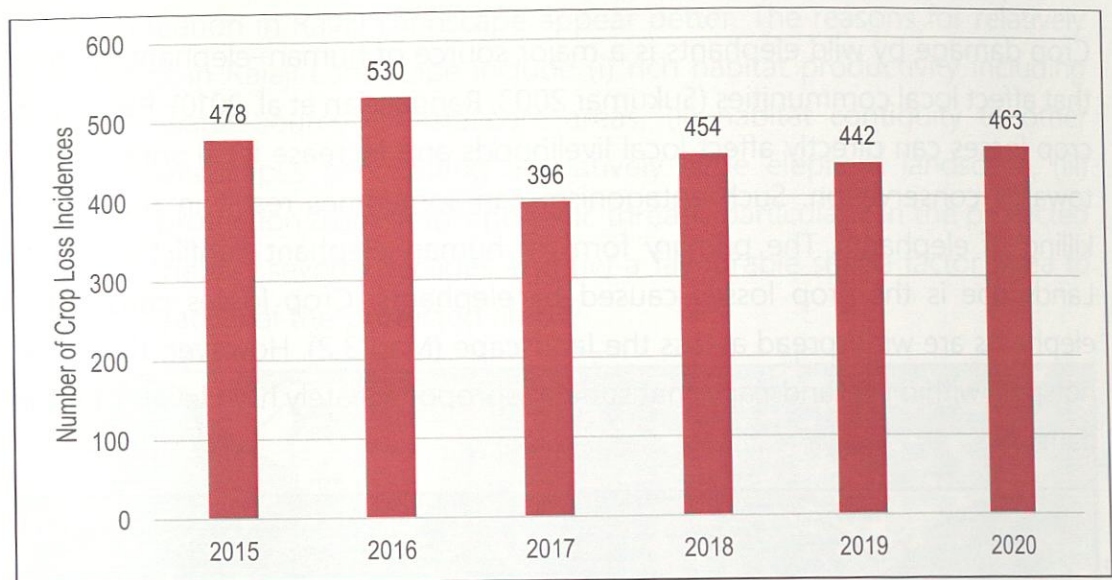
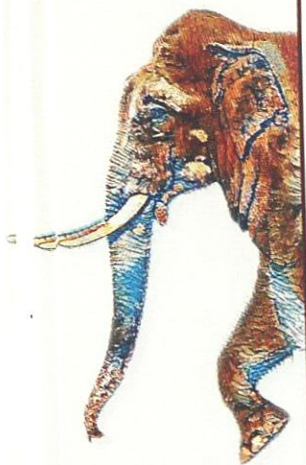


Figure-3.1 Crop loss incidences reported in the Rajaji Landscape during the period 2015 to 2020

Crop loss by elephants in the overall Rajaji landscape was highest in the Haridwar Forest Division followed by Dehradun Forest Division (in Thano and Barkot areas). The incidences were relatively low for Lansdowne Forest Division as only Kotdwar and Laldhang Ranges were included in the assessment (Figure-3.2).



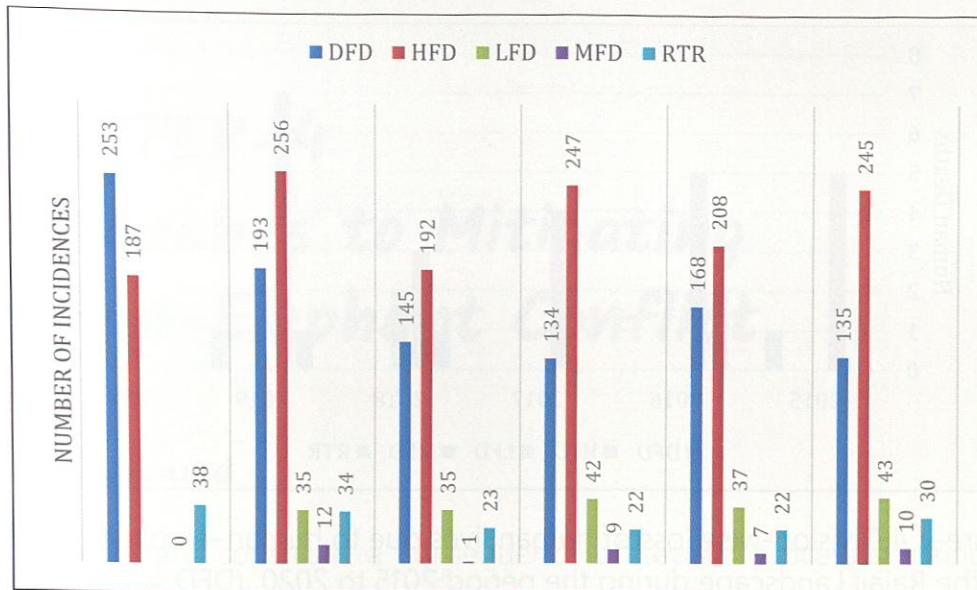


Figure-3.2 Division-wise reported crop loss incidences in Rajaji Landscape during the period 2015 to 2020 (DFD = Dehradun Forest Division, HFD = Haridwar Forest Division, LFD = Lansdowne Forest Division, MFD = Mussoorie Forest Division, and RTR = Rajaji Tiger Reserve)

3.2 Loss of Human Lives

Loss of human lives due to elephants is often the most serious form of HEC. In the Rajaji Landscape, on an average 6 (std. deviation ± 1) human lives were lost due to human–elephant conflict (Figure-3.3). The human deaths due to HEC was marginally high in the Haridwar Forest Division (Figure-3.4).

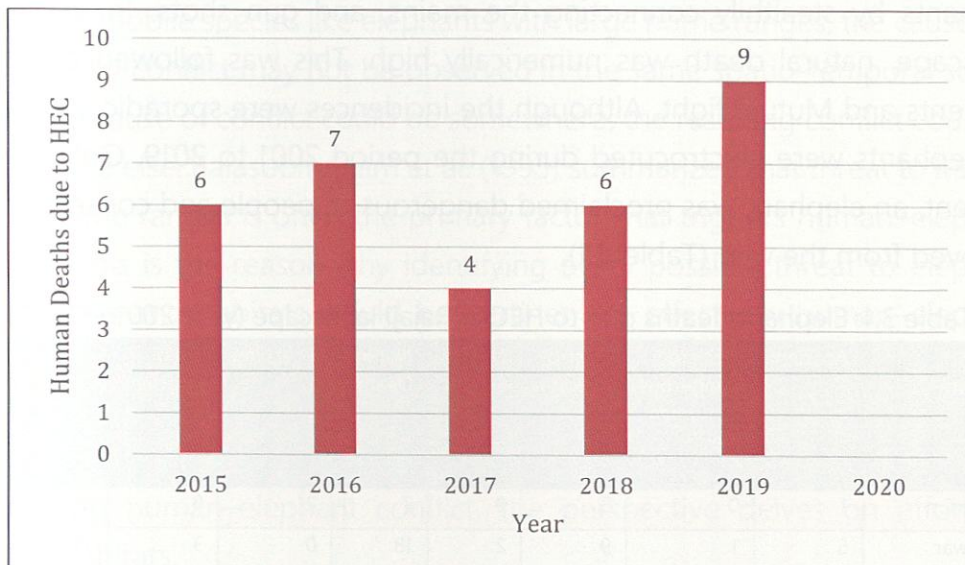


Figure-3.3 Loss of human lives due to human–elephant conflict in the Rajaji Landscape during the period 2015 to 2020



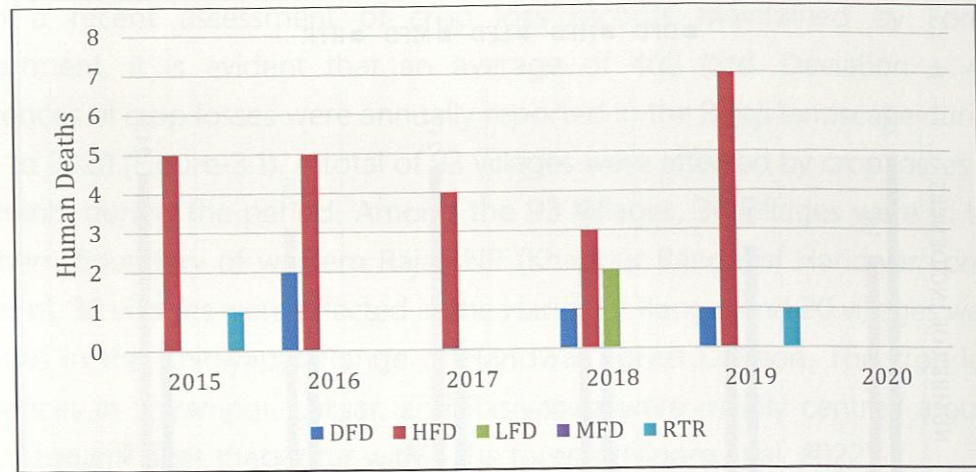


Figure-3.4 Division-wise loss of human lives due to human–elephant conflict in the Rajaji Landscape during the period 2015 to 2020. (DFD = Dehradun Forest Division, HFD = Haridwar Forest Division, LFD = Lansdowne Forest Division, MFD = Mussoorie Forest Division, and RTR = Rajaji Tiger Reserve)

3.3 Loss of Elephant Lives

In areas of acute conflict, HEC can be a main source of elephant mortality. Such mortalities can be accidental and sometimes, deliberate. Accidental deaths include snapping of power transmission lines, negligence, connecting direct power supply into fences due to sheer ignorance, and others. Retaliatory killing of elephants is relatively low in India as elephants are revered in the country. Yet, there are reports of poisoning, deliberate attempts to electrocute elephants by stealthily connecting the mains, and gun shots. In the Rajaji landscape, natural death was numerically high. This was followed by other accidents and Mutual fight. Although the incidences were sporadic, a total of 25 elephants were electrocuted during the period 2001 to 2019. Only in one incident, an elephant was proclaimed dangerous to people and consequently, removed from the wild (Table 3.1).

Table 3.1: Elephant deaths due to HEC in Rajaji landscape (year 2001 – 2019)

Forest Division	Accident	Declared dangerous to human life	Electro-cution	Mutual Fight	Natural Death	Poaching	Train Accident	Unknown	Total
Dehradun	1	0	5	0	7	2	0	3	18
Haridwar	5	1	9	2	18	0	3	13	51
Lansdowne	15	0	6	11	24	1	0	6	63
Narendranagar	0	0	0	0	0	0	0	1	1
Rajaji NP	18	0	5	17	47	2	7	6	102
Grand Total	39	1	25	30	96	5	10	29	235

Data as provided by Uttarakhand State Forest Department



CHAPTER-4

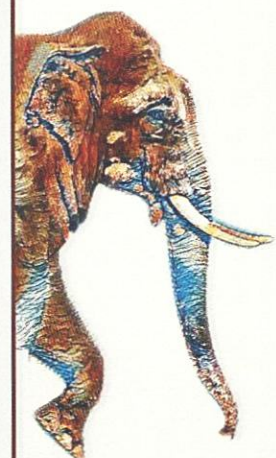
Approaches to Mitigating Human-Elephant Conflict

4.1 Background

Human–elephant conflict is a consequence of several processes acting on elephant habitats as well as populations. Therefore, holistically addressing human–conflict would essentially involve understanding the process and then addressing the issues. Some of the drivers of conflict may appear unrelated on the face of it, but may turn to be important in the long-run. For example, a highway that is built somewhere in the elephant habitat could be a silent trigger for long-term conflict if the road bisects the home ranges of some of the elephant clans (=integrated family unit of elephants comprising of related individuals). Thus, it is important to firstly comprehensively understand habitat-related threats to elephants so as to understand human–elephant conflict holistically.

For highly mobile species like elephants with large home ranges, the cause and the effect of conflict may not be observed in the same spatio-temporal scales. While the cause of conflict could be somewhere, the resulting conflict could be somewhere else. Balasubramiam et al. (1995) summarized that threat to habitat within home ranges is often the primary factor that triggers human–elephant conflict. This is the reason why identifying every possible threat to elephant populations and habitats would be pertinent to effectively human–elephant conflict in the landscape. Thus, a wildlife manager interested in addressing human–elephant conflict cannot ignore threats to elephant habitat as both are intricately connected. Thus, considering the importance of habitat integrity for minimizing human–elephant conflict, the perspective delves on efforts to restore habitats.

As elephants have evolved high mobility, conflict mitigation measures implemented in one site could result in the problem shifting to other sites if elephant home ranges are not understood well. Therefore, while planning for conflict mitigation, it is important to identify whether the effort envisaged



would address the problem in the site and does not result in deflection/shift of problem elsewhere (Barua et al. 2013, Shaffer et al. 2019). This aspect of mitigating human–elephant conflict has not been well recognized as yet. Hence, the mitigation measures prescribed need to take into account the (i) an idea about the extent of elephant home ranges that may be inferred from telemetry studies (ii) habitat considerations (iii) extent of conflict mitigation strategies with respect to elephant home range size. Additionally, it would be important to use topographic maps to try and qualitatively predict where conflict could potentially shift. The perspective plan strongly emphasizes on having a minimum of 10-year plan for conflict management

- Mitigating conflict between elephants and people would essentially entail both long-term measures aimed at addressing the root-cause of conflict, and short-term measures aimed at addressing the symptoms and providing immediate relief to affected communities. Both measures are equally essential. Considering this, the perspective discusses both short-term, and long-term measures to mitigate human–elephant conflict in Rajaji landscape. The definition of ‘short-term’ or ‘long-term’ is just indicative and not rigid as some of the measures enlisted would possibly fit into both the sets of measures
- The perspective recognizes the importance of continuous engagement to achieve continuous improvement of conflict mitigation strategies. Therefore, conflict mitigation strategies implemented in the field need to be actively evaluated so that the efficacy can be objectively understood. A conflict mitigation strategy implemented in one site may not work in the other as the complex issues of human and elephant behaviour that determine the outcome of intervention may differ significantly between sites. Therefore, conflict mitigation strategies entailing major investments should ideally involve plans to monitor and objectively evaluate the efforts.

4.2 Short-Term Conflict Mitigation Strategies

4.2.1 Physical barriers to prevent elephant ingress to human-use areas

Physical barriers such as elephant-proof walls, discarded rail fences, trenches and psychological barriers like solar fences are being widely used for minimizing elephant ingress into human-use areas. In India, considerable experience and consequent expertise has been gained in use of different



physical barriers. During the period 2016-2017, WII and Uttarakhand Forest Department carried out rigorous statewide assessment of physical barriers (particularly the walls) used for elephants and wild pigs, and important suggestions were provided (Natarajan et al. 2017). That assessment also included survey of about 31.5 km stretch of walls in Rajaji Tiger Reserve. Overall, walls were found to be less effective than intended and the reasons for low efficacy were detailed in the report (Natarajan et al. 2017). While technical specification including the design of the barrier is important to consider, there are other essential considerations to improve the efficacy of the physical barriers.





A stretch of well-built brick wall in Ranipur range, Western Rajaji National Park



Composite barrier comprising of both wall and solar power fence



4.2.1.1 The Landscape Orientation and Placement of Barriers

For most part, the interface between elephant habitat and non-habitat in Rajaji landscape is a hard edge. This is advantageous as decision making on where to build barriers is relatively easy unlike that of landscapes where habitat and non-habitat are highly interspersed and indistinct. Overall, elephant habitat in Rajaji landscape is distributed along the east-west orientation. While considering use of physical barriers in the Rajaji landscape, it would be appropriate to consider different sections of the landscape as detailed in (Table 4.1).

Table 4.1: Different sections and appropriateness for barrier placement in Rajaji landscape

S. No	Section	Remarks
1	Western Rajaji: Southern boundary (Chillwali to Ranipur gate)	In this section, the interface between elephant habitat and non-habitat is a sharp edge with either agriculture or urban built-up. Physical barriers can be built along the entire section. There is no risk of elephant movement getting affected by barriers as the forest patches occurring outside the Rajaji TR in the southern boundary are all small and unviable for elephants. Allowing elephants to use these patches will only perpetuate the conflicts.
2	Western Rajaji: Northern boundary (From Ramgarh to Nepali Farm)	In this section, although the interface between elephant habitat and non-habitat is a hard edge for most part, habitat connectivity, habitat-use in forest patches, and corridor status need to be cumulatively assessed to demarcate locations where barriers can be built. The important Lal Tappar and Teen Pani corridors occur here and also elephant use of Lachiwala-Thano-Barkot-Raipur-Narendranagar need to be considered while selecting areas where physical barriers can be built.
3	Western Rajaji: Nepali Farm till Har-ki-Pauri in Haridwar	This section is highly urbanized and thus, the interface in elephant is a sharp edge. Other than the critical Chilla-Motichur corridor area, barriers can be potentially built along the entire stretch with an aim of containing elephants in the forests.
4	Eastern Rajaji: Kunaon barrage till Chilla	This section does not require any barrier. Elephants should be provided unhindered access to River Ganga and even the existing linear infrastructure needs to be aligned accordingly.



5	Eastern Rajaji: Chilla till Bhimgoda barrage	No barrier is required in this section. Elephants should be provided unhindered access to River Ganga
6	Eastern Rajaji: Bhimgoda to Chandi bridge	No barrier is required in this section. Elephants seldom use this stretch.
7	*Eastern Rajaji: Chandi bridge to Anjani	Physical barrier is required along the entire stretch. The barrier should be placed along the Highway stretch and ideally, elephants should not be allowed to cross the Highway.
8	*Eastern Rajaji: Anjani to Peeli rau	Physical barrier is required along this entire stretch. The barrier can be placed along the Highway stretch and ideally, elephants should not be allowed to cross the Highway.

* The areas opposite or across the road towards Ganges from Chandi bridge to Peeli rau is the main route presently used by elephants to venture into agriculture lands crossing the River Ganga and cause conflict. The barrier suggested is along the already existing electric fence on the edge of the road adjacent to the forest, which is to stop the movement of elephants from crossing the road and raid crops. Moreover, Anjani chaur and the adjoining forest areas between Ganges and the road are the sites, which are used for camping and vehicle parking during Kumbh, and are actively secured during that period. This suggested barrier would drastically reduce the movement of elephant through these areas. All areas beyond south of Peeli rau will be accessible to elephants, including River Ganges.

4.2.1.2 Choice of Physical Barriers

In Rajaji Tiger Reserve, several different barriers have been tried in the past. The following sections provide a brief review and recommendations:

- i. *Rubble walls*: Due to ample availability of boulders, rubble walls have been the barriers of choice in Rajaji landscape. The assessment of barriers carried out by WII during 2016-17 indicated that walls were not wholly effective as barriers particularly in areas where elephants have repeatedly breached them. Even well-built rubble walls did not work as stand-alone physical barriers in restraining elephants. The following may be considered:
 - a. In sections where elephants have repeatedly damaged walls, the walls may have to be reinforced with additional layer of protection with solar fences.
 - b. In sections where the walls offer protection from elephants, continuing maintenance of walls is critical.



- ii. *Solar-Powered Fences:* In sections where the layout, construction and maintenance were optimal, the power fences were found to be very effective in Rajaji. In particular, the tentacle fences (hanging fences) were quite effective. Thus, in areas where elephants have repeatedly damaged walls, the department should consider use of solar-powered fences.
- iii. *Composite Barriers:* In areas where conflict is high and single barrier type did not work, composite barriers may be tried. Similarly, in areas where the existing barriers like rubble walls are only partially effective, in such stretches, additional barriers like solar-powered fences can reinforce the existing barrier.
- iv. *Special Barriers:* Karnataka Forest Department has been using discarded railway lines as barriers to mitigate human–elephant conflict. Although expensive (Rs. 1.3 crores per kilometer), the rail barriers proved to be relatively effective in areas where conflict was high. Similarly, the Tamil Nadu Forest Department has developed ‘Steel-Rope Fence’ and built them in Hosur Forest Division. The steel-rope fence is reportedly very effective and relatively economical than the rail fences. Uttarakhand Forest Department may consider using these high-specification barriers as “special structures” in *raus* (Shivalik streams) where the conventional barriers like rubble walls and trenches that Uttarakhand FD had built would not work.

