Ministry of Environment, Forest & Climate Change

PROJECT ELEPHANT
GOVT. OF INDIA

भारतीय वन्यजीव संस्थान
Wildlife Institute of India

FRAMEWORK FOR PREPARATION OF ELEPHANT CONSERVATION PLAN (ECP) FOR THE ELEPHANT RESERVES

Project Elephant, Ministry of Environment, Forests and Climate Change
Government of India & Wildlife Institute of India

ISBN: 978-81-972769-2-7

ISBN (Online): 978-81-972769-6-5

Photo Credit
Devvrat Singh (Cover Photo), Lakshminarayanan, N., Mradul Pathak
Kushgra Meshram, Udaiveer Singh, Bivash Pandav

Layout, Graphics, Design & Illustrations
Ritesh Vishwakarma, Senior Project Associate, WII

Citation: PE-WII-MoEF&CC (2024). *Framework for preparation of Elephant Conservation Plan for the Elephant Reserves. Technical Report, Project Elephant* & Wildlife Institute of India*, Ministry of Environment, Forests and Climate Change, Government of India.*

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ACKNOWLEDGEMENT

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PREFACE

The Asian elephant (*Elephas maximus*) is India's National Heritage Animal. Elephants hold a significance in the ecological, cultural, and economic landscapes of the regions they inhabit. As flagship and keystone species in biodiversity conservation, elephants play a critical functional role in the ecosystems they occupy. Activities such as seed dispersal and habitat modification, support the survival of numerous other species. Due to their voluminous feeding habits, elephants play an effective role in the nutrient cycling in tropical forests. Despite their ecological significance, elephant populations are under pressure from the synergistic effects of habitat loss, human-wildlife conflict, and poaching for ivory. The urgent need for a comprehensive and effective conservation strategy has always been apparent.

Due to large range requirement, elephant conservation entails effective management of relatively large areas that may encompass multiple administrative units. Considering this, the Elephant Reserves involve an integrated landscape approach, which extends beyond Protected Areas, multiple-use forests, forest plantations, and include elephant corridors and zones where human-elephant interactions are frequent. Three essential constituents considered for managing elephant landscapes are (i) protecting intact forest habitats (ii) identifying and protecting corridors that connect otherwise discrete forest habitats and (iii) effectively managing human-elephant conflicts in the interface areas where elephants could have profound influence on local communities and vice-versa. Thus, any sort of management plan should essentially deal with all the three aspects discussed above and provides a comprehensive roadmap for the managers to follow. Such a comprehensive document that encompasses myriad aspects relevant for managing elephants and their landscapes that typically involve large spatial scales has been missing for long. Taking note of this gap, the Project Elephant embarked on the task of preparaing a framework that can be used in drafting Elephant Conservation Plan for Elephant Reserves of our country. The framework for an Elephant Conservation Plan is primarily developed with the aim of providing a structured approach to address the management needs for elephants. The framework is prepared taking into account an understanding of the elephant ecology, the socio-economic factors influencing their conservation, and the latest scientific research and conservation practices.

The Elephant Conservation Plan, besides providing an approach for landscape-level management of the Elephant Reserves, will be an overarching plan in the implementation areas under different management regimes viz. Tiger Conservation Plan in the Tiger reserves; Management Plan of Protected Areas; Traditional forestry management as per Working Plan; and Zonal Master Plan of Eco-sensitive Zones. The challenge is to integrate different planning processes in not only achieving the goal of sustainable forest management but also of wildlife conservation with conservation emphasis on elephants.

The implementation of the Elephant Conservation Plan will help in addressing various conservation issues dealing with the elephants. Some critical thrust areas of the Elephant Conservation Plan include-

Protect and Restore Habitats: Ensuring that elephants have access to large, contiguous, and safe habitats is critical for their survival and this involves habitat restoration, identifying and securing migration corridors, and mitigating human-induced changes.

Mitigate Human-Elephant Conflict: As human populations expand into elephant habitats, conflicts inevitably arise and strategies to minimize these conflicts include community-based conservation programs, the development of early warning systems, and the promotion of coexistence through awareness and incentives.

Combat Poaching and Illegal Trade: Strengthening anti-poaching efforts and disrupting the illegal ivory trade are crucial components of this plan and this includes increasing law enforcement capacity, improving intelligence networks, and enhancing international cooperation.