Box 4a: Securing village enclaves in Rajaji Landscape

Village enclaves are those surrounded by forests on all sides. Securing village enclaves with strong barriers can not only help in HEC, but could reduce threat of encroachment and forest degradation by local people. Considering this, involving local communities, and in a participative manner it would be appropriate to build and maintain physical barriers in the village enclaves of Ganga Bhogpur, Talla and Malla in Rajaji National Park. This will not only secure the villages from crop raiding by elephants, but also enable elephants to access the remnant grasslands in these villages. Similarly, the other large enclaves of Laldhang and Peeli in Haridwar Forest Division can be identified for developing permanent barriers so as to prevent elephant incursion into villages and controlling encroachment and degradation by villagers. In the long run some of these villages, at least in part, can have a comprehensive resettlement plan.



4.2.2 Developing Early-Warning System

The main objective of using early-warning systems is to alert people so that they can subtly modify their activities to minimize surprise encounters with wild elephants. Early-warning systems are developed based on site-specific information about elephant habitat-use and movement patterns, and also human activity patterns. While early-warning approaches are not foolproof, if well implemented with active participation of local communities, they can minimize negative interactions between people and elephants, and also improve the goodwill for the management. There are diverse types of early-warning approaches used for mitigating human–elephant conflict. These include (i) Mobile-phone based early warning system (ii) Visual-based early warning system (iii) vehicle-based broadcast and (iii) Telemetry-based early warning system.

4.2.2.1 Mobile phone-based early warning system

Mobile phones have become indispensable means of communication. Mobile network has reached even the remote villages. Thus, mobile network can be used as an effective means of disseminating information on elephant occurrence in a locality. States like Odisha and Chhattisgarh have developed mobile-phone based early warning. While the staff members in a circle remained core members, there were beat-level sub-groups wherein; the messages of elephant locations were percolated to the villagers. Considering the utility of early-warning systems, Uttarakhand Forest Department can institutionalize mobile-based early warning system in areas where mobile network is good. In high conflict areas, improving mobile network connectivity would be crucial.

4.2.2.2 Visual-based early warning system

Early-warning system involving display boards, flashlights etc. illuminated in critical locations like bus stops, ration shops etc. Visual-based early warning system has been very effectively used in Valparai region of Anamalai Tiger Reserve in Tamil Nadu by the combined team of Nature Conservation Foundation (NCF), Tamil Nadu Forest Department and local tea plantations to minimize human–elephant interactions.

4.2.2.4 Telemetry-based early-warning system

Telemetry-based early warning system includes broadcasting telemetry location fixes of the collared elephants (radio or satellite collars) through sms, whatsapp messages etc. to the respective beats/villages to alert people of



elephant presence. It is also possible to create “virtual fences” wherein conflict locations can be mapped in GIS and when satellite collared elephants use such areas, automatic alert messages can pop-up.

4.2.3 Rapid Response Teams

Uttarakhand Forest Department has developed good rapid response units comprising of both permanent frontline staff and temporary watchers recruited from local communities. In Haridwar Forest Division, some of the temporary watchers have become exceedingly well trained in tracking and following elephants. The rapid response teams working with Forest Department act as a bridge between Forest Department and local communities. The role of RRT is crucial in human–elephant conflict mitigation. Additionally, in select conflict hotspot villages, interested youths as need to be trained as elephant deterring watchers, who will be also helping these patrolling Forest Department staff to drive away elephants from entering villages.

To further the efficacy of RRTs, Forest Department can consider institutionalizing RRT units with better budgetary support, well defined work schedule that enables engagement throughout the year, capacity building and improvement in human resource management.

4.2.4 Alternative Livelihood and Other Measures to Minimize Pressure on Forests

Following resettlement of Van Gujjars in Rajaji Landscape, there has been a remarkable recovery of wildlife, particularly the prey species and tigers in the Rajaji Landscape (Harihar et al., 2009). However, it is critical to assess if pressure from resettled Van Gujjars continue to be a concern in the landscape. As mentioned by Johnsingh & Joshua (1994), resettlement of Gujjars is one step forward, but the ultimate objective would be to minimize their dependence on forest habitats. Along the fringes of Rajaji Tiger Reserve, Gujjars continue to exert pressure on the elephant habitat. Thus, as a sequel of voluntary Gujjar relocation, continuously engaging with them to minimize the pressure on wildlife habitat through alternative livelihood programs, value addition of their produce and other mainstreaming initiatives probably in collaboration with the district administration. The following may be considered:

- i. Alternative livelihoods through ecotourism in the lines of the eco-development model that was successfully demonstrated in Periyar Tiger Reserve, Kerala. Periyar EDC (eco-development committee) is



considered a very successful initiative in generating huge revenue from tourism sector that directly benefited local communities. In Rajaji Tiger Reserve, there is a potential to regularize tourism and engage Van Gujjars actively so that income generated through tourism can help in minimizing resource related pressure on wildlife habitats.

- ii. The concept of ecosystem service trade-off and carbon credits that can be linked with payment for ecosystem services (PES) model at state and national level can be integrated with management. Payment for Ecosystem Services can be in the form of carbon credit, supply of purified air, density of pollinators, raptors and seed dispersers.
- iii. Integrated farming aimed at developing fuelwood and fodder plots (Silvipastoral System can be followed) for sustenance and self-use with incentives can be promoted in areas where firewood and fodder related pressures exerted by villagers are high.
- iv. The villages presently involved in resource extraction should be given the responsibility of helping the Uttarakhand Forest Department in protecting and managing the adjacent patch of forest. For this the Ecodevelopment Committee (EDC) if already exists or new EDCs or Village Forest Protection and Management Committee (VFCMC) made in charge and given full responsibility for the protection and management, including implementation of plans in that patch along with the Forest Department. Then a separate assessment committee set up by the state forest department that would include managers and wildlife ecologists should evaluate the status of the patch for different ecosystem services like carbon credits and other ecosystem service provisioned from the forest patch protected by them.
- v. Fostering support through corporate social responsibility. The funding support for ecosystem services can be augmented from Bharat Heavy Electricals Limited (BHEL) and other industries located in the Rajaji Landscape, and including the electricity department, Northern Railways, road department and temple authorities, that depend on / use Rajaji Landscape. These industries can adopt villages around the elephant corridors and those that are adjacent to forests, which are degraded and fragmented and help in minimizing resource extraction pressures from those villages. The Uttarakhand Govt. can include this model in their system and thus support in mitigating HEC. The above model should



also include that initially, these industries provide funds for restoration of these degraded and fragmented forests with the help of the adopted villages in collaboration, guidance and supervision of the State Forest Department. Then once all this is done six months or yearly once quantify the benefits provided/got in the form of different services, amount of carbon credited, the companies can pay incentives to the village committee, which can be used for village development. The industries can also provide funds for constructing appropriate barriers around the respective agriculture fields to keep out the conflict from elephant and other wildlife. Along with this the EDC/VFPMC members and other interested villagers need to be trained in Rapid Response and also managing the crisis situation, in addition to involving in deterring the elephant/other wildlife. The EDC/VFCMC should also be in charge of regular monitoring and maintenance of the barriers and its weaker sections.

4.2.4.1 "One Health" in Mitigating HEC

Wider public acceptance and active participation are key for elephant conservation and conflict mitigation. Local support for elephant conservation can be achieved by integrating and providing equal recognition of social, psychological and health related aspects of humans along with ecological and environmental health of habitats, under "One Health" program. "One Health" is a multi-disciplinary approach, that takes into consideration all visible and hidden dimensions of health of elephant and other animals, ecological and environment of habitat for both humans and animals, and equally important human health. Regular, routine and systemic check-ups by medical, veterinary and habitat ecological experts needs to be done in a coordinated manner with healthy cooperation, highly important for a better and positive support for conservation, very crucial for mitigating HEC more efficiently. Therefore, as a conflict mitigation strategy in the Rajaji Landscape, so as to gain wider support of local people and to minimize undue burden on marginalized people, specifically living along the fringes of the forest and elephant habitats in the co-existence zones, implementing One-Health programs may be considered.

4.2.5 Streamlining Ex-Gratia Payment

States such as Odisha and Karnataka have developed user-friendly mobile-based apps to record crop losses and provide compensation. The app developed by Karnataka Forest Department called the *e-parihara* had



improved the response time in providing ex gratia significantly. While it used to take 60 – 90 days to process claims and pay ex gratia to affected farmers in divisions where e-parihara portal is active, the response time has come down to 30 days. Furthermore, highly reliable database on conflict is parallely being obtained through e-parihara portal that enables stratification of conflict areas based on actual intensity of conflict. Uttarakhand FD may consider creating a similar app/e-portal to reduce the response time to ex gratia payment.



Involving Gujjar communities and advancing alternative livelihood strategies aimed at reducing their dependence on forests is a crucial conflict mitigation strategy

4.2.6 Translocation of Elephants

Escalated conflict situations sometimes necessitate capture and removal of individual elephants and even groups from the site. From conservation standpoint and economic and logistic considerations, bringing large number of elephants into captivity is neither practical nor desirable. Therefore, experimenting well-planned elephant translocation with telemetry would be important. Identifying potential habitats to translocate elephants beforehand and having a prior plan in this regard is crucial. The potential elephant release sites should be reasonably far from human habitations, well-protected and have good barriers that elephants cannot easily breach. It is also important to identify transportation routes that would be used to transport elephants so that the hurdles enroute such as low-hanging transmission wires and others can be rectified beforehand. Furthermore, it would be desirable to keep a few radio-



collars ready for contingencies and train teams at the earnest before any emergency situations arise. The translocation can be executed as per the SOP (Nigam et al, 2021) prepared under WII-UKFD collaborative project to maximize the chances of translocated elephants settling down in good habitats.

Crop raiding and notorious bulls and elephants, if not possible to translocate, need to be captured and domesticated and used in regulated and ethical tourism, patrolling and monitoring of movements of elephants and guarding some sensitive sites, to keep out elephants.

4.2.7 Awareness and Education

Awareness among frontline staff about elephant ecology, behaviour, and conflict management, to improve preparedness in tackling difficult conflict situations, especially during challenging time such as Maha Kumbh.

Awareness and Basic precautions: Local Communities in the Human Elephant Co-existence Zone (HECeZ)

Awareness and Basic precautions: Local communities along the fringes of the forest on preparedness, and significance of protecting and conserving the forest

Awareness and Basic precautions: Local communities around the high conflict zones and beyond, which are probably future areas of sensitivity

Awareness and Basic precautions: Authorities and pilgrims of religious place in and around the forests in the RTR landscape.

4.2.8 Research and Monitoring

- Considering the life span of elephants of 50 – 60 years in the wild, it is important to assess patterns of conflict for longer durations covering different seasons of the year across several years to make and also check whether there is inter-season and inter-annual variations in human–elephant conflict. To objectively record human–elephant conflict it is important to develop user-friendly formats that field staff can easily use and office staff can easily feed data into system. Data on human–elephant conflict would include recording details of elephant-related crop losses (Annexure II), loss of human lives (Annexure III), loss of elephants due to conflict incidences and efficacy of barriers. Additionally, qualitative notes on interventions like elephant drives and their outcomes can be recorded. The research carried out in RTR



landscape on elephants and other ecological aspects of the species are provided in Annexure VIII.

- Understanding how elephants use corridors would be crucial to monitor. Therefore, in all the identified corridors (three corridors in case of Rajaji Landscape), it would be important to place permanent camera traps to monitor elephant movement. Any bottleneck for elephant movement needs to be identified early and resolved so that elephants do not breach out of designated corridors into human-use areas.
- WII and UKFD collectively evaluated the efficacy of wall barriers for elephants across entire Uttarakhand during the year 2016-2017 (WII, 2017). Similarly, it would be crucial to objectively evaluate conflict mitigation strategies so that there is continuous learning and course correction, as applicable.
- Monitoring with the help of GPS tracking and high-resolution satellite imageries can provide empirically sound information on how elephants are navigating in human-dominated landscapes and effectiveness of potential mitigation methods for HEC.
- Monitoring habitat quality would be critical to develop/maintain habitats in optimal condition. Monitoring vegetation indices such as plant phenology, spread of invasive plants, density of critical food plants etc. can be useful to correlate habitat quality and human–elephant conflict.

In general, it is recommended that Uttarakhand Forest Department be forthcoming in inviting research institutions and individuals to embark on site-specific research in Rajaji Landscape on range of topics focusing on elephant ecology, conflict, vegetation etc. so that long-term database is generated for enabling informed decision making.

4.3 Long-term Conflict Mitigation Strategies

4.3.1 Habitat Restoration

Habitat restoration plans entail an attempt to restore the habitat/land use or forest landscape similar to what it was earlier besides ensuring habitat connectivity, and adequate protection from sources of habitat degradation. It is a well-established that habitat destruction affects animal abundance and distribution in the habitat. Therefore, restoration of habitats added to the



existing habitats in the landscape making them larger and resilient with enhanced carrying capacity. Habitat restoration should ideally follow the prescriptions emerging from the science of restoration ecology. It is imperative to plan systematically towards ecologically viable and practical restoration strategies so as to bring back the patches to its near original condition that is readily usable for elephants and other wildlife.

A precursor for habitat restoration is a proper assessment of site/habitat/ecosystem/landscape along with a clearly spelt-out objective behind restoration. Before attempting habitat restoration, it would be important to list down the present state of the area, prevailing threats and reasons for the degradation in the first place. This will help to plan various ecological amendments needed as part of restoration. Then, proper and appropriate site-specific plans need to be developed and implemented. It is also important to consider and take care, while restoring, that none of the negative factors that were causes for the degradation of the specific habitat/landscape reoccur. This will aid in planning the protection measures that will secure the site from all those negative factors, and ensure a successful restoration.

4.3.1.1 Restoration – Habitat, Food and Shelter

- The restoration plan should also into consideration, land amendments, where necessary, like addressing highly eroded sites, strengthening the embankment of the *raus* (gabion structures, retention walls in unstable areas, growing short, medium to tall grass along with shrub and tree cover), where top soil is loose and exposed (over grazed and sites that had frequent livestock and people movement) improve ground cover, removal and eradication of exotic, invasive and weed species, restore vegetation that includes minimum of at least three levels/strata, ground (short, medium and tall grass and herbs – both annuals and perennials, mix of palatable and non-palatable, for improving the soil fertility and secure top soil in addition to providing food for elephant and other wildlife), shrub layers to improve vegetative cover and enhance the cover and fodder availability for animals) and tree layer, which can be small, medium and large sized tree species that would provide food and shelter).
- The plant species to be used in restoration should include as mentioned above, short, medium, tall grass species that is palatable and non-



palatable, annual and perennial, shrubs, climbers and trees (small, medium and large), both fast and slow growing, species, with priority given to species that have very poor or no natural regeneration and recruitment and elephant food plants.

- Presently, along the banks of the *raus* and *nadi*, where short grass (*Cynodon dactylon*) was predominant, *Jatropha curcas* (plant used as bio-diesel) has been introduced at many locations. While the fruits of *Jatropha* are not collected for the purpose it was planted, *Jatropha* plants have degraded the habitat and led to non-availability of the short grass that elephants prefer to feed during the summer. Hence, as part of restoration, when removing and eradicating the exotics, invasives and weeds, it is suggested to remove all the *J. curcas* to provide the presently lost important food for elephant and other wild grazers.
- The banks of *raus*, *nadi* and *sots*, had patches of small grasslands that have been lost over time. Thus, it is timely to restore river banks with grass (short, medium and tall) species. The grass species chosen should comprise of both palatable and non-palatable native species as the latter would be crucial to consolidate the bunds and minimize erosion.
- The removal of the exotic, invasive and weeds needs to be done every year immediately after first rains after these species start geminating, until they disappear or completely removed. Monitoring of these restored areas for positive impacts, establishment of vegetation, stability of the sites with soil erosion, sustenance of watering points, animals use. Equal importance needs to be given to monitor the negative aspects like spread of exotic, invasive and weeds, reoccurrence of the threats which were reasons for the degradation and to identify areas with problems for recovery. Some of the important elephant food plant species, that are food for also other wildlife, that can be used for restoration are listed in the Table-4.1.

Table-4.2: Plants Species suggested for Restoration

S. N	Species	Life Form	Parts Eaten
A	Elephant & Other Wildlife Food Plants		
1	<i>Dendrocalamus strictus</i>	B	L, S
2	<i>Flemingia procumbens</i>	C	F
3	<i>Ichnocarpus frutescens</i>	C	F
4	<i>Chloris dolichostachya</i>	G	F



S. N	Species	Life Form	Parts Eaten
5	<i>Eulaliopsis binnata</i>	G	L
6	<i>Desmostachya bipinnata</i>	G	F
7	<i>Imperata cylindrica</i>	G	BP
8	<i>Cynodon dactylon</i>	G	F
9	<i>Neyraudia arundinacea</i>	G	L
10	<i>Chrysopogon fulvus</i>	G	L
11	<i>Bauhinia vahlii</i>	L	L, B
12	<i>Pueraria tuberosa</i>	C	B
13	<i>Helicteres isora</i>	S	B
14	<i>Mallotus philippensis</i>	ST	T, B, R
15	<i>Ehretia laevis</i>	ST	T, B
16	<i>Acacia catechu</i>	ST	L, T, B
17	<i>Zizyphus xylopyra</i>	ST	B
18	<i>Grewia elastica</i>	ST	L, B
19	<i>Bauhinia variegata</i>	ST	L, T
20	<i>Kydia calycina</i>	MT	B
21	<i>Garuga pinnata</i>	MT	B, L, T
22	<i>Bridelia retusa</i>	MT	B
23	<i>Lanea coromandelica</i>	MT	B
24	<i>Dalbergia sissoo</i>	T	T, B
25	<i>Ougeinia oojeinensis</i>	T	L
26	<i>Shorea robusta</i>	T	B
27	<i>Ficus benghalensis</i>	T	B
28	<i>Albizia odoratissima</i>	T	L, T
29	<i>Bombax ceiba</i>	T	B
30	<i>Casearia tomentosa</i>	T	L
31	<i>Cordia myxa</i>	T	F
32	<i>Terminalia tomentosa</i>	T	L
33	<i>Gaurga Pinnata</i>	T	
34	<i>Mitragyna Parviflora</i>	T	L
35	<i>Flacourtia indica</i>	T	L,F
36	<i>Buchanania lanzan</i>	T	F
37	<i>Anogeissus latifolia</i>	T	L
38	<i>Syzygium cumini</i>	T	F
39	<i>Aegle marmelos</i>	T	F
40	<i>Holarrhena antidysenterica</i>	T	



4.3.1.2 Conversion of monoculture plantations into with mixed forest/woodland:

This should be planned and executed in a systematic and phased manner, so that these habitats or patches that are less/not used presently, except for passing through from one patch to another, will also add to the potential habitats that the elephants and other wildlife can use as part of their regular and seasonal ranges for food and shelter.

4.3.1.3 Restoration of Raus and Nadis (Streams)

Towards the end of summer and advent of monsoon, elephants and other grazing herbivores increasingly use the *rau* banks and beds to feed on tall, medium and short grass. In the *raus* and streams located close to human habitations, such grassy banks were lost/degraded. Thus, restoration of the *raus* and *nadi* need to include growing tall to short grass species. These grasses would not only improve the food availability but also sever in stabilization of the banks.



Degraded banks of Rawasan river in Haridwar forest division

Further, along these drainages, plans to stabilize and restore the banks and embankments should also be part of the restoration. Wherever necessary gabion structures or retention walls need to be constructed along with developing three layered (ground, shrub and tree layers) forest habitat, that

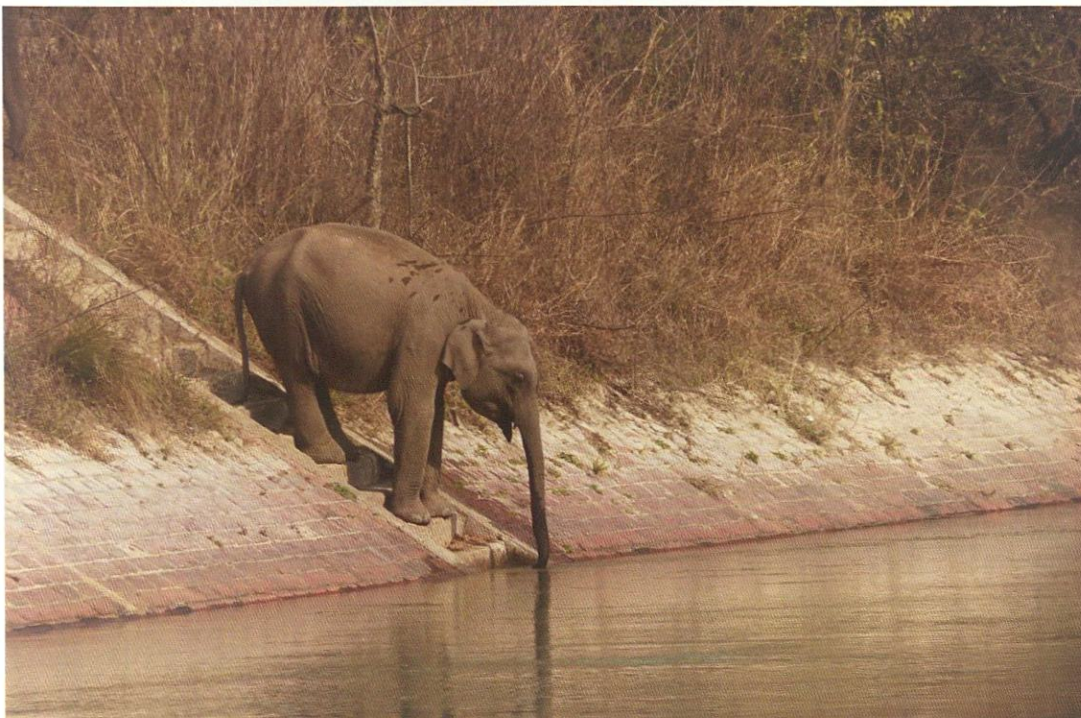


includes mix species of palatable plant of elephants and other wildlife and non-palatable species, so that over use of vegetation does not happen.

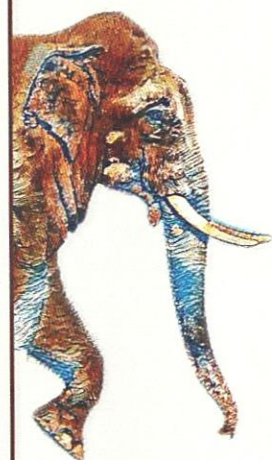
Presently, the invasives, exotics and weeds have been eradicated and there are these spaces freed from the unusable plants, where vegetation (three layered) can be restored, so that the potential and quality of the habitat improves. The list of plants that can be used for restoration are given in Table 4.2.

4.3.1.4 Release of Water in Canal

It would be critical for Uttarakhand Forest Department to initiate a dialogue with irrigation department to ensure flowing water in the east-bank Ganga canal flowing through Haridwar Forest Division along the Nazibabad Highway during mid-winter (January) till beginning of monsoon (mid-June). There, are at least four to five places where the embankment of the canal had been damaged, which are being used by elephants to go down for water. It is critical to ensure that elephants and other wildlife are provided safe ramps and natural entry points into canal for accessing water not only for drinking, but also for bathing, wallowing and swimming.

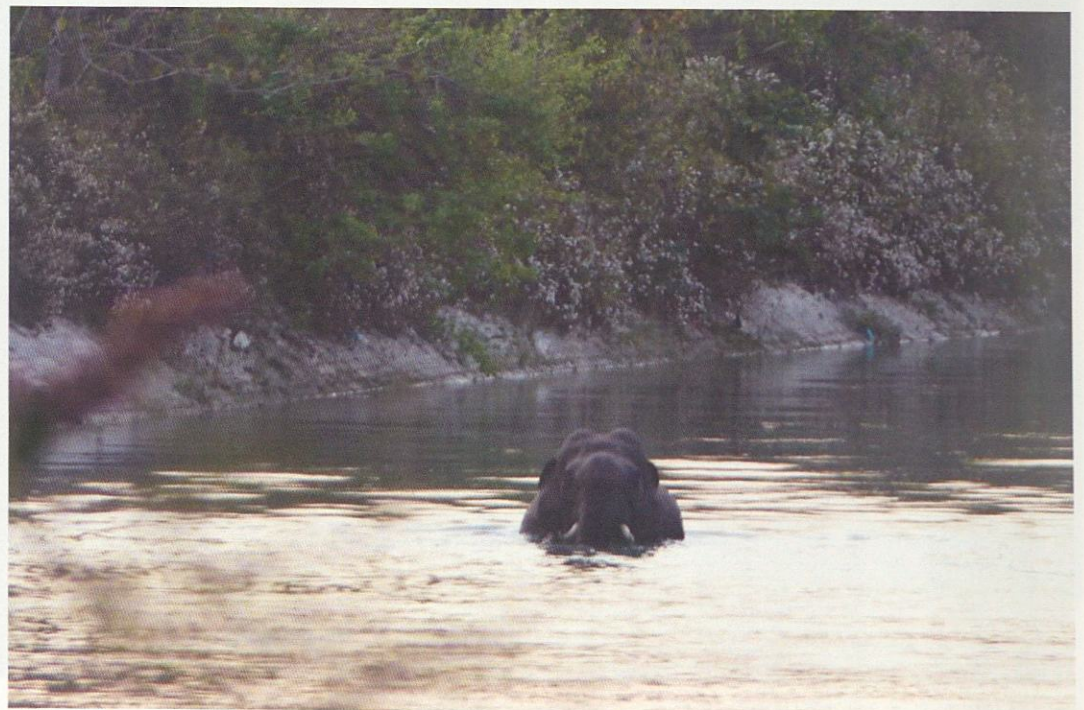


*Providing access to elephants and other wildlife is critical.
The canal structure is not wildlife friendly at present and therefore required wildlife friendly re-engineering*





Elephants and other wildlife are using breach locations to access water from the canal. While repairing the breaches care should be taken to provide safe access to wild animals.



Release of water in canal should be coordinated with forest department to ensure water availability and also to prevent untoward incidences that may arise due to sudden release of water



4.3.1.5 Desilting Water Holes and Improving Other Micro Habitats

Improving the water availability and moisture in the area should involve, plans to restore all the existing watering point that are highly polluted and degraded, which will also be another important step towards restoration. The water holes need to be desilted and deepened for better water holding capacity and improved quality. As water need to be made available for longer period, efforts need to be made similar to what has been done in Rajaji part of the RTR, where the forest department has used the natural gradient and gravitational flow for continuous supply of water to waterhole. Create waterhole at strategic locations without water for animals. Create more mud/slush ponds that can be used by elephants and other wildlife, to keep off the insects and other parasites. All-natural springs in the area needs to be revegetated to provide proper shelter and canopy cover, for better and continuous availability of water in the springs. Similarly, the surrounding of the waterholes and slush ponds needs to be restored with good vegetation cover with dense canopy that will help in minimizing the evapotranspiration of water and increase the availability of these important resources.

All the above has taken into consideration of the concept that restoring the habitat to satisfy the primary needs of the elephant, as well as other wildlife would require total protection and habitat improvement through weed eradication and promoting the regeneration of palatable species (Johnsingh & Joshua, 1994) of degraded and relocated areas.

4.3.1.6 Restoration of Shyampur Range of Haridwar FD

Shyampur range located just bordering the south-eastern boundary of the Rajaji National Park, encompasses an area of about 134-km². Of this presently, about 76-km² is managed under Rajaji Tiger Reserve. The remaining area of about 31 km² excluding Peeli village and part of Rasoolpur, Mitiberi village is administered under Shyampur Range of Haridwar Forest Division. There are four villages and the human settlements in the islets of river Ganga falling within the boundary of Shyampur range (Table 4.3). Presently 945 Gujjar families are residing within Shyampur range. Till the year 2006, there were very few Gujjar families, which increased when Rajaji National Park was declared, and subsequently, further increased after Rajaji Tiger Reserve was notified during the year 2016. These Gujjar settled in this range, during the time when many families were resettled at Pathiri block (Gujjar resettlement 2006) and at Chidiyapur (Gujjar Resettlement 2016).



Table 4.3: Extent of Area under different Categories within Shyampur Range

S.No	Division	Range	Category	Size in Km ²
1	Rajai Tiger Reserve	Shyampur	Only Rajaji Tiger Reserve	75.8
2	Haridwar Forest Division	Shyampur	Above Road excluding RTR & Villages	31.1
3	Haridwar Forest Division	Shyampur	Below road with Anjani Chaur	8.3
4	Haridwar Forest Division	Shyampur	Peeli Padav, Rasoolpur Mithiberi, Shymapur, Kangri & human area on islet	18.7
5	Haridwar Forest Division	Shyampur	Whole range	133.9

Before the year 2000, forests in Shyampur and Chidiyapur ranges were highly used by elephants during monsoon months. The area was rich in forage for elephants including rank growth of bamboo (*Dendrocalamus strictus*) and highly nutritive *Neyraudia arundinaceae* grasses favored by elephants. The study on movement and habitat utilization of elephant in Chilla, part of Rajaji NP, between 1989 to 1993 carried out by WII (Justus Joshua Unpublished data) reported the presence of 18 female groups in the areas that Gujjars have been settled during 2006 and 2016. This clearly indicates how elephants lost an important foraging ground owing to Gujjar settlement in the area. Presently, the use of area by elephant herds had reduced considerably although bulls continue to use (Pers. Comm. WII Field Assistants & Local Community). This was expected as female herds are sensitive to habitat degradation and human disturbance and may abandon such areas. Williams et al (2005) using telemetry data surmised that elephant herds in the Rajaji Landscape preferred areas free from human disturbance. The above suggestions corroborate with observations that female herds avoided areas close to Gujjar settlements, while males did not show such patterns (Justus Joshua, unpublished data, WII).

Clearly, the settling of Gujjar (about 945 families) in the Shyampur range has degraded one of the most optimal elephant habitats within Rajaji Landscape with possible repercussions on human–elephant conflict. Johnsingh & Joshua (1994) suggested that the life-styles of increasing Gujjar population would not be not ecologically sustainable in the long-run. Sustained pressure on vegetation in the form of lopping, cutting and cattle grazing had affected regeneration and natural recruitment of preferred food plants of elephants (Williams et al., 2005). In addition to impact on vegetation, the watering points



and water holes being occupied and polluted by the buffaloes, adds to the degradation and non-availability of water. Competition for spring water between Gujjars and elephants occur every summer throughout the elephant range except in Corbett National Park (Johnsingh and Joshua 1994). Thus, there is a reason to believe that loss of critical habitat in Rajaji Landscape had possibly triggered localized conflict across the landscape.

Recommendations

Since loss and degradation being one of the prime causes for human–elephant conflict, considering the aforementioned factors, it is suggested to resettle the 945 Gujjar families, including the Shri Siddh Maharaj Kuti Ashram, located in Siddh Sot, in Shyampur range to the forest patches extending to about 3500 ha, adjacent to Pathri block, between Chiriyapur Gujjar resettlement and Pathri resettlement. The informal discussion with few Gujjars revealed the readiness and willingness to leave this area and get resettled if Govt. provide resettlement site. They also shared their willingness for same resettlement package as the Chiriyapur Gujjar Resettlement model, where each family was given just 10-12 begha /c.3ha of land for sustenance. Once the Gujjar are moved out of Shyampur, total of 10695.14 ha area (areas more than three times the area to be given during resettlement) would be freed from human interference and fully available for elephants.

Once the Gujjars are relocated, entire Shyampur range, especially the areas intensively used by Gujjars and heavily degraded, needs to be restored through a systematic habitat restoration program. This would include:

- i. Removal of man-made structures and deposit in the areas where the rubbles generated, as part of the highway widening is dumped, and remove/eradicate all exotics, invasive and weed plant species.
- ii. Reclaim sites that are eroded and then develop (plant) three layered vegetated habitats with mixed species that include more elephant and other wildlife food plant species and in areas with frequent erosion, in order to establish and stabilize the site from further erosion plant non plateable species that improves the ground cover, shrub layer followed by small to big tree.
- iii. Clean up water holes by desilting, and deepening, so these are reclaimed and become usable to the elephants and other wildlife. Increase and improve the availability of water and slush ponds for frequent mud bath



Additionally, the *raus* and streams within Shyampur range after relocating the Gujjars, need to be restored. Along the *raus* and streams, wherever the embankments are eroded and weak, it needs to be stabilized, through gabion structures and growing tall to short grass along the inner sides of the *rau* and planting grass, shrub and trees on the embankment. Wherever invasives, exotics and weeds are proliferated, including the plantation of *Jatropha curcas* in the short grass areas of the banks of the *raus*. While all areas need to be planted with three layered vegetation cover, the short grass areas should be left open as this grass, *Cynodon dactylon* is favoured by elephants and other wild grazers and feed on them, when they come for water. Details on species and other processes involve in restoration are given in the section on Restoration (refer section 4.3.1).

4.3.2 Voluntary Relocation of Villages

4.3.2.1 Resettling of Van Gujjars and Restoration of Kunaon and Chilla Chours (Grasslands)

The Van Gujjars settled in Kunaon and Chilla *chaur* grasslands need to be resettled in the area close to Pathri Gujjar resettlement and the Chiriyapur Gujjar resettlement following the later model. Basically, providing space (10 - 12 bigha/c.3 ha) for cultivating food crops and growing grass and browse fodder for their livestock, and all aspects that was taken care of, for the Gujjars settled in the Chidiyapur resettlement area.

Similarly, the Ganga Bhogpur Talla village, which is in the Kunaon and Chilla Chours, and Ganga Bhogpur Malla should also be resettled outside the fringes in a separate area in the Pathri block. Once these areas are freed, the existing structure need to be dismantled leaving few good buildings along the edge of these grasslands and can be used as antipoaching camps. After the land is reclaimed including removal of rubbles, removal and eradication of invasives, exotics and weeds, it should be restored with grass species preferred by the elephants and other wildlife and all grass species what were present, when this was a natural grassland/ that is in a natural grassland in the landscape. The grasses along the *rau* or river system that are presently available and are frequently used by elephants towards end of summer and entire monsoon, can also be included as species for restoring the grasslands.

This way the 15 km² grasslands that are degraded and lost to development can be made available for the elephants and other wildlife for regular use.



4.3.2.2 Relocation of Kunaon Goth Village

Relocation of Kunaon Goth for providing better habitat and facilitating free movement of elephants along the CMC, is another important aspect of mitigation, as it is not only for the movement of elephants, but would also stop elephants moving into the villages around the corridor due to narrowness and hurdles caused for their movement. All processes and means, and possible locations for relocations, provided in the Rajaji Tiger Reserve – Tiger Conservation Plan, with slight modifications where needed, are given in the Box 4b.

Box 4b: Plans for Relocation of Kunaon Goth Village

1. Kunaon Goth's village with lease holder of 236 families prior to notification of Rajaji National Park, spreads over 7.383 ha in Gohri range. Though the leases were cancelled after settlement proceedings by awarding compensation, the villagers did not accept the settlement and hence their presence continues as encroachers and hence needs to be addressed immediately.
2. Relocation of Chaks.
3. The isolated and fragmented forest areas, outside and along the fringes of the elephant habitat, that are prone to encroachment like areas of Rishikesh and Barkot range in Dehra Dun Forest division, Khanpur and Sikroda area of Haridwar forest Division are probable ideal sites for relocation.

Managerial intervention prescribed under Zone Plan

1. Relocation Process of all human settlements located within the core zone of RTR should be done following NTCA guidelines with ensured financial support from centre and state. As a continued process to foster full-fledged rehabilitation integration of various sectors of state government for holistic development of the site is essential.
2. Rehabilitation of relocated Sites includes
 1. Levelling of the man-made structures/constructions.
 2. Government or other smaller buildings to be retained and used as Patrolling camps
 3. Construction of Parapet walls around existing open wells
 4. Native grasses to be sown to develop grasslands after levelling and ploughing the agriculture fields. This would also avoid spreading of weeds and exotics.
 5. Retain existing native fodder and fruit tree and based on need plant some fruit and fodder species.
 6. Avoid infestation and spread of weeds and woody vegetation in the grasslands
 7. Systematic and continuous monitoring for changes in floral composition and use of elephants and other animals.

Source and modified from: Rasaily 2022 (TCP awaited finalization from UKFD)

4.3.3 Conservation and Management of Corridors

It is important to resolve each and every issue threatening the corridors according to its magnitude of impacts and secure them first. Then followed by



specific strategies and projects for improving quality of livelihood of the local people, one of most important strategies, that need to be addressed in a wholistic manner, to minimize their dependency of forests along the corridor.

All the corridors are highly degraded due to anthropogenic use that has led to proliferation of exotics, invasive and weed species, all these needs to be eradicated in a systematic and phased manner. This should be immediately followed by restoring these patches with native grasses, herbs, shrubs, small and large tree species, which should be mix of more number of palatable species used by elephants and other wildlife and less non palatable. Added in the other degraded patches plantation following gap plantation system should be followed to restore those patches along the corridors.

Mitigating all hurdles along the corridor for safe and free movement and passage of the elephants, without deviating into the human landscapes, is of prime need. To this end it is imperative to secure both sides of the corridors with barriers, Railway Line Fence (RLF) and at weaker portions double barriers, add Solar Electric Fence (SEF) single line/double line/tentacle fence This can serve as barriers to elephant from going into the village and their crop fields while using the corridor, and also act as barrier for minimizing the use of corridor by the villagers and their livestock. This will help in guiding the elephants and other wildlife through specific path inside the corridor.

There is a need to secure degraded habitats from biotic pressures of fringe and other villages. Further, a communication system is to be developed to inform the movement and presence of elephant(s), in and near the corridor is very crucial. It is very important to involve and integrate local villagers along the corridor in its protection and security. Hence, forming an Eco Development Committee (EDC) or Village Corridor Protection and Management Committee (VCPMC), and educating and training along the lines of what is detailed under "Minimizing Pressure along Fringes of Elephant Habitat", along with concept of payment for ecosystem service is recommended

It is equally important to encourage local community living on agriculture, to cultivate crops that are not eaten by the elephants and completely avoid sugarcane, wheat, paddy, and other crops favoured by elephants in close vicinity of the corridors (at least 1 -1.5 km on either side of the corridors. This will ensure safe and quick movement of elephant through the corridor and reduce the present level of conflicts to bare minimum.



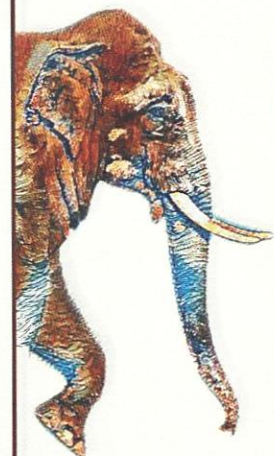
Fly over though constructed, all remaining small scraps of debris under and around the underpass (flyovers) need to be cleaned up immediately and restored by spreading with good soil and plant native grass species, both palatable and unpalatable, tall and short grass species (*Saccharum munja*, *Neyraudia arundinacea*, *Desmostachya bipinnata*, *Chloris dolichostachya*, *Imperata cylindrica* *Cynodon dactylon*), local shrubs (*Helicteres isora* under the flyover and plant *Ehretia laevis*, *Dendrocalamus strictus*, *Mallotus philippinensis*, *Dalbergia sissoo* and other native trees and shrubs on either side leading into both sides of the corridor.

However, the above-mentioned measures and strategies are important for preserving and maintaining the habitat continuity of all the seven corridors at various locations within RTR landscape, the most crucial is the Chilla-Motichur corridor as it is the only linkage that maintains and ensures continued genetic exchange between the Rajaji (western) and Chilla (eastern) parts of the Rajaji National Park area of the Rajaji landscape. Johnsingh and Joshua (1994), mentioned this corridor to be the most threatened because of its accessible terrain and needs immediate attention.

4.3.3.1 Chilla-Motichur Corridor

Due to disturbances in the form of degradation, fragmentation, development and establishment of Raiwala Army Camp and Ammunition dump, encroachment for urban expansion, and location of Khandgaon settlement I and II, inside the corridor, no such elephant congregations that used to be there before early 70s has been seen. Additionally, elephants in the western part of Rajaji TR stopped crossing the Ganges due to the construction of the 14 km long power channel on the eastern bank (Singh 1974) and construction, widening of the roads and broad-gauge railway lines with increasing train frequency. All the above prevented female elephant movement across the river Ganges (Williams et al. 2005).