Promote Sustainable Livelihoods: Engaging local communities in conservation efforts by promoting sustainable livelihoods can reduce dependency on activities that harm elephant populations and the key areas of focus include ecotourism, ecodevelopment, tribal development, sustainable agriculture, and alternative income sources.

Enhance Research and Monitoring: Ongoing research and monitoring are essential to adapt and refine conservation strategies and this includes population monitoring, ecological studies, and the development of new technologies for tracking and protecting elephants.

Foster International Collaboration: Elephants in the northwest and northeast regional populations often cross-national borders, necessitating international cooperation and shared databases, joint conservation initiatives, and harmonized policies for effective conservation of transboundary elephant populations.

This framework is designed to be adaptable, allowing for adjustments based on new findings, changing conditions, and lessons learned from implementation. It recognizes the complex interplay of ecological, social, and economic factors in elephant conservation and seeks to address these holistically.

The development of this framework has been a collaborative effort, drawing on the expertise and experience of wildlife managers, conservationists, researchers, government agencies, non-governmental organizations, and local communities. It reflects a collective commitment that is critical for conserving elephant landscapes and places emphasis on maintaining a holistic perspective considering the interconnectedness of elephants with their habitats and human communities.

Drafting of the guidelines for ECP has been steered by the Elephant Cell at the Wildlife Institute of India. The Wildlife Planning Experts of the Wildlife Institute of India Dr. Sanjay K. Srivastava, Former PCCF & CWLW, Tamil Nadu and Shri. Praveen C. Tyagi, Former PCCF & HoFF, Tamil Nadu made substantial contributions in developing the guidelines for the ECP. The scope of the guidelines for the ECP and its overall appropriateness has improved due to the meticulous reviews by Dr. P.S. Easa, Former Director, KFRI, Shri. S.S. Bist, Former PCCF, West Bengal and Shri. V.B. Sawarkar, Former Director, Wildlife Institute of India. During the course of drafting the document, there were two major consultation workshops with subject matter experts and seasoned foresters whose comments further improved the document.

By implementing this framework, we aim to create a sustainable landscape for elephants where they can thrive in their natural habitats and move freely across habitats with minimal of conflicts with people. The task ahead is formidable, but with concerted effort and unwavering dedication, it is possible to secure a future for elephants.

Ramesh K Pandey
IGF (PT&E) & Director, Project Elephant
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Executive Summary

The Elephant Conservation Plan (ECP) is for the management of large forest tracts / landscape having enormous diversity in the topography, biodiversity, climate, hydrology and edaphic factors. It harbours a spectrum of vegetation types with a variety of habitats ranging from old-growth forests to managed forest. The area has numerous rivers, streams and rivulets, some are perennial providing water-source to the wildlife. The elephant reserves (ER) are constituted into several administrative and functional units, based on their ecological, floral, faunal, geomorphological and natural significance and some lie under the protected area network governed by the Wildlife (Protection) Act, 1972 and others are managed as forest divisions as per the National Working Plan Code, 2023 prescriptions emanating from the Indian Forest Act, 1927 or/ and the State enacted Forest Acts and other environmental legislations.

The elephant reserves have been constituted for achieving the goals and objectives of the 'Project Elephant'. The main focus of the Elephant reserve management is to protect the elephants across the entire range, their habitat and corridors and address issues of human-elephant conflict and eventually ensure long-term conservation of viable populations of the Asian elephant. This can be achieved by the ecological protection and restoration of existing natural habitats and migratory routes; developing scientific and planned management programs; mitigating human-elephant conflict; promoting management related research; and participatory involvement in the ecological sustainable development. Considering elephant not only as a keystone species but also an umbrella and flagship species, the plan besides necessitating landscape-level approach, has to be overarching in the implementation areas under different management regimes viz. guidelines of the Tiger Conservation Plan (TCP); management plans for the Protected Areas (PA); traditional forestry management as per Working Plan (WP) prescriptions guided by the National Working Plan Code; and Zonal Master Plan (ZMP) in the fringe areas governed by the Eco-sensitive Zone (ESZ) guidelines. The challenge is to integrate the different planning processes in not only achieving the common goal of sustainable forest management but also of wildlife conservation