However, since 1996 the genetic continuity between subpopulations, on either side of Ganges, the west and east, was maintained by three or four bulls crossing through the narrow corridor area. Two bulls that were collared in 1995-96 moved through the Chilla-Motichur corridor and went into Chilla crossing the Ganges and the power channel through the existing narrow bridge and roamed around till Khara beat during musth and came back to Rajai and Motichur part of (RNP) present RTR (A. Christy Williams pers. com.). Presently six to seven bulls are using the Chilla- Motichur corridor, to move from



Motichur, cross Ganges, through the islands/islets, enter the Chilla range following same route as the bulls in 1996. It is also established that two female groups, one with three individuals and another with eight individuals (composition of the groups were not known) from Motichur had crossed one branch of Ganges (with less flow) and reached an island/islet in Ganges, from where they through same route has come to the villages on the Haridwar and Raiwala sides that were adjoining Motichur rau and raid crops mainly wheat, and return to the same island for day resting. This was between November to January, after which they had apparently returned back to Motichur. The female groups, however were not seen to cross and go into Chilla side (Ramsharan Chauhan Field Assistant WII and Forest Guard Suni sot block, Chilla range pers. com) (Map 2.2).

Another evidence that bull use the corridor and the route taken to move between Chilla and Motichur was based on the capture of a bull elephant involved in intense conflict, was captured, radio collared and translocated to Chilla part of RTR. The radio collar was provided and monitored by WWF India, Dehara Dun office. This bull, came back to Motichur overnight, using the Suni sot narrow bridge over the power channel, crossing Ganges and the islets, through the present under pass back to where it was ranging (Ramsharan Chauhan Field Assistant WII Pers. Com). Thus, showing that this bull also must be using this route to move between west and east in some part of the year. Apparently, this bull was captured and domesticated, presently in Chilla, as it was continuously involved in HEC. This clearly show that bulls are moving between western part of RTR to the eastern part, thus maintaining the genetic continuity.

This corridor is also highly important for movement of tigers between east and west. Considering the strategic location and significance of the corridor, it is very important to restore, revive and secure it with the following mitigation plans, so that the female groups that are presently using half of the corridor, would start crossing the Ganges and move into Chilla.

Johnsingh et al., (1990) made four recommendations for conserving this corridor: (1) acquisition of land for the corridor; (2) banning cattle grazing and other human activities from the islands on the Ganges; (3) relocating Gangabhagpur (Talla & Malla) village, which is between the Ganges and the channel on the east bank, instead of broadening the existing bridges and building new ones; and (4) enforcing protection of the corridor to allow vegetation to recover and facilitate large wild mammal use of the area.



The expansion of Motichur and other villages along the banks of Motichur need to be stopped from encroaching further and using the corridor. Elephants, mainly two tuskers and a makhana stray/move downstream through Motichur rau, below the road and get into the Haripurkalan settlements on south bank of the rau, occasionally and break single brick walls, walk through the small patches of cultivation in between the houses and reach the patch of forest upstream, on the southern side of Motichur rau, crossing the underpass. The movement of elephants is probably restricted/blocked due to some barriers, along the northern and southern bank of Motichur rau, upstream of the railway bridge, or these bulls are still trying to use the traditional routes to reach the forests in the southern bank of the rau. So, it is very crucial to identify these barriers and site-specific mitigation needs to be addressed on priority, which would ensure these bulls restraining from entering into conflict with these villages.

Since already, settlements have come up till the edge of the southern banks of Motichur rau, both upstream and downstream of the Motichur flyover, retention walls either pakka stone wall or strong and large gabion structures can be constructed along the southern bank of Motichur rau. This will serve three purpose:

- i. Would retain and strengthen the southern bank from being eroded;
- ii. Stop further encroaching of the corridor;
- iii. Serve as barriers to keep out elephants entering these villages and also guiding them towards Ganges along the corridor.

Barriers need to be constructed along the eastern boundary of the village environs, which will ensure elephants and other wildlife to not enter the villages during cropping period and also the village does not expand or encroach further toward Ganges. The possibilities of putting up barriers along the northern boundary of the corridor also needs to be checked, as putting up barriers and then restoring the degraded forest in to three layered (ground cover, shrub layer and tree layer) forest and tall to short grass (For grass species refer table 4.2 plants for restoration) along the edges and embankments of the Motichur rau, after eradication the invasive and exotics like *Hyptis suaveolens*, *Parthenium hysterophorus*, and *Lantana camara*.

All these would help in managing and reducing the HEC in and around the corridor and provide better conditions along the corridor for better facilitation for use by elephants and other wildlife.



4.3.3.2 Rehabilitation of Khandgaon III

The rehabilitation of the Khandgaon III village site needs to follow the strategies given above for relocation process and some rehabilitation in the case of Kunao Goths village Box 4.b.

Active management prescription detailed in the Tiger Management Plan specifically for securing Chilla-Motichur Corridor (CMC) with some modifications are provided in the Box 4c.

Box 4c: Management Prescriptions Recommended for management of Chilla - Motichur Corridor (CMC) Linkage

1. The crop protection barriers to be constructed around the Khandgaon village I and II, that has been resettled along NH-7. These two villages should also be involved and integrated in protecting managing and securing the CMC following the model detailed in section 4.3.3.
2. If feasible shifting of army ammunition dump from corridor should be taken up, which needs centre and state political will.
3. The islands on river Ganga, need proper and strict protection from illicit felling/grazing/Cannabis sativa collection.
4. Construction of bridge for movement of elephants and wildlife across Chilla channel at designated site need to be established.
5. Voluntary relocation of Gangabhogpur Malla and Talla, Kunao Goth villages located in the Gohri range of the Rajaji TR need to be done as detailed in Box 4b.
6. However, the flyover has been completed, the floor under the flyover needs to be cleared free of all smaller bits of rumbles and should be grown with native grass, under shrubs and shrubs to make it more natural.
7. Further, sound proofing to be done to reduce/minimize the sound and vibrations, persisting presently, when a heavy vehicle moves on the flyover.

Source and Modified from Rasaily 2022

4.3.3.3 Motichur – Gohri (Binj-Rau) Corridor

This corridor, aligned along the Song River, that starts from the park near Nepali Farm and flows into Ganges near Gohri Mati village, also connects the eastern and western parts of RTR. This can be a viable alternative to Chilla-Motichur corridor, if managed with some mitigatory interventions as provided in the Box-4d.



Box-4d: Interventions for Managing Motichur-Gohri Corridor

1. Stabilize river banks and develop vegetative cover along the banks of Song River and Ganges, through constructing a combination of toe wall and spurs along the banks.
2. Stop erosion of the islands/islets on the Ganges through stabilization and protection.
3. To provide protection to elephants and other wildlife through establishing anti-poaching camps at suitable locations.
4. Eco-restoration of the islands through broadcasting and planting native food tree, shrub, grass species, following development of tree layer vegetation (ground, shrub and tree).
5. Undertake rigorous habitat improvement work in the Motichur range and Gohri range to improve the habitat of elephants and other wildlife and also minimize them raiding crops from Gohri Mafi village through constructing barriers.
6. The Gohri Mati Village need to be involved in protection, management and securing this corridor, following the similar model suggested for managing the fringe forest through involving and integrating them into conservation through incentives like payment for ecosystem services.

Source and Modified from Rasaily 2022

4.3.3.4 Kansrau – Barkot Corridor

This is a narrow stretch of forest near Tinpani, that connects Kansrau range of the Rajaji TR with forest areas of Barkot range of Dehradun division. Since elephants and other wildlife use this corridor frequently, a under pass has been created as part of widening of the NH 72.

1. Funneling
2. Breaking the wall
3. Disallow dumping of cremation material

It is important to take up corridor restoration (three layered – ground, shrub and tree, through gap plantation in degraded patches and gaps) with consideration of vegetation in the landscape and securing it completely from further degradation and use by people and their livestock.

This needs to be done by putting up barriers (railway line fence/solar electric fence) along both side of the corridor extending into the forest. This would ensure keeping out the livestock and the people from using the corridor and also guide the elephants reach the other patches without any straying.



It will be very important to identify the villagers using this corridor and involve them in protecting, managing and securing the corridor, though following the model for managing the fringe forest through involving and integrating them into conservation and sustaining through incentives like payment for ecosystem services and helping in securing their agriculture.

The industries nearby can adopt the corridor and the villages using the specific corridor and support all these activities in collaboration with the Uttarakhand Forest Department.

4.3.4 Landscape-level Zonation

A threat more challenging than the problem of crop raiding by elephants is the ever-increasing risk of elephants entering densely populated urban and semi-urban areas, that are ever expanding sandwiching elephant habitat, as is the case of Rajaji landscape and the ever-expanding cities of Dehradun, Haridwar and Rishikesh. In this scenario, the best means of conserving elephant and also feasible means of addressing HEC, it is needed to demarcate different zones "Elephant Conservation Zone", "Elephant Human Co-existence Zone" and "Elephant Exclusion Zones or no-go" areas for elephants, as suggested for Karnataka state by the task force committee of the Karnataka Elephant Task Force (2012). Even for Rajaji Landscape, it would be pertinent to develop a zone-based approach towards elephant conservation, which is elucidated as under:

4.3.4.1 Elephant Conservation Zone (ECZ)

This includes the large, continuous and intact forest habitats of the entire Rajaji Tiger Reserve and the six corridors, Kansrao-Barkote and Motichur-Barkote & Rishikesh (Tinpani Corridor) in Dehradun Forest Division, and Chilla-Motichur and Motichur – Gohri (Binj-Rau) of Haridwar Forest Division and Rawason – Sonanadi (Lansdowne Forest Division) and Rawason – Sonanadi (Bijnor Forest Division) of Lansdowne Forest Division. This zone also includes, both sides of river Ganges and all islets along the Chilla-Motichur and Motichur – Gohri (Binj-Rau) corridors, and Kunaon and Chilla Chaur, this would further, include the entire Shyampur range above the Haridwar-Nagibabad road after freeing it from Gujjars and restoring and enhancing the quality for the elephants. This zone, which holds the majority of the elephants in the RTR landscape, need to be protected for its integrity and safety of the elephants and preventing to the maximum from getting into the agriculture fields and settlements in the village enclaves (Map 4.1).



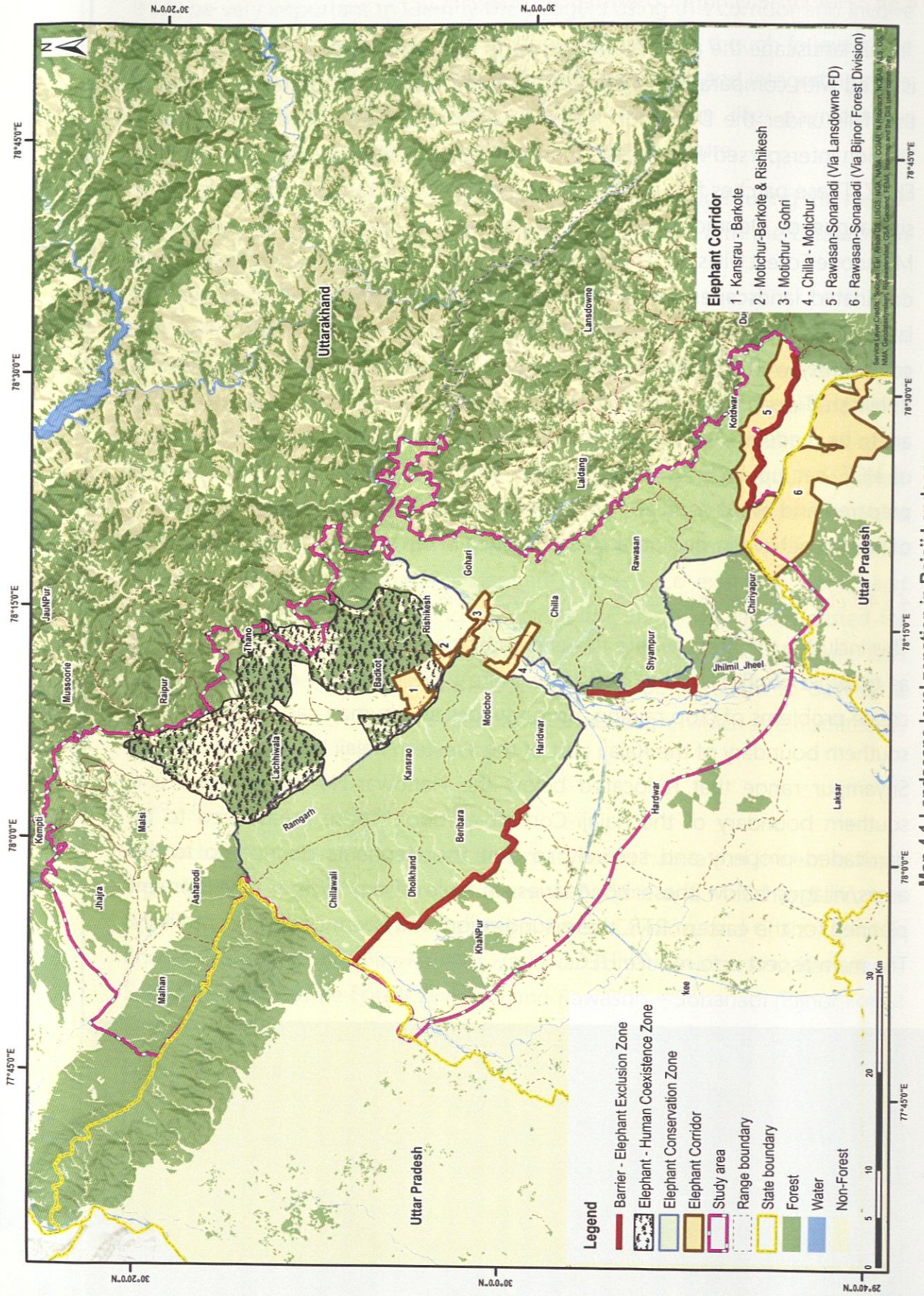
4.3.4.2 Human–Elephant Co-existence Zone (HECoZ)

In this landscape the areas along the north eastern boundary of the RTR, that is faced with comparatively high HEC, but with fairly intact patches of forests that falls under the Dehradun Forest Division and part of Mussoorie Forest Division interspersed with forests that have connectivity has been identified as EHCZ. These patches fall under total 51 beats of eight ranges, with 45 beats of six ranges of Dehradun Forest Division and six beats of two ranges of Mussoorie Forest Division. This zone though not so fragmented, but has human dominated landscapes on all sides with a narrow connectivity between the large patch of forest in the north with the patch in the southern side, which has connectivity with RTR through the Kansrau-Barkote and Motichur-Barkote & Rishikesh (Tinpani Corridor), corridors. In this zone, all efforts to reduce the HEC are to be made and by setting up Rapid Response Team to address the issues of HEC, set up Early Warning System to make people in this zone alert, prepared and avoid conflict. People in this landscape need to be made aware of how to behave in situations of emergence in terms of HEC (Map 4.1).

4.3.4.3 Elephant Exclusion Zone or No- Go Zone

This includes the areas where the elephants need to be stopped from going, as to avoid conflict. In this landscape there have been few elephants, which create problems of crop raiding, property loss and human casualty, along the southern boundary of the Rajaji part of the Western Rajaji NP and the areas of Shyampur range that is located below the Haridwar-Nagibabad road and southern boundary of the Rajaji-Corbett corridor. These areas need to be barricaded properly and securely so that the elephants do not go to the areas/villages below these boundaries. In case of any further development planned for the eastern RTR, these suggestions may be modified accordingly. The main aspect is to reduce HEC.





Map 4.1 Landscape level zonation in Rajaji Landscape



The areas to be secured from elephants are some of sites with intense HEC. The inner side of all three sites mentioned above is part of the Elephant Conservation Zone (Map 4.1).

Along the southern boundary of Rajaji part of RTR that runs along 10 forest beats of Khanpur and Haridwar ranges, single barrier using Railway Line Fence (RLF) or Solar Electric Fence (SEF) or Stone Walls (SW), or depending upon the persistence of the elephants, at the areas where there is frequent attempt to cross, double barriers can be put up to stop them from going out of RTR and involve in HEC. Similar barriers need to be constructed along the northern/upper side of the Haridwar-Nagibabad road from starting near Chandi temple foot path to the Peeli nadi, and the southern boundary of the Rajaji-Corbett corridor from Laldang (start) to Kotdwar (end). Along these boundaries also single or double barriers, depending up the attempts of elephants needs to be constructed. The villagers below need to be trained in maintenance of these barriers and also being part of the Elephant Detering Guards. This will ensure not only the elephants from crossing and going into the village and get into conflict, but these barriers would also serve to stop the livestock and the villagers, from getting into the ECA (Table 4.4 and Map 4.1).

Table 4.4: Range and Beats that forms the Elephant Exclusion Zone EEZ or No-Go Zone

S.No	Division	Range	Beat
1	Haridwar	Hardwar	Bhadrabad
2	Haridwar	Hardwar	Blshampur_South
3	Haridwar	Hardwar	Devpura_Ahatmal
4	Haridwar	Haridwar	Harnaul Beat
5	Haridwar	Khanpur	Aurangabad
6	Haridwar	Khanpur	BudhwashahId_East
7	Haridwar	Khanpur	Hazara
8	Haridwar	Khanpur	NF
9	Haridwar	Khanpur	Rasulpur_Papri
10	Haridwar	Khanpur	Shahmansur
Total	1	2	10
1	Rajaji_Tiger_Reserve	Laksar	Bhogpur_North
2	Rajaji_Tiger_Reserve	Shyampur	Anjani
3	Rajaji_Tiger_Reserve	Shyampur	NF
4	Rajaji_Tiger_Reserve	Shyampur	SajanPur
5	Rajaji_Tiger_Reserve	Shyampur	Shyampur
Total	3	2	5



S.No	Division	Range	Beat
1	Lansdowne	Kotdwar	Glwain
2	Lansdowne	Kotdwar	Gularjhala
3	Lansdowne	Kotdwar	Gwalgarh
4	Lansdowne	Kotdwar	Malan
5	Lansdowne	Kotdwar	NF
6	Lansdowne	Kotdwar	Sukhrao
7	Lansdowne	Kotdwar	Giwain
8	Lansdowne	Kotdwar	Gularjhala Beat
9	Lansdowne	Kotdwar	Gwalgarh Beat Edha Beat
10	Lansdowne	Kotdwar	Sukhro Beat
11	Rajaji Tiger Reserve	Laldang	South Papidanda-I
12	Rajaji Tiger Reserve	Laldang	South Papidanda-II
13	Rajaji Tiger Reserve	Laldang	South Papidanda I Beat
14	Rajaji Tiger Reserve	Laldang	South Papidanda_I Beat
Total	2	2	14
RTR Landscape	3	6	29

4.3.5 Addressing Threats Posed by Linear Infrastructure

Linear infrastructures like hydro-electric power channel, railway tracks, national highways and overhead electric transmission lines passes through the RTR, resulting in not only degradation and fragmentation of elephant habitat but leading to elephant and other wildlife mortality and conflicts.

4.3.5.1 Railway Infrastructure

The railway line from Haridwar to Dehradun, passes through this elephant habitat for 13 km and there have been 22 deaths of elephants due to accident with the train, since 1987. Since this line traverse along the northern boundary of the RTR, and elephant need to cross these lines, in order to move from Motichur to forage on the other side of the railway line and also reach to the perennial water source inside the forest and the Song River. The elephants also cross the railway line to reach Barkote range from Motichur through the Motichur-Barkote & Rishikesh corridor

Between 1992 – 1999, a comparison of elephant deaths due to natural and human related causes in Rajaji NP, showed that out of 20 deaths, six were due



to natural cause, while 14 were due to train accidents and electrocution during crop raiding (Williams et al.2005). The above indicates that more elephants in this RTR landscape died due to human related causes than natural deaths. This is a serious issue to be worried, as it was found that there has been the loss of whole family groups of elephants or part of such groups in train accidents, and being a matriarchal society, death of matriarch, the leader, would have a very bad effect on the behaviour of the remaining group member and their ecological needs (Williams et al. 2005). These elephants, which would not have the knowledge of resource availability during very scare and drought years, would end up in wandering into new areas, that might include the human dominated landscapes, thus resulting in HEC. This, though an indirect effect of Railway line in elephant habitats, is one of the drivers for HEC.

Water being one of the very important resources, which force the elephants to cross the railway line, through which train passes 2.5 trips per hour (Menon et al., 2017), and in the process gets killed. Already there are some mitigation measures in place, which are detailed below, based on the efficacy of which specific mitigations are suggested.



World Wide Fund Awareness Program

A regular awareness programmes, for the railway pilots and other railway workers on the precautions that needs to be followed, check for sign boards, which state, the speed limit to be followed, elephant crossing point and other aspects of precautions to save elephants, are being conducted.

Monitoring Critical Sections - Wildlife Trust of India

Monitoring and patrolling of critical sections of the railway track by Uttarakhand Forest Department, Wildlife Trust of India and Northern Railways, during night hours is being done. This is to keep out elephant from staying close to the line for longer time, so as to avoid accidents.

Early Warning System – Seismic Sensors

Further, another means to avoid elephants being hit by trains is in an experimental stage. This known as the '*Intelligent Elephant Movement Detection and Alert System*', which involves development of seismic sensors to detect elephants' movement/presence, when they are 50m to the railway line. This will raise an alarm when elephants are within 50 m of the line, so that can be informed to the concern officer. who would alter the train pilot, based on which he would slow down the train or move cautiously as to avoid elephants being hit.

Though it sounds efficient, this has to take the behaviour of elephant into consideration, especially the speed of their movement. The time between detection and passing on the message is about two minutes, considering the movement of elephants within that time, they would be either near the line or crossing the line, most of the time. Secondly, it is a question how this signal would be transferred to the concern station master then be communicated to the pilots, considering that even if it takes minimum of 5 minutes by then the train will reach the place where the elephants are crossing and still there could be killing of elephants. So, it is important to take elephant movement into consideration.

At times, the availability of food close to the railway line also attracts the elephants to feed and spend more time close and, on the line, so the vegetation along both sides of railway line needs to be maintained through regular removal. The usable/palatable plants should be cleaned up to a width of 30 m on either side at regular intervals. Presently, the vegetation along this route is mostly weed, exotic and invasive species, that are not preferred by



elephants. But removal of vegetation would increase visibility and detection probability of elephants and other wildlife.

In order to address this particular issue of deaths due to train accidents it is important to plan the retrofitting measures and continue the management systems already in place that are detailed in the Box 4e.

Box 4e: Retrofitting Measure Suggested for Mitigating Train Accidents

- i. Re-alignment of railway lines, of the 18 km stretch passing through Motichur and Kansrau forests within the core zone, is very important. The re-alignment needs to go beyond the core zone or outside of the reserve.
- ii. If the realignment is not feasible, then as an alternative, elephant overpass, at least at two places where elephant crosses the most. Once elephant over passes are constructed, then the barricading other stretches to guide them into the overpass is very important.
- iii. Clearing of vegetation, including the food plant species of elephant and other wildlife, along the railway lines on a regular and systematic manner needs to be done, specifically during monsoon, to improve visibility.
- iv. Improving and increasing water availability during summer, through creation of water bodies with sufficient water supply (continuous water supply, through gravitational flow – natural system being used presently by Forest Department in the Rajaji part of RTR) on the southern side of the railway track is very crucial.
- v. Clearing the debris and modifying the existing bridges would help in enhancing animal movement.
- vi. Continuous monitoring of these crossing that are intensively used by elephants and other wildlife is very important. This can be achieved through providing proper capacity building to the stakeholders involved and also maintaining the monitoring/patrolling routes systematically and regularly.
- vii. Three ranges Haridwar, Motichur and Kansrau, through which railway track passes through need to be patrolled regularly, with increase in intensity during January to June, when water starts becoming scarce and frequency of crossing of elephants and other wildlife increase.
- viii. Early warning system radar, seismic sensor & Lasers as detailed in Section –4.2.3 and under *Early Warning System – Seismic Sensors*.
- ix. Rapid Response Team (RRT) detailed in Section 4.2.4.
- x. It is very important to identify the points at which elephants and other animals cross the track frequently and rarely, along the stretch, and then plan possible barricading the other stretches to stop the elephant and other wildlife and guiding/channeling them to the specific crossing locations. Once this is done dialog with Railway Department can be had to have the trains slow down and move cautious 0.5 – 1 km before these strategic crossing sites both ways. There is a need for regular maintenance survey along the barricades to check its intactness and strengthen/reinforce the weaker sites. Further, continuous use of the specific crossing will habituate the elephants and other wildlife in using these crossings on



a regular basis. More details regarding barricades and fencing are provided in the Tiger Conservation Plan

- xi. Use of Audio/visual deterrent to deter elephants and wild animals from the railway track.
- xii. The railways should clear the existing bridges and remove the debris every year after monsoon.

Source and modified from: Rasaily 2022

4.3.5.2 Roads

Three National Highways (NH72 – Dehradun to Haridwar, NH 58 – Dehradun to Rishikesh, NH72A Dehradun to Delhi) and ancillary roads (Haridwar-Chilla-Rishikesh) and its connectivity to the Dehradun, Haridwar, Rishikesh towns have facilitated and intensified heavy use of these roads that has not only led to wild animal road kills, but also fragmented the elephant habitat and narrowed the corridors. Added, the widening of the NH72 and NH72 A would also have a negative influence on the use of Chilla-Motichur, Motichur-Gohri, Motichur-Kansrao-Barkot corridors and connectivity between RTR and Shivalik Forest Division by elephant, tiger and other wildlife. In order to minimize this conflict, following mitigations are suggested (Box 4f).

Box 4f: Mitigations to minimize the effect of Roads

- i. The already constructed overpass along NH72 across the Chilla-Motichur, Motichur-Gohri, Motichur-Kansrao-Barkot corridors need to be facilitated with sound and vibration proof measures and simultaneously make the habitat under the flyovers more habitable. Details given in 4.3.3.
- ii. Speed limits to be strictly adhered and stringent fines to be imposed for violation
- iii. Establishment of early warning system and monitoring of movement of Elephant and other wildlife in close proximity to highways through installing electronic surveillance system, linked to control room.
- iv. Capacity building of all stakeholders involved in management of both the wildlife and highways and roads is important for ensuring proper effective monitoring and following of norms.
- v. Involvement of Public in preventing road accidents: Put up signages/display boards on precaution and speed limit, and approach of sensitive elephant and animals crossing. Added give toll-free number so that any instance of animal road kill can be intimated to the control room/highway patrol.

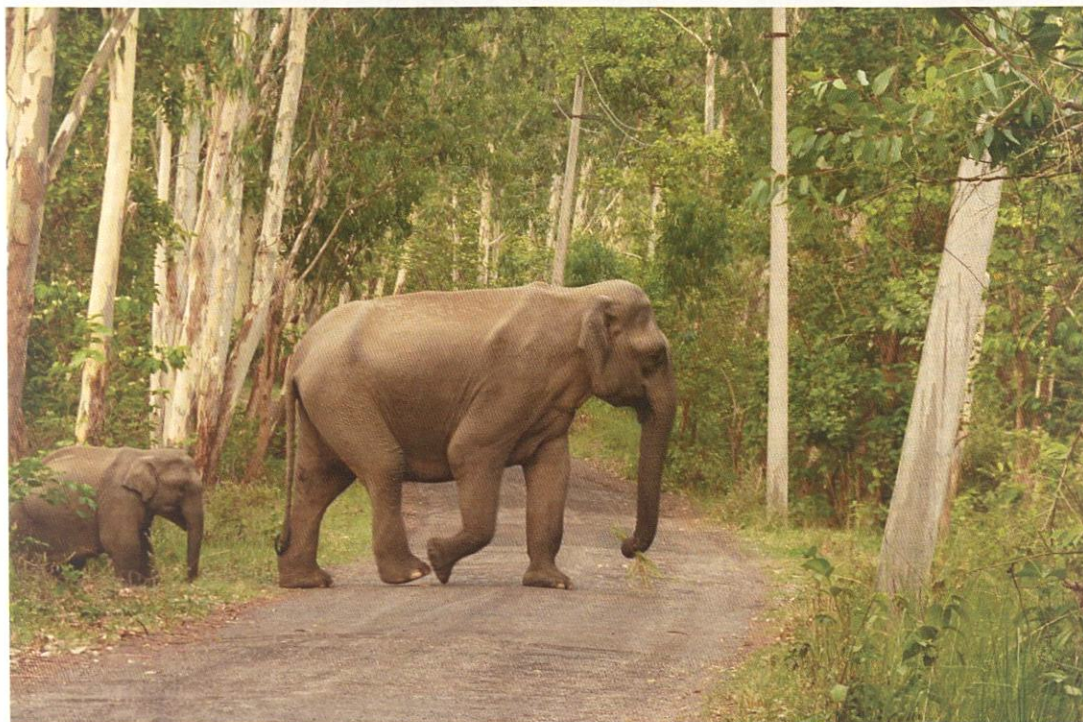
For further details, refer to the Tiger Conservation Plan (Rasaily 2022)

Source & Modified from Rasaily (2022)



4.3.5.3 Canal

The construction of 14 km long Chilla Power Channel as part of Hydro Electric project in 1976, in the core critical tiger habitat and rich elephant habitat has hindered the movement of elephants and other wildlife. This canal with its steep cemented slopy banks had made it difficult to not only cross the channel but also made it difficult for the animals to drink water from the channel. Hence appropriate retrofitting mitigation strategies are suggested in Box 4g.



Box 4g: Mitigatory Measures for minimizing the effect of Chilla Power Channel

- i. Construction of new bridge (elephant bridge), in addition to the existing one, is very crucial, which needs to be fairly wide (10-12 m) and start from the forest along the bank of Suni Sot arching over the channel leading down directly to the path going into the 15 sq km patch between Ganges and the power channel. Rethinking on these lines is essential to facilitate the movement of elephants and other wildlife including tiger. This bridge needs to be made in such a manner that it can hold soil to the level of growing shrubs, herbs and grasses, so as to make it more habitable and usable for elephant and other wildlife.
- ii. The first and foremost attempt is to check the possibility of completely stopping the buses and other vehicles plying between Rishikesh (Kunao barrage) and Haridwar along the canal road. This needs to be done immediately after resettling the Gujjars from Kunao grasslands, Kunao Goth, Gangabogpur Malla and Talla located along the power channel. Then this canal road should be used only for supervision of



channel by Electricity Board Personals and for patrolling and monitoring by Forest Department.

- iii. The cemented concrete lining along the sides/slopy embankment of the canal to be removed in a phased manner.
- iv. The embankment needs to be replaced with earthen embankment above the maximum water line followed by stone pitching, similar to the Suni sot portions.
- v. In order to strengthen the structure, take up some vegetative measures.

The last three amendments need to be done with very high caution, as elephant groups go down to drink, there are all chances that young calf if in the group could fall into the canal, as they are very playful and ignorant and could readily get in to the water in the process could get washed away.

Water holes van be created in the Chilla chaur area, using solar operated pumps to draw water from the wells in the relocated village areas.

Source and modified from: Rasaily (2022)

4.3.5.4 Power Transmission Line

Electrocution of elephants and other wildlife due to overhead electric transmission lines passing through several portions of the tiger reserve has already been reported. In order to minimize the effect of this conflict the following measures in Box 4h, are suggested.



Box 4h: Mitigation Measures suggested to minimize Electrocutation

- i. Since the vegetation under the transmission line for its entire length is to be devoid of tall vegetation, it is suggested to grow shrubs with grass that can be utilized by elephants and wildlife.
- ii. While the trees on both sides of the RoW (Transmission line route) within 30 m are to be lopped frequently, the regeneration of tree species, weeds and exotic/invasive species are to be cleared frequently and replaced with native shrubs and grasses.
- iii. When planning for construction of transmission lines in future, the RoW (transmission line route should avoid passing through/cutting across corridors, potential elephant habitats, sites where elephants congregate, their seasonal routes and frequently visited sites like waterholes, rivers and slush ponds.
- iv. In order to increase the height at the lowest sag of the transmission lines, the towers should be placed closer, as done in the areas with road crossing or in areas where the transmission lines cross over a lesser power transmission line. This will make the lowest sag height higher than normal. The minimum sag should be more than 10m and whatever constructions norms are right for this, needs to be planned and followed inside elephant habitat.
- v. The earth line should be insulated, in addition to, if possible, insulating also the transmission line.
- vi. The maintenance and monitoring of the transmission line needs to be done jointly by involving all stakeholders, mainly electricity board and forest department. During this monitoring along with checking for sag/breakage and other damages. In addition, the presences of elephant signs also need to be recorded, which would provide information on frequently used stretches, that can be monitored more than the regular monitoring. Patrolling can also be combined along with this monitoring.

Source and modified from Rasaily (2022)

4.3.6 Training and Capacity Building of Frontline Staff

Training Capacity building of the frontline staff in handling crisis situation pertaining to HEC, capture and translocation of elephants, maintenance of the barriers been constructed to identify the weak zones or stretches to rectify it, identifying elephants and following them and collecting simple and basic field data, creating awareness and educating local community on aspects of HEC, their role and being part of HEC management, and on treating of sick and injured elephants, to veterinary and frontline staff from ACF downwards. Training and capacity building of frontline staffs, from ranger and below on identification of individual elephants based on body characteristics, take photos of elephants and using them to identify individuals elephants (solitary as well as individuals in groups), sexing and aging of elephants and using it to classify different elephants into age and sex class, using of different data sheets



to record basic and broad aspects of behaviour and ecology and in identifying the problem elephants or the one that come in regular conflict and their movements. Added, capacities of frontline staff need to be improved in terms of recording different HEC systematically using set data format and reporting of the same along with proper cause for the death of both human and the elephant.

4.3.7 Awareness and education

Awareness among frontline staff about elephant ecology, behaviour, and conflict management, to improve preparedness in tackling difficult conflict situations, especially during challenging time such as Maha Kumbh. and other festivals

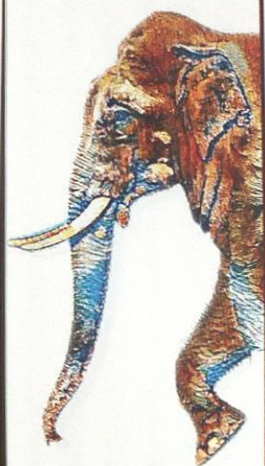
4.3.7.1 Awareness and Basic precautions: Local Communities highly sensitive areas

Preparedness to tackle the conflict situations, mainly pertaining to do's and don't, awareness on the early warning system and what it conveys and needs to be done immediately. Awareness on how everyone should behave in crisis situation and when elephants or other wildlife are being chased, captured and translocated, as many a time crowd behaviour end up in unwarranted incidents at time to the level of badly being injured or even loss of life.

Basic information on the behaviour of elephants and other conflicting wildlife and the reason for their coming to their village and informing the head of the village or the rapid response team on seeing or hearing of animals and their movement in the village environs. Respect the animals and always be precautionous. Awareness on what crops could be grown that would not attract elephants and other wildlife. Awareness about the barriers, where it has been put up and how it works and the importance of maintaining these for better and timely result.

4.3.7.2 Awareness and Basic precautions: Local communities - moderate and low sensitive area

While most of the above need to be made aware of, the preparedness for facing conflict and reporting of news to the village about the movement of animals in the nearby villages are very important. Awareness on how to behave and react in crisis time is also very important to know. Crops to be grown that do not attract wildlife are to be made aware. Awareness about the barriers,



where it has been put up and how it works and the importance of maintaining these for better and timely result.

4.3.7.3 Awareness and Basic precautions: Local communities – Probably future areas of sensitivity

Awareness about early warning system, about the animals and possible conflict, preparedness and how to react. Gathering and sharing the information on animal movements and also any incident of conflict that has happened in the surrounding. Awareness about the barriers, where it has been put up and how it works and the importance of maintaining these for better and timely result.

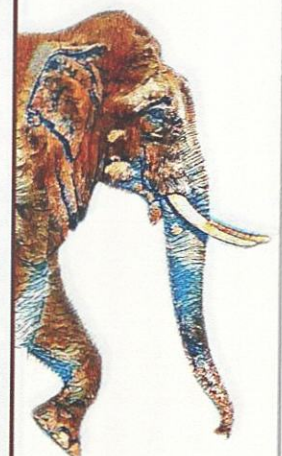
4.3.8 Research and Monitoring

Considering the life span of elephants of 50 – 60 years in the wild, it is important to assess patterns of conflict for longer durations covering different seasons of the year across several years to make and also check whether there is inter-season and inter-annual variation in HEC. It is very crucial that a proper set format be used to record the HEC systematically, that would provide the most needed site-specific information, like identifying the magnitude of HEC, its shift, the specific reason, derive and implement site specific modifications in the management action being followed which will help in mitigating and managing the specific HEC, in the best possible means.

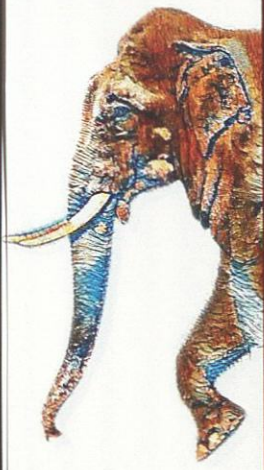
Understanding how elephants use corridors to move between habitats, bottlenecks that hinder their free movement and the impact of linear development on movement pattern, and other prevailing threats is important. This is very crucial as threats could be an implicate trigger for conflict in the locality.

The understanding of fine scale patterns of habitat uses and movement by elephants is very important, as this data will prove in assessment of structural, functional and fitness value of the landscapes (Wittemyer et al., 2019). Hence, regular and systematic monitoring at beat level for the presences and use of elephants by the front-line staff is highly needed.

Population monitoring can be done as part of the above, with the frontline staff with specific capacities to class the elephants into different sex and age class. Added, the capacity building also needs to include photographing individual elephants and also looking for individual identification marks. This will help in knowing the movement and habitat us to a broad extent.



Effect of barriers and hurdles on movement and habitat use of elephants and effectiveness of the barriers set up for mitigating HEC. Monitoring with the help of GPS tracking and high-resolution satellite imageries, we can provide empirically sound information on how elephants are navigating in human-dominated landscapes and effectiveness of potential mitigation methods used for HEC.

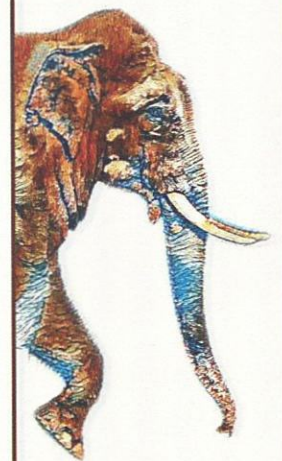


CHAPTER 5

Management of Religious Places in The Rajaji Landscape

5.1 Background

In India, biodiversity conservation and cultural heritage are deep-rooted, complex and closely connected. The positive role of religious, cultural and spiritual belief system in biodiversity conservation is increasingly being recognized. There are numerous examples of cultural belief system directly contributing towards biodiversity conservation. There are several places of cultural and religious worship within the protected areas of the country. Many protected areas in India were even created as sacred groves and mystic values, and owe their existence to the cultural and religious significance surrounding the area. In fact, creation of sacred sites was one of the earliest forms of conserving habitats important for biodiversity. Notwithstanding the positive role played by cultural and religious belief systems towards wildlife and biodiversity conservation in India, evaluating the biotic pressure exerted by places of religious worship on wildlife habitats seem important. The places of religious worship can pose challenges to wildlife management due to large number of people, resource extraction pressures, noise, pollution; creation of secondary infrastructure including roads, forest fire, and others that exert pressure on wildlife habitats causing both degradation and tacit loss of habitat. In the Rajaji landscape, there are numerous places of religious worship located both within the forests and in the surrounding areas with potential impact on forests and wildlife. There have been numerous incidences of interactions between elephants and pilgrims throughout the landscape, some of which turned negative even resulting in human fatalities. Therefore, as a first step towards mitigating potential conflict between elephants and people pertaining to places of religious worship, the religious establishments in Rajaji landscape have been mapped and impacts evaluated.



5.2 Mapping of Religious Places in Rajaji Landscape

Initially, a total of 278 places of religious worship (PRW) were mapped from 1:50,000 topographic maps of the Survey of India in the Rajaji landscape (Map 5.1). Based on the physical surveys, 77 PRWs where there is a potential for human–elephant interaction either within the premise or in the vicinity including the connecting roads were identified. All the 77 identified PRWs were visited to qualitatively evaluate characteristics of the PRWs, pilgrim inflow, carnivals/festivals, access through forests, and wildlife use of the area and forest degradation around the PRWs. Among the 77 PRWs, 39 were in Rajaji Tiger Reserve, 18 were in Dehradun Forest Division, 16 were in Haridwar Forest Division, 3 were in Lansdowne Forest Division and 1 was in Narendranagar Forest Division (Figure-5.1). Division-wise list of temples has been provided in the Annexure VI

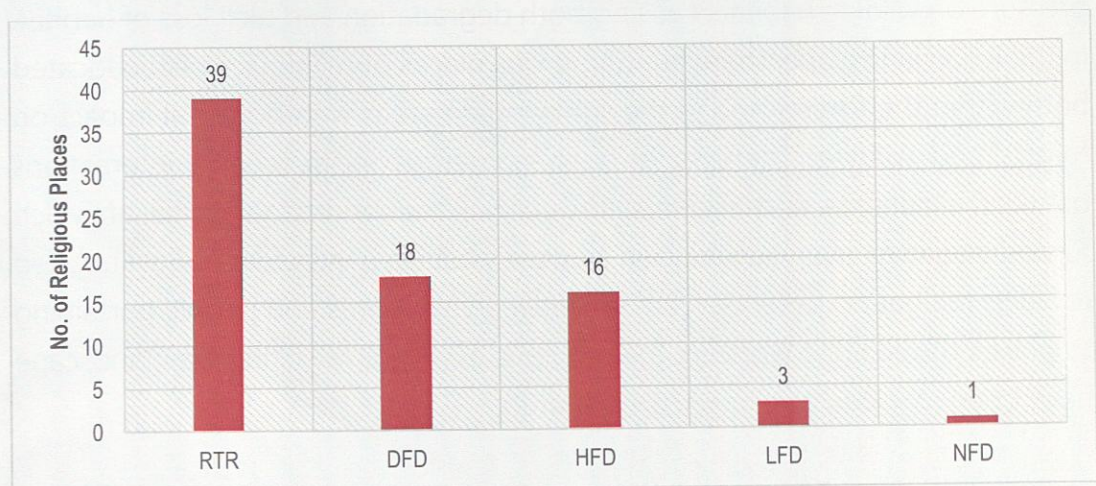
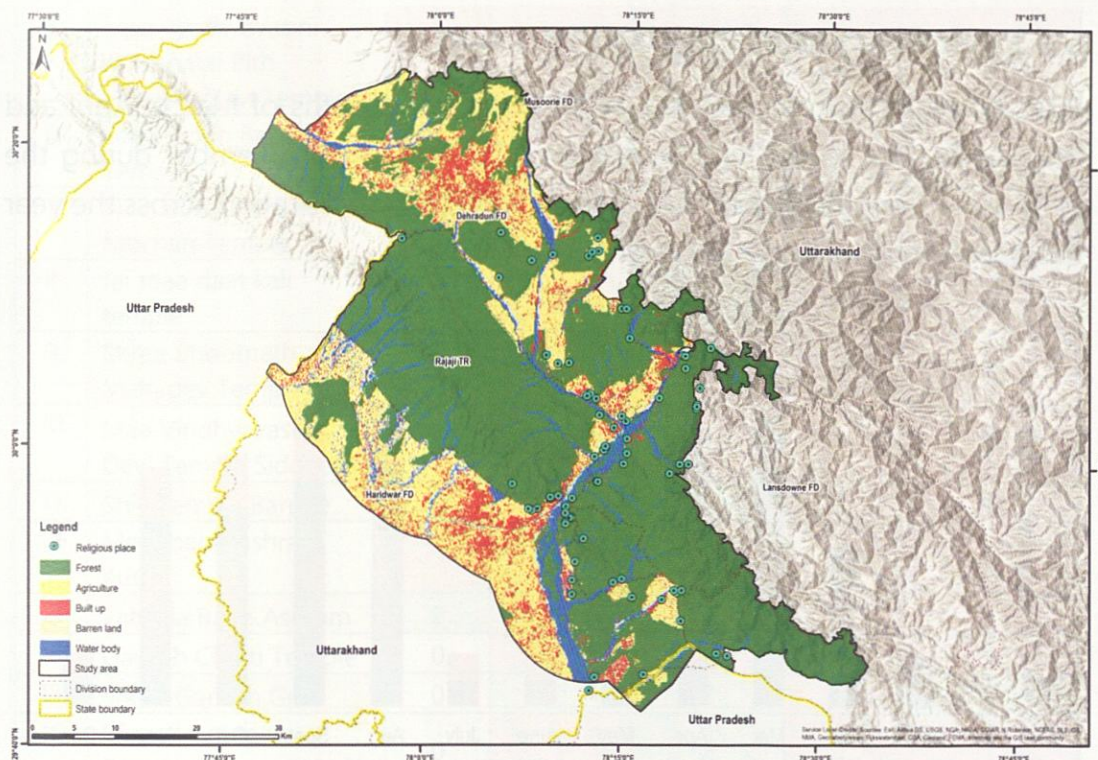


Figure-5.1: Places of Religious Worship (PRW) in the Rajaji Landscape





Map 5.1 Places of religious worship in Rajaji Landscape

5.3 Visitation by Pilgrims

The annual visitation by pilgrims to the Place of Religious Worship (PRW) in the Rajaji Landscape was evaluated. Visitation was categorized into six different types namely (i) 10-100 (ii) 100-500 (iii) 500-2000 (iv) 2000-5000 (v) 5000 – 10000 and (vi) 10000 and above. There were 14 PRWs with over 10000 pilgrims visiting each year. Among the 14, 8 of them were within Rajaji Tiger Reserve (Table-5.1).

Table-5.1: Annual pilgrim visitation to PRWs in Rajaji landscape

Number of Pilgrims	Number of Places of Religious Worship					Total
	RTR	DFD	HFD	LFD	NFD	
10 – 100	4	8	3	1	0	16
100 – 500	18	5	4	0	1	28
500 – 2000	5	4	4	0	0	13
2000 – 5000	2	0	1	0	0	3
5000 – 10000	2	0	1	0	0	3
10000 & above	8	1	3	2	0	14
Total	39	18	16	3	1	77



5.4 Peak Seasons of Pilgrim Visitation

Visits by pilgrims were relatively high during the months of March, April and May during dry season and September, October, and November during the early winter months (Figure-5.2). Temple-wise pilgrim visitation across the year has been provided in the Annexure VII.

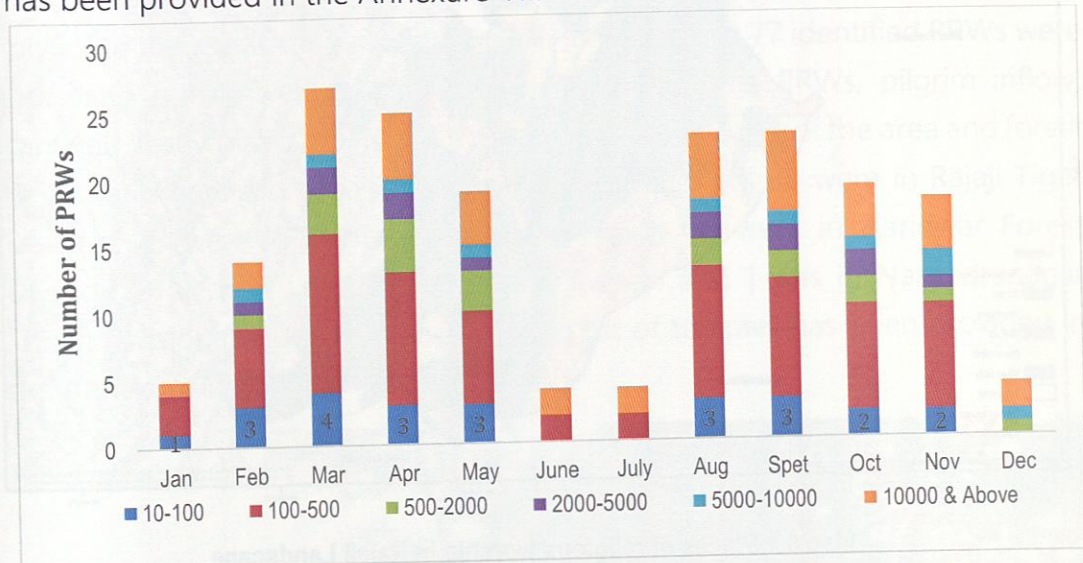


Figure-5.2: Number of PRWs along with their annual crowd inflow

5.5 Wildlife Occurrence in and around PRWs

5.5.1 Rajaji Tiger Reserve

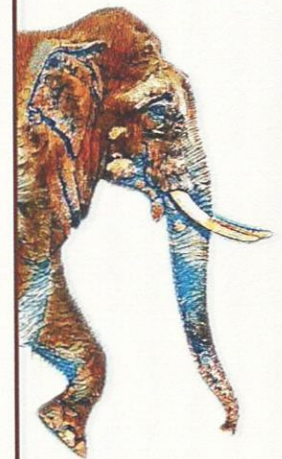
Among the 39 PRWs in Rajaji Tiger Reserve (RTR), 20 PRWs reported regular movement of elephants while in 15 PRWs, the elephant movement was sporadic. Regular tiger movement was reported from 7 PRWs while sporadic tiger movement was reported from 16 PRWs. Regular leopard presence cum movement was reported from 37 PRWs while sporadic leopard presence cum movement was reported from 2 PRWs in RTR (Table 5.2).

Table-5.2: Wildlife occurrence around PRWs in Rajaji Tiger Reserve

S No	Religious Places (RP)	Wildlife occurrence frequency (RTR)				
		1 = Regular/Monthly		2 = Sporadic		0 = No Occurrence
		Tiger	Leopard	Elephant	Other Her*	Other Carn**
1	Shiv Shakti Temple	2	1	1	1	1
2	Jama Masjid	2	1	1	1	1
3	Lal Sot Majar	1	1	1	1	1
4	Mota Mahadev Temple	1	1	1	1	1



5	Maa Vindhyavasini Adhishakti Pith Sharada Devi Temple	1	1	1	1	1
6	Loha Siddh Baba Temple	1	1	1	1	1
7	Shiv Shakti Sankat Mochan Temple	2	1	1	1	1
8	Jai maa daat kali temple	0	1	2	1	1
9	Shree Bhootnath Mahadev Temple	2	1	1	1	1
10	Maa Vindhyavasini Devi Temple Siddhpith	0	1	1	1	1
11	Shiv Temple Barraje	0	1	2	1	1
12	Moni baba Ashram Kuti	1	1	1	1	1
13	Tatwala Baba Ashram	2	1	1	1	1
14	Garudh Chatti Temple	0	1	1	1	1
15	Shree Ganesh Gufa	0	2	2	1	2
16	Shree Hanuman Temple	0	1	2	1	1
17	Jhilmil Gufa	0	1	2	1	1
18	Bilkeshwar Mahadev Temple	0	1	2	1	1
19	Shree Gauri kund Tapathsal	0	1	2	1	1
20	Shree Bhikshu Kutiya	0	1	2	1	1
21	Hajrat Saiyad Sultana Shah Zabari Pir	0	1	2	1	1
22	Siddhpith Shree Sureshwari Devi Temple	2	1	1	1	1
23	Shree Manasa Devi Mata Temple	2	1	2	2	2
24	Maa Bhagavati Temple (Laldhang)	2	1	1	1	1
25	Khaki Baba Temple	0	1	2	1	1
26	Siddh Baba Temple	1	1	1	1	1
27	Shri Satyanarayan Temple	2	1	1	1	1
28	Kalu siddh Pir	2	1	2	1	1
29	Jamal Kamal Pir	2	1	1	1	1
30	Maa Bhagavati Vasanti Devi Temple	0	1	0	1	1
31	Bramhalin Naga Baba Mahipat Giriji Maharaj Temple	0	1	2	1	1
32	Hanuman Temple	0	1	0	1	1
33	Shree Laxmi narayan Temple	0	1	0	1	1



34	Shree Anjani Devi Mata Temple	2	1	2	1	2
35	Shree Sit sot Maharaj Ashram	1	1	1	1	1
36	Bheda wali strot	2	1	1	1	1
37	Loha Siddh Temple	2	1	2	1	1
38	Shree Mundal Devata Temple	2	1	1	1	1
39	Shree Chandi Devi Temple	2	2	2	1	2

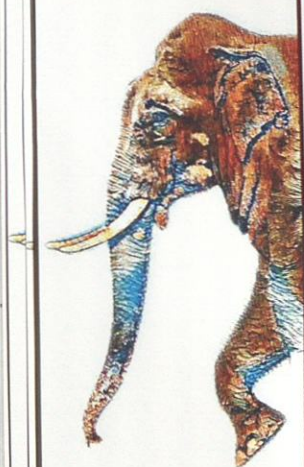
* Other herbivores, ** Other Carnivores

5.5.2 Dehradun Forest Division

Among the 18 PRWs in Dehradun Forest Division (DFD), 10 PRWs reported regular movement of elephants while in 7 PRWs, the elephant movement was sporadic. Regular tiger movement was reported from 2 PRWs while sporadic tiger movement was reported from 9 PRWs. Leopard presence cum movement was reported from all the 18 PRWs in DFD (Table 5.3).

Table-5.3: Wildlife occurrence around PRWs in Dehradun Forest Division

S No	Religious Places (RP)	Wildlife occurrence frequency				
		1 = Regular/Monthly		2 = Sporadic		0 = No Occurrence
		Tiger	Leopard	Elephant	Other Her*	Other Carn**
1	Bhuresa baba	2	1	1	1	1
2	Oneshwar Maharaj Temple	2	1	1	1	1
3	Himalaya Devi Mata Temple	2	1	2	1	1
4	Shri Maa Bhadrakali Temple	2	1	1	1	1
5	Bhakt Ravidas Sheragarh Jakhan - Doiwala	0	1	2	1	2
6	Singh Sabha Sheragarh - Lal Tappar	0	1	1	1	1
7	Jwaleshwar Mahadev Shiv Temple (Old Shiv Temple)	2	1	1	1	1
8	Manimai Temple	1	1	1	1	1
9	Shri Laxman Siddh Temple	1	1	1	1	1
10	Bhuiyan Temple	2	1	1	1	1
11	Shree Chaitanya Mahaprabhu Gaudiya Math	0	1	2	1	1



12	Shiv Temple Medhawala	0	1	2	1	1
13	Siddhpith Mahamaya Mata Bala Sudari Temple	0	1	2	1	2
14	Kalusiddh Temple	2	1	2	1	1
15	Maa Manas Devi	2	1	1	1	1
16	Kali Devi Temple	2	1	1	1	1
17	Kuti	0	1	2	1	1
18	Shree Durga Mata Temple	0	1	0	1	1

* Other herbivores, ** Other Carnivores

5.5.3 Haridwar Forest Division

Among the 16 PRWs in Haridwar Forest Division (HFD), 4 PRWs reported regular movement of elephants while in 12 PRWs, the elephant movement was sporadic. Sporadic tiger movement was reported from 2 PRWs. Leopard presence cum movement was reported from 15 PRWs in HDF (Table 5.4).

Table-5.4: Wildlife occurrence around PRWs in Haridwar Forest Division

S No	Religious Places (RP)	Wildlife occurrence frequency (HFD)				
		1 = Regular/Monthly		2 = Sporadic		0 = No Occurrence
		Tiger	Leopard	Elephant	Other Her*	Other Carn**
1	Shiv Seva Ashram & Durga Mata Temple	0	1	2	1	1
2	Maa kali Prachin Siddhapith	0	1	2	1	1
3	Maa Kali Temple	0	1	2	1	1
4	Shiv Temple and Gaushala	0	1	2	1	1
5	Shree Siddh Maharaj Kutiya	0	1	1	1	1
6	Siddhpith Dakshin Kalikanand Temple	0	1	1	1	1
7	Pai Khan	0	1	1	1	1
8	Shree Shanidev Temple	0	1	2	1	1
9	Kaila Mata Temple	0	1	2	1	1
10	Shree Shanidev Temple (Devpura_Ahatmal)	0	1	2	1	1
11	Ravidas Temple	0	1	2	1	1
12	Gauri Kund Temple	2	1	2	1	1
13	Nileshwar Mahadev Temple	2	1	2	1	1



14	Saiyad Pir	0	1	2	1	1
15	Shree Soteshwar Maharaj Temple	0	1	1	1	2
16	Shree Siddhapith Shanidham	0	0	2	1	0
* Other herbivores, ** Other Carnivores						

5.5.4 Lansdowne Forest Division

Among the 3 PRWs in Lansdowne Forest Division (LFD), 2 PRWs reported regular movement of elephants while in 1 PRW, the elephant movement was sporadic. Regular tiger movement was reported from 1 PRW. Leopard presence cum movement was reported from 2 PRWs in LFD (Table 5.5).

Table-5.5: Wildlife occurrence around PRWs in Lansdowne Forest Division

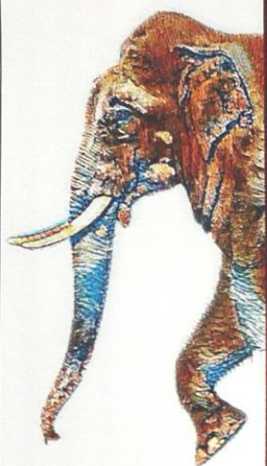
S No	Religious Places (RP)	Wildlife occurrence frequency (LFD)				
		1 = Regular/Monthly		2 = Sporadic		0 = No Occurrence
		Tiger	Leopard	Elephant	Other Her*	Other Carn**
1	Shree Nilkanth Mahadev Temple	0	1	1	1	1
2	Adhishakti Pith Sharada Devi Temple (Small Sister)	1	1	1	1	1
3	Hanuman Temple (Chillarkhal)	0	0	2	1	0
* Other herbivores, ** Other Carnivores						

5.5.5 Narendranagar Forest Division

Among the 1 PRW in Narendranagar Forest Division (NFD), Sporadic elephant movement was reported from 1 PRW. Leopard presence cum movement was reported from 1 PRW in NFD (Table 5.6).

Table-5.6: Wildlife occurrence around PRWs in Narendranagar Forest Division

S.No	Places of Religious Worship	Wildlife occurrence frequency (NFD)				
		1 = Regular/Monthly		2 = Sporadic		0 = No occurrence
		Tiger	Leopard	Elephant	Other Herbivores	Other Carnivores
1	Maa Manichha Devi Temple	0	1	0	1	1
* Other herbivores, ** Other Carnivores						



5.5.6 Animal presence around PRWs within study area

Among the 77 PRWs in Rajaji Landscape, 39% of elephant movement was reported as regular, while 4% of elephant movement was reported sporadic. 92% of leopard movement was reported as regular, while 3% of leopard movement was reported sporadic. 39% of tiger movement was reported regular, while 13% of tiger movement was reported sporadic. 99% other herbivores and 88% of other carnivore movement was reported regular, while 1% of other herbivores and 3% other carnivore movement was reported sporadic (Figure-5.3).

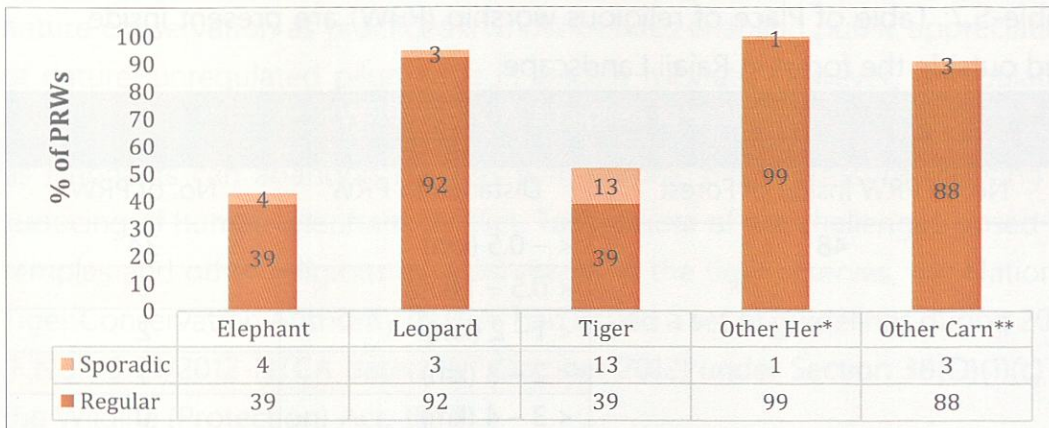


Figure-5.3: Animal presence cum movement around PRWs in Rajaji landscape

5.6 Forest Access to Religious Places

In Rajaji Landscape/study area 27% of religious places are accessed through forest trails, 24% of religious places are accessed through forest roads and 26% of religious places are accessed through major/main roads (NH/SH/District & Village roads) in this landscape (Figure-5.4). These main/major roads are passing/cutting through the elephant movement corridors and reserve forested areas.

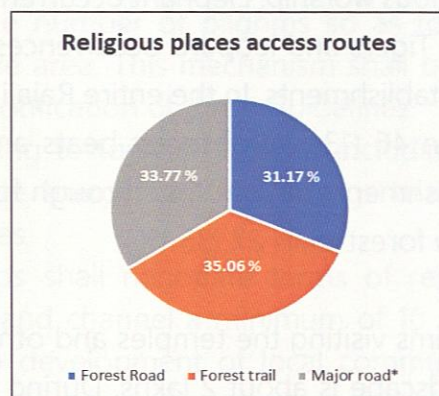


Figure-5.4: Access routes for PRWs (*major road: NH/SH road or main road)



Distance to the PRW from the forest boundary or nearest access route.

The distance from forest boundary or closest the access route to PRW in the Rajaji Landscape was evaluated. Distance was categorized into six different categories namely (i) 0-0.5 (ii) 0.5-1 (iii) 1-2 (iv) 2-3 (v) 3-4 and (vi) 4 & above (Table-5). Among 48 PRWs, there were 34 PRWs comes within < - 0.5 km from the forest boundary or nearest access route. and 2 PRWs were comes within 4 & above km from the forest boundary or nearest access route (Table-5.7).

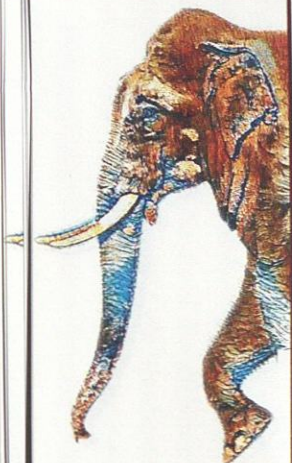
Table-5.7: Table of Place of religious worship (PRW) are present inside and outside the forest in Rajaji Landscape.

Place of Religious Worship (PRW)		
No. of PRW Inside of Forest	Distance to PRW	No. of PRW
48	< - 0.5 (km)	34
	< 0.5 - 1 (km)	9
	< 1 - 2 (km)	2
	< 2 - 3 (km)	1
	< 3 - 4 (km)	0
	< 4 & above (km)	2

5.7 Summary

The total number of places of religious worship with potential impact for wildlife in the entire Rajaji Landscape is 77. Amongst these, in 58 establishments are right inside the forests and the remaining 19 establishments are outside the forests, but have potential influence on wildlife owing to either proximity to forests or having access through the forest. Wild animal presence was reported in all the 77 places of religious worship. Elephant occurrence was reported from 33 (43%) establishments. Tigers and leopard occurrences were reported from 40 (52%) and 73 (95%) establishments. In the entire Rajaji Landscape, places of religious worship occur in 46 (13.6%) of forest beats and 18 (58%) of forest ranges. Numerous establishments have access through forest roads 24 (31.2%) and even through narrow forest trails 27 (35.1%)

The average annual pilgrims visiting the temples and other places of religious worship in the Rajaji Landscape is about 2 lakhs. During the Half-Kumbh that is celebrated once in 6 years, over 20 lakh people visit temples in and around



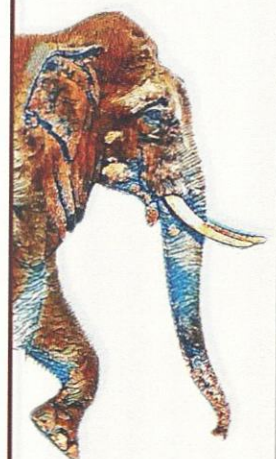
Rajaji Landscape. During the Maha-Kumbh event that is celebrated once in 12 years, about 70 to 90 lakh pilgrims visit Rajaji Landscape. The peak pilgrim visitation occurs during two seasons namely (i) March to May and (ii) August to November. There is a high overlap of areas demarcated for Kumbh and elephant habitats as recorded during a recent study involving radio collaring of elephants (Nigam et al 2022). This spatial overlap can potentially turn into acute conflict resulting in untoward incidences.

5.8 Management recommendations

Religious tourism has the potential to reinforce cultural underpinnings of nature conservation as practiced in India besides enabling public appreciation of nature, unregulated pilgrimage in wildlife habitats. However, unregulated religious tourism/pilgrimage in forests can pose a challenge to \ conservation as elephants can abandon habitats with chronic biotic pressure resulting in surfacing of human–elephant conflict. Taking note of the challenges posed by temples and other religious establishments in the tiger reserves, the National Tiger Conservation Authority (NTCA) had issued a set of guidelines during 2012 (F.No: 15-31/2012-NTCA dated 15th October 2012) under Section 38(O)(1)(c) of the Wildlife (Protection) Act, 1972.

The guidelines had envisaged the following (copied from the guidelines without any change)

1. Pilgrim sites located inside tiger reserves shall be in accordance with the Forest (Conservation) Act, 1980, Wild Life (Protection) Act, 1972 and the Environment (Protection) Act, 1986 to prevent any further expansion. This shall be periodically reviewed.
2. All transit camps and places of stay for such pilgrimage shall be restricted to nominated days in a year. The protected area managers shall work with the temple authorities to develop a system for controlling the number of pilgrims so as to maintain the ecological integrity of the area. This mechanism shall be developed within three years of the notification of these Guidelines.
3. All rules relating to tourism facilities including noise, building design, use of alternate energy and free passage to wildlife shall apply to such pilgrim facilities.
4. Temple boards shall negotiate terms of revenue sharing with local communities and channel a minimum of 10 percent of gross revenue collected into development of local communities through the Gram Sabha.



- The tourist operators, drivers and temple controlling authorities shall be given an exposure on the value of forest ecosystem and their ecological services and along with the do's and don'ts during visits to forests and tiger reserves.

Since most of the Rajaji Landscape come under the Rajaji Tiger Reserve, the aforementioned guidelines readily apply. The LTPP is in full conformity with the aforementioned recommendations from the elephant standpoint as well.

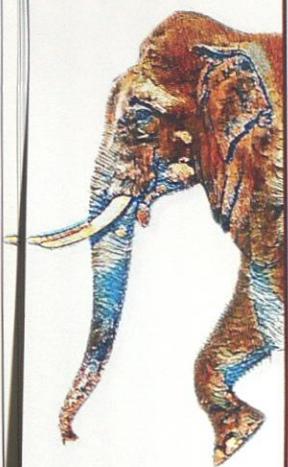
While religious tourism has the potential to reinforce cultural underpinnings of nature conservation as practiced in India besides enabling public appreciation of nature, unregulated pilgrimage in wildlife habitats can pose a challenge to elephant conservation as elephants can abandon habitats with chronic biotic pressure resulting in surfacing of human–elephant conflict. Measures to minimize the threats posed by places of religious worship are deliberated.

Hitherto, the temple committees and other religious institutions have not proactively engaged with the forest department in regulating pilgrims and maintaining the integrity of local ecology. Forest department with lean headcount of staff cannot be expected to regulate pilgrims and their activities. Given the huge biotic imprint of places of religious workshop on wildlife habitats in Rajaji Landscape, the LTPP favors vesting substantial responsibility and sharing of resources by committees of the religious worship to maintain the integrity of forests as envisaged by NTCA guidelines issued during 2012.

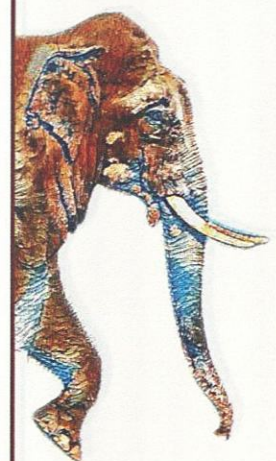
The indiscriminate use of forest roads and trails by tourists visiting places of religious worship poses a huge risk of fatal encounters with wildlife. The situation calls for regulating/restricting use of forest roads and trails by tourists. There are also instances of forest trails being used as roads (Table-5.8) by clearing vegetation, which need to be curtailed.

Table-5.8: Details of forest trails being used as roads.

S. No	Trail/Road	Access Route	Division and Range	Recommendation
1.	Trail (and not a road) Neelkanth Mahadev Temple	Forest trail (through Gohri range – Moni Baba Ashram to Neelkanth Mahadev Temple)	Rajaji TR; Gohri range	There is a safe alternative road. Therefore, this trail needs to be closed for public considering safety issues. The trail is heavily used by elephants and tigers

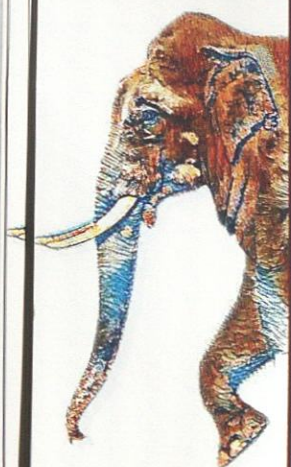


S. No	Trail/Road	Access Route	Division and Range	Recommendation
2.	Forest dirt road (and not a road) Maa Vindhyavasini Adhishakti Pith Sharad Devi Temple	Access through forest dirt road from Ganga Bhogpur village of Chilla range of Rajaji Tiger Reserve.	Rajaji TR; Chilla Range	There is an alternative road in the making. Therefore, this trial needs to be permanently closed considering the heavy use of elephants and tigers in the area.
3.	Forest Road. Kunao barrage (Rishikesh) to Garudh Chatti temple (through Gohri range)	Kunao barrage barricade to Garudh Chatti road passing completely through Gohri range of Rajaji Tiger Reserve.	Rajaji TR; Chilla Range	Considering the heavy elephant use and availability of alternative road (passing through Laxman Chula and Chaurasi Kutia), this road needs to be closed permanently
4.	Jhilmil Jheel Gufa and Shree Ganesh Temple Road	A trail cuts off the main village road passing from Nilkant. The trail leads to Jhilmil Jheel Gufa. The trail is being made as road.	Lansdowne FD; Laldang Range	The trail is being widened as a road. This should not be allowed. Further, public use of the trail should be regularized
5.	Shree Sit Sot Maharaj Ashram forest trial	Najibabad Highway passing through Sid Soth Gujjar Dehrad	Rajaji TR; Shyampur Range	This is a trial, but illegally widened by Ashram and Gujjar Dehra. There is high pressure from pilgrims and Gujjar cattle. The trial needs to be closed for outsiders
6.	Shree Siddh Maharaj Kutiya forest road/trail	Access route from Chidiyapur village through forest till the Maharaj Kutiya	Haridwar FD; Chidiyapur Range	The trial is illegally widened as a road and being indiscriminately used. The trial needs to be shut down
7.	Shyampur canal road	Access by Kavadi yatri and the Kumbh pilgrims.	Haridwar FD; Shyampur Range, Jhilmil Jheel Range and Chidiyapur Range	Public use of the road should be completely disallowed.



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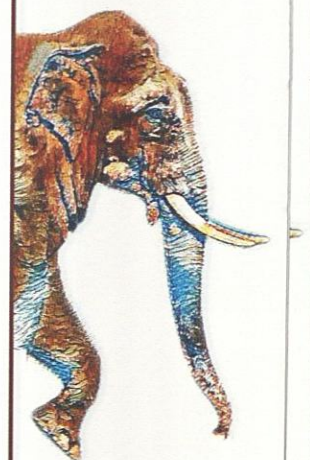
Annexure - I

Users and Utility of the LTPP

The LTPP for mitigating HEC in and around RTR, is a document that will be use or utility not only for mitigating HEC, by the main stakeholders Uttarakhand Forest Department, but can also be used by all other Government departments, Kumbh Festival Committee/Authority, Other Place of Religious Worship, NGOs, research and academic institutions. The details on the different users and the utility of this document are given in the table below (Table 6.1).

Table 6.1: List of Departments, Organizations, Authorities, and Institutions that can Use this LTPP

S. No	Department/Organization/ Authority	Govt./NGO/Institutions/ Religious	Use & Utility
1	Uttarakhand Forest Department	State Government	Managing HEC/Planning/ Developing/ Research/Relocation of Gujjars & other villages
2	Uttar Pradesh Forest Department	State Government	Coordinated Interstate Managing /Planning/Developing/ Research
3	Project Elephant	MoEF&CC	Planning/Managing/Research
4	Elephant Cell	MoEF&CC	Planning/Managing/Research
5	National Highway Authority	Central Government	Planning/Developing
6	State Highway Department	State Government	Planning/Developing
7	Public Works Department	State Government	Planning/Developing
8	Indian Railways	Central Government	Planning/Developing
9	District Collector	State Government	Managing/Planning/Developing / Relocation of Gujjars & other Villagers
10	Agriculture Department	State Government	Planning/Developing
11	District Rural Development	State Government	Planning/Developing
12	Urban Development	State Government	Planning/Developing
13	Kumbh Mela Organizing & Management Committee/Authority	Central & State Government	Planning/Developing/Managing
13	Place of Religious Worship Authority/Committees	Religious Authority/Committee	Planning/Developing/Managing
14	Government Institutes	Central Government Research Institutes	Academic Research & Monitoring
15	Government Institutes	State Government Research Institutes	Academic Research & Monitoring
16	NGOs – Research Organization	National and International	Academic Research & Monitoring
17	Universities & Colleges	Central & State Government/Private	Academic Research & Monitoring
18	Local Communities	Village Institutions	Planning/Developing/Managing



Annexure - III

Data sheet on recording human fatality by elephants

CONFLICT REPORTING: HUMAN CASUALTY DUE TO ELEPHANTS

TODAY'S DATE: ___ / ___ / _____ FORM NUMBER: _____

DIVISION: _____ RANGE: _____

BEAT / COMPT NO.: _____ PA/RF/OTHER: _____

Others (Which?) _____

INCIDENT PARTICULARS

DATE & TIME OF INCIDENT: ___ / ___ / _____ ; _____

GPS OF INCIDENT SITE'S: _____

NEAREST HOUSE (DISTANCE ANY METRIC): _____

DETAILED DESCRIPTION OF THE INCIDENT SITE: CROP LAND/IN FOREST/ FOREST EDGE/
OPEN LAND/ ON ROAD / OTHER (WHAT?)

DETAILS OF THE FIRST REPORTER: NAME _____ WHETHER WITH
VICTIM? YES/NO; IF YES HOW IT HAPPENED? _____

IF NO - TIME OF FIRST DETECTING OF THE INCIDENT: _____

METHOD OF DETECTION OF THE INCIDENT: DIRECTLY SEEN / HEARD / SEEN ELEPHANT /
DOGS BARKED / OTHERS

NOTE: _____

DETAILS OF FRUITING TREE AROUND INCIDENT SITE: _____

CROPS CULTIVATED AND STAGE: _____ CROP _____ STAGE _____

VICTIM PARTICULARS:

NAME, AGE, GENDER AND ETHNICITY:

CONDITION OF THE VICTIM: NORMAL / HANDICAP / UNWELL-WEAK / MENTALLY UNSTABLE

WHAT WAS THE VICTIM DOING IN THE INCIDENT SITE?

CONDITION OF THE CORPOSE / SEVERELY MANGLED / MANGLED / SEVERELY INJURED /
MIDLY INJURED / NO EXTERNAL INJURIES

NOTE: _____

DESCRIPTION OF VICTIM'S GARMENTS, EYEWITNESS AND THEIR STATEMENT:

WILDLIFE INSTITUTE OF INDIA

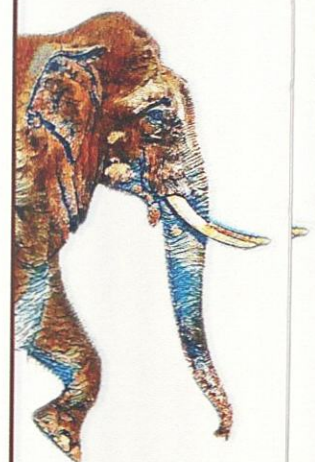
ELEPHANT DETAILS

GROUP SIZE: _____ FAMILY HERD (WITH CALF) _____ ALL MALE GROUP
SOLITARY ELEPHANT _____ NOT CLEAR

GROUP SIZE: _____

ELEPHANT MOVEMENT: _____ CAME FROM _____
HEADED _____ TOWRDS _____

ELEPHANT IDENTIFICATION



DUNG PARTICULARS: ADULTS SUB-ADULTS JUVENILES INFANTS
ELEPHANT SIGNS NEAR INCIDENT ID SITE:
DIMETER OF FAREFOOT _____
DIMETER OF DUNG: _____
REMARK: _____

WERE VILLAGERS AWARE THAT THE ELEPHANTS WERE AROUND IN THE VICINITY?

DETAILED FILED NOTES:

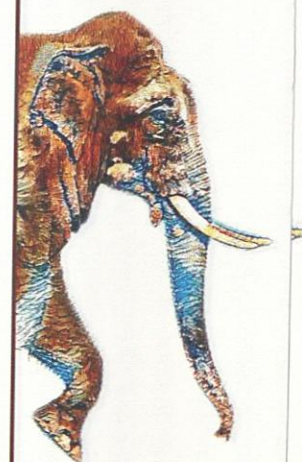


Annexure - IV

Data sheet for individual identification of elephants

Elephant Identification and Profiling

Date of Identity Card				
Profile Created By				
Elephant ID Number (State – UK, Male – Female – F, Number: 001 – 999)				
Elephant Name (If already existing)				
Age & Sex	Adult Male-AM	Adult Female – AF		
Photographer				
Details when Photographed First	GPS			
	Location		Range/FD	
	Date		Habitat	
Height	Front foot circumference: Not measured		Estimated shoulder height: Not measured	
Estimated Age	>50 years (possibly a matriarch of a small family)			
Left Profile Photograph				
Photo Details				
Right Profile Photograph				
Photo Details				
Front Photo			Rear Photo	
Photo Details				
Tusk/Tush		Right	Left	
(i) Arrangement (parallel, divergent, convergent, crossed)				
(ii) Direction to ground (parallel, angled down 30°, angled down 60°, angled down straight)				
(iii) Length (long, medium, short)				
(iv) Thickness (thick, intermediate, slender)				
Ear Pinnae		Right	Left	
(i) Size				
(ii) Fold orientation				
(iii) Fold type				



Annexure - V

Data sheet for monitoring elephants

Monitoring of Elephant & Population

Name of Reporter				Date: / /	Time Sighted	
ID of Elephant				Solitary/Group	Total no .of Elephants -	
Age & Sex	Adult Male -	Adult Female -	SAM	SAF	Calf	
Compartment/Beat				Location – GPS		
Range				Lat	Long	
Division						
PA	RF	Forest Edge				
Habitat	Forest	Human Habitation		Agriculture field		
Forest Status	Dense	Semi Dense		Open		
	Scrubby					
Activity	Feeding	Moving		Resting		
	Drinking	Mud Bath				
Distance to water (metric)	0-100 m	100-500 m	500 – 1000 m	>1000 m		
Distance to Human Settlement/Habitation	0-100 m	100-500 m	500 – 1000 m	>1000 m		
Distance from Forest Boundary	0-100 m	100-500 m	500 – 1000 m	>1000 m		
Weed & Exotic Status	Nil	Poor	Moderate	High		
	Species –					
Threats	Fire	Wood Cut	Lopping	Grazing	Livestock	
No. of Dung Piles Seen	Fresh -		Old		Old Dry	
Other Animals Seen	Tiger		Leopard		Sloth Bear	
	Black Bear		Sambar		Chital	
	Barking Deer		Hog Deer		Common Langur	
	Rhesus Macaque		Jackal			
Notes:						



Annexure - VI

Places of religious worship (PRWs) in Rajaji Landscape

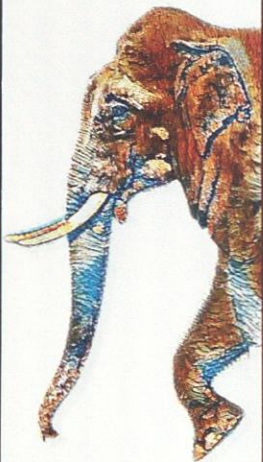
SN.	Name of Religious Worship	Latitude	Longitude	Division	Range	Beat
1	Shiv Shakti Temple	29.97442	78.21395	RTR	Chilla	Chilla Beat
2	Jama Masjid	29.97451	78.21469	RTR	Chilla	Chilla Beat
3	Lal Sot Majar	29.99494	78.24674	RTR	Chilla	Andheri
4	Mota Mahadev Temple	30.00653	78.25075	RTR	Chilla	Gohri_Beat
5	Maa Vindhyavasini Adhishakti Pith Sharada Devi Temple	29.99635	78.31776	RTR	Chilla	Dugadda
6	Loha Siddh Baba Temple	29.98574	78.30522	RTR	Chilla	Dugadda
7	Shiv Shakti Sankat Mochan Temple	29.95562	78.18270	RTR	Chilla	Chilla beat
8	Jai maa daat kali temple	30.23847	77.95844	RTR	Chillawali	Patharsot Beat
9	Shree Bhootnath Mahadev Temple	30.11658	78.31804	RTR	Gohari	Laxmanjhula Beat
10	Maa Vindhyavasini Devi Temple Siddhpith	30.02286	78.25055	RTR	Gohari	Khadari Beat
11	Shiv Temple Barraje	30.06923	78.28950	RTR	Gohari	Khadari Beat
12	Moni baba Ashram Kuti	30.10217	78.32184	RTR	Gohari	Churrnigarh Beat
13	Tatwala Baba Ashram	30.11596	78.32128	RTR	Gohari	Laxmanjhula Beat
14	Garudh Chatti Temple	30.12570	78.35364	RTR	Gohari	Laxmanjhula Beat
15	Shree Ganesh Gufa	30.05800	78.33744	RTR	Gohari	Bidasani Beat
16	Shree Hanuman Temple	30.06296	78.33783	RTR	Gohari	Bhaun_Beat
17	Jhilmil Gufa	30.06069	78.33761	RTR	Gohari	Bidasani Beat
18	Bilkeshwar Mahadev Temple	29.95422	78.15535	RTR	Haridwar	Mayapur East Beat
19	Shree Gauri kund Tapathsal	29.95566	78.15493	RTR	Haridwar	Mayapur East Beat
20	Shree Bhikshu Kutiya	29.95616	78.15499	RTR	Haridwar	Mayapur East Beat
21	Hajrat Saiyad Sultana Shah Zabari Pir	29.94306	78.13941	RTR	Haridwar	Mayapur West Beat
22	Siddhpith Shree Sureshwari Devi Temple	29.96978	78.10723	RTR	Haridwar	Ranipur West Beat
23	Shree Manasa Devi Mata Temple	29.95778	78.16530	RTR	Haridwar	Mayapur East Beat
24	Maa Bhagavati Temple (Laldhang)	29.78773	78.37064	RTR	Laldang	South Papidanda II Beat



SN.	Name of Religious Worship	Latitude	Longitude	Division	Range	Beat
25	Khaki Baba Temple	29.85400	78.31789	RTR	Laldang	Chamriya II Beat
26	Siddh Baba Temple	29.82245	78.32385	RTR	Laldang	Jaspur I Beat
27	Shri Satyanarayan Temple	30.04824	78.21452	RTR	Motichor	Gular Padawa East Beat
28	Kalu siddh Pir	30.00203	78.20986	RTR	Motichor	Military
29	Jamal Kamal Pir	29.85651	78.32395	RTR	Rawasan	Rawasan Beat
30	Maa Bhagavati Vasanti Devi Temple	30.01316	78.22360	RTR	Settlement	Settlement
31	Bramhalin Naga Baba Mahipat Giriji Maharaj Temple	30.00964	78.22117	RTR	Settlement	Settlement
32	Hanuman Temple	30.01392	78.22330	RTR	Settlement	Settlement
33	Shree Laxmi narayan Temple	30.03434	78.23328	RTR	Settlement	Settlement
34	Shree Anjani Devi Mata Temple	29.93398	78.18250	RTR	Shyampur	Chandi Beat
35	Shree Sit sot Maharaj Ashram	29.91091	78.19875	RTR	Shyampur	Chandi Beat
36	Bheda wali strot	29.86334	78.23776	RTR	Shyampur	Peli I Beat
37	Loha Siddh Temple	29.86749	78.24838	RTR	Shyampur	Kansavali Beat
38	Shree Mundal Devata Temple	29.88538	78.18882	RTR	Shyampur	Shyampur Beat
39	Shree Chandi Devi Temple	29.93371	78.17996	RTR	Shyampur	Chandi Beat
40	Bhuresa baba	30.06626	78.20981	DFD	Rishikesh	Gola_East
41	Oneshwar Maharaj Temple	30.07145	78.20256	DFD	Badkot	Chandi
42	Himalaya Devi Mata Temple	30.06924	78.19853	DFD	Badkot	Chandi
43	Shri Maa Bhadrakali Temple	30.10509	78.17432	DFD	Badkot	Jakhan-I
44	Bhakt Ravidas Sheragarh Jakhan - Doiwala	30.10381	78.15988	DFD	Badkot	Chandi
45	Singh Sabha Sheragarh - Lal Tappar	30.11298	78.14476	DFD	Lachhiwala	Shergarh-II
46	Jwaleshwar Mahadev Shiv Temple (Old Shiv Temple)	30.19751	78.08230	DFD	Lachhiwala	Semlas
47	Manimai Temple	30.21700	78.12324	DFD	Lachhiwala	Kuwawala
48	Shri Laxman Siddh Temple	30.24746	78.08363	DFD	Lachhiwala	Dulhani
49	Bhuiyan Temple	30.22350	78.19538	DFD	Thano	Danda
50	Shree Chaitanya Mahaprabhu Gaudiya Math	30.22933	78.20793	DFD	Thano	Danda



SN.	Name of Religious Worship	Latitude	Longitude	Division	Range	Beat
51	Shiv Temple Medhawala	30.22804	78.19950	DFD	Thano	Danda
52	Siddhpith Mahamaya Mata Bala Sudari Temple	30.24396	78.20607	DFD	Thano	Thano
53	Kalusiddh Temple	30.22409	78.14979	DFD	Thano	Kaluwala
54	Maa Manas Devi	30.16643	78.23920	DFD	Badkot	Sainkot-I
55	Kali Devi Temple	30.13391	78.25030	DFD	Badkot	Sainkot-II
56	Kuti	30.04229	78.24826	DFD	Rishikesh	Birbhadra
57	Shree Durga Mata Temple	30.04774	78.24302	DFD	Rishikesh	Birbhadra
58	Siddhpith Dakshin Kalikanand Temple	29.94509	78.17499	HFD	Hardwar	Devpura Ahatmal
59	Pai Khan	29.94634	78.17527	HFD	Hardwar	Hardwar
60	Shree Shanidev Temple	29.94236	78.12924	HFD	Hardwar	Devpura Ahatmal
61	Kaila Mata Temple	29.94079	78.13237	HFD	Hardwar	Hardwar
62	Shree Shanidev Temple (Devpura_Ahatmal)	29.93891	78.17501	HFD	Hardwar	Hardwar
63	Ravidas Temple	29.94241	78.12799	HFD	Hardwar	Hardwar
64	Gauri Kund Temple	29.92883	78.17535	HFD	Hardwar	Devpura Ahatmal
65	Nileshwar Mahadev Temple	29.92719	78.17561	HFD	Hardwar	Devpura Ahatmal
66	Saiyad Pir	29.84732	78.26172	HFD	Shyampur	NF
67	Shiv Seva Ashram & Durga Mata Temple	29.84566	78.29938	HFD	Chiriyapur	Gandikhata-II
68	Maa kali Prachin Siddhapith	29.85617	78.31476	HFD	Chiriyapur	Gandikhata-II
69	Maa Kali Temple	29.76225	78.27874	HFD	Chiriyapur	Sherpur
70	Shiv Temple and Gaushala	29.74284	78.21080	HFD	Chiriyapur	NF
71	Shree Siddh Maharaj Kutiya	29.75778	78.21726	HFD	Chiriyapur	Amsot
72	Shree Soteshwar Maharaj Temple	29.84918	78.18601	HFD	Shyampur	NF
73	Shree Siddhapith Shanidham	29.86493	78.18556	HFD	Shyampur	NF
74	Shree Nilkanth Mahadev Temple	30.08110	78.34074	LFD	Laldang	NF
75	Adhishakti Pith Sharada Devi Temple (Chhoti Behen)	29.99656	78.32869	LFD	Laldang	NF
76	Hanuman Temple (Chillarkhal)	29.78532	78.38489	LFD	Laldang	South Papidanda II Beat
77	Maa Manichha Devi Temple	30.16631	78.24528	NFD	Shivpuri	Khusralla - 1



Annexure - VII

Month-wise classification of pilgrim visitation

Rajaji Tiger Reserve (RTR)

SN	Name of the religious place (RTR)	Months											
		January	February	March	April	May	June	July	August	September	October	November	December
1	Shree Bhootnath Mahadev Temple	J	F	M	A	M	J	J	A	S	O	N	D
2	Shiv Shakti Temple	J	F	M	A	M	J	J	A	S	O	N	D
3	Jama Masjid	J	F	M	A	M	J	J	A	S	O	N	D
4	Lal Sot Majar	J	F	M	A	M	J	J	A	S	O	N	D
5	Mota Mahadev Temple	J	F	M	A	M	J	J	A	S	O	N	D
6	Maa Vindhyavasini Devi Temple Siddhpith	J	F	M	A	M	J	J	A	S	O	N	D
7	Maa Vindhyavasini Adhishakti Pith Sharada Devi Temple	J	F	M	A	M	J	J	A	S	O	N	D
8	Loha Siddh Baba Temple	J	F	M	A	M	J	J	A	S	O	N	D
9	Shiv Temple Barraje	J	F	M	A	M	J	J	A	S	O	N	D
10	Moni baba Ashram Kuti	J	F	M	A	M	J	J	A	S	O	N	D
11	Tatwala Baba Ashram	J	F	M	A	M	J	J	A	S	O	N	D
12	Garudh Chatti Temple	J	F	M	A	M	J	J	A	S	O	N	D
13	Shree Ganesh Gufa	J	F	M	A	M	J	J	A	S	O	N	D
14	Shree Hanuman Temple	J	F	M	A	M	J	J	A	S	O	N	D
15	Bilkeshwar Mahadev Temple	J	F	M	A	M	J	J	A	S	O	N	D
16	Shree Gauri kund Tapathsal	J	F	M	A	M	J	J	A	S	O	N	D
17	Shree Bhikshu Kutiya	J	F	M	A	M	J	J	A	S	O	N	D
18	Hajrat Saiyad Sultana Shah Zabari Pir	J	F	M	A	M	J	J	A	S	O	N	D
19	Siddhpith Shree Sureshwari Devi Temple	J	F	M	A	M	J	J	A	S	O	N	D
20	Shri Satyanarayan Temple	J	F	M	A	M	J	J	A	S	O	N	D
21	Kalu siddh Pir	J	F	M	A	M	J	J	A	S	O	N	D
22	Maa Bhagavati Vasanti Devi Temple	J	F	M	A	M	J	J	A	S	O	N	D

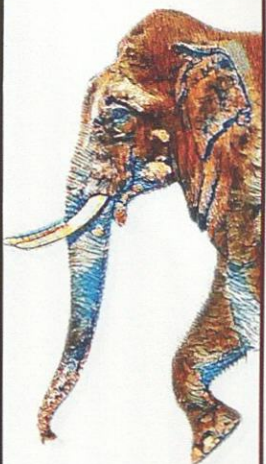


Perspective Plan to Manage
Human-Elephant Conflict in Rajaji Landscape
(2023 – 2033)

SN	Name of the religious place (RTR)	Months											
		January	February	March	April	May	June	July	August	September	October	November	December
23	Bramhalin Naga Baba Mahipat Giriji Maharaj Temple	J	F	M	A	M	J	J	A	S	O	N	D
24	Hanuman Temple	J	F	M	A	M	J	J	A	S	O	N	D
25	Shree Anjani Devi Mata Temple	J	F	M	A	M	J	J	A	S	O	N	D
26	Shree Manasa Devi Mata Temple	J	F	M	A	M	J	J	A	S	O	N	D
27	Shree Laxmi narayan Temple	J	F	M	A	M	J	J	A	S	O	N	D
28	Shree Sit sot Maharaj Ashram	J	F	M	A	M	J	J	A	S	O	N	D
29	Bheda wali strot	J	F	M	A	M	J	J	A	S	O	N	D
30	Loha Siddh Temple	J	F	M	A	M	J	J	A	S	O	N	D
31	Jamal Kamal Pir	J	F	M	A	M	J	J	A	S	O	N	D
32	Maa Bhagavati Temple (Laldhang)	J	F	M	A	M	J	J	A	S	O	N	D
33	Jai maa daat kali temple	J	F	M	A	M	J	J	A	S	O	N	D
34	Jhilmil Gufa	J	F	M	A	M	J	J	A	S	O	N	D
35	Shiv Shakti Sankat Mochan Temple	J	F	M	A	M	J	J	A	S	O	N	D
36	Khaki Baba Temple	J	F	M	A	M	J	J	A	S	O	N	D
37	Siddh Baba Temple	J	F	M	A	M	J	J	A	S	O	N	D
38	Shree Mundal Devata Temple	J	F	M	A	M	J	J	A	S	O	N	D
39	Shree Chandi Devi Temple	J	F	M	A	M	J	J	A	S	O	N	D
		<i>Note: Size of pilgrim category-wise in colour codes</i>											
			10 -100						100 – 500				
			500 – 2000						2000 – 5000				
			5000 – 10000						10000 & above				

Dehradun Forest Division (DFD)

S. No	Name of the religious place (DFD)	Months											
		January	February	March	April	May	June	July	August	September	October	November	December
1	Bhuresa Baba	J	F	M	A	M	J	J	A	S	O	N	D
2	Oneshwar Maharaj Temple	J	F	M	A	M	J	J	A	S	O	N	D
3	Himalaya Devi Mata Temple	J	F	M	A	M	J	J	A	S	O	N	D
4	Shri Maa Bhadrakali Temple	J	F	M	A	M	J	J	A	S	O	N	D



S. No	Name of the religious place (DFD)	Months											
		January	February	March	April	May	June	July	August	September	October	November	December
5	Bhakt Ravidas Sheragarh Jakhan – Doiwala	J	F	M	A	M	J	J	A	S	O	N	D
6	Singh Sabha Sheragarh - Lal Tappar	J	F	M	A	M	J	J	A	S	O	N	D
7	Jwaleshwar Mahadev Shiv Temple (Old Shiv Temple)	J	F	M	A	M	J	J	A	S	O	N	D
8	Manimai Temple	J	F	M	A	M	J	J	A	S	O	N	D
9	Shri Laxman Siddh Temple	J	F	M	A	M	J	J	A	S	O	N	D
10	Bhuiyan Temple	J	F	M	A	M	J	J	A	S	O	N	D
11	Shree Chaitanya Mahaprabhu Gaudiya Math	J	F	M	A	M	J	J	A	S	O	N	D
12	Shiv Temple Medhawala	J	F	M	A	M	J	J	A	S	O	N	D
13	Siddhpith Mahamaya Mata Bala Sudari Temple	J	F	M	A	M	J	J	A	S	O	N	D
14	Kalusiddh Temple	J	F	M	A	M	J	J	A	S	O	N	D
15	Maa Manas Devi	J	F	M	A	M	J	J	A	S	O	N	D
16	Kali Devi Temple	J	F	M	A	M	J	J	A	S	O	N	D
17	Kuti	J	F	M	A	M	J	J	A	S	O	N	D
18	Shree Durga Mata Temple	J	F	M	A	M	J	J	A	S	O	N	D
		<i>Note: Size of pilgrim category-wise in colour codes</i>											
			10 - 100						100 - 500				
			500 - 2000						2000 - 5000				
			5000 - 10000						10000 & above				

Haridwar Forest Division (HFD)

S. No	Name of the religious place (HFD)	Months											
		January	February	March	April	May	June	July	August	September	October	November	December
1	Siddhpith Dakshin Kalikanand Temple	J	F	M	A	M	J	J	A	S	O	N	D
2	Pai Khan	J	F	M	A	M	J	J	A	S	O	N	D
3	Shree Shanidev Temple	J	F	M	A	M	J	J	A	S	O	N	D
4	Kaila Mata Temple	J	F	M	A	M	J	J	A	S	O	N	D
5	Shree Shanidev Temple (Devpura_Ahatmal)	J	F	M	A	M	J	J	A	S	O	N	D
6	Ravidas Temple	J	F	M	A	M	J	J	A	S	O	N	D



Perspective Plan to Manage
Human-Elephant Conflict in Rajaji Landscape
(2023 - 2033)

S. No	Name of the religious place (HFD)	Months											
		January	February	March	April	May	June	July	August	September	October	November	December
7	Gauri Kund Temple	J	F	M	A	M	J	J	A	S	O	N	D
8	Nileshwar Mahadev Temple	J	F	M	A	M	J	J	A	S	O	N	D
9	Saiyad Pir	J	F	M	A	M	J	J	A	S	O	N	D
10	Shiv Seva Ashram & Durga Mata Temple	J	F	M	A	M	J	J	A	S	O	N	D
11	Maa kali Prachin Siddhapith	J	F	M	A	M	J	J	A	S	O	N	D
12	Maa Kali Temple	J	F	M	A	M	J	J	A	S	O	N	D
13	Shiv Temple and Gaushala	J	F	M	A	M	J	J	A	S	O	N	D
14	Shree Siddh Maharaj Kutiya	J	F	M	A	M	J	J	A	S	O	N	D
15	Shree Soteshwar Maharaj Temple	J	F	M	A	M	J	J	A	S	O	N	D
16	Shree Siddhapith Shanidham	J	F	M	A	M	J	J	A	S	O	N	D
		<i>Note: Size of pilgrim category-wise in colour codes</i>											
		10 -100						100 - 500					
		500 - 2000						2000 - 5000					
		5000 - 10000						10000 & above					

Lansdowne Forest Division (LFD)

S. No	Name of the religious place (LFD)	Months											
		January	February	March	April	May	June	July	August	September	October	November	December
1	Shree Nilkanth Mahadev Temple	J	F	M	A	M	J	J	A	S	O	N	D
2	Adhishakti Pith Sharada Devi Temple (Small Sister)	J	F	M	A	M	J	J	A	S	O	N	D
3	Hanuman Temple (Chillarkhal)	J	F	M	A	M	J	J	A	S	O	N	D
		<i>Note: Size of pilgrim category-wise in colour codes</i>											
		10 -100						100 - 500					
		500 - 2000						2000 - 5000					
		5000 - 10000						10000 & above					



Narendranagar Forest Division (NFD)

S. No	Name of the religious place (NFD)	Months											
		January	February	March	April	May	June	July	August	September	October	November	December
1	Maa Manichha Devi Temple	J	F	M	A	M	J	J	A	S	O	N	D
<i>Note: Size of pilgrim category-wise in colour codes</i>													
			10 -100						100 – 500				
			500 – 2000						2000 – 5000				
			5000 – 10000						10000 & above				



Annexure - VIII

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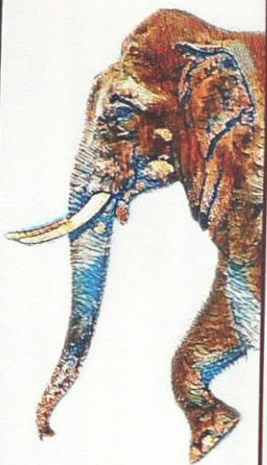
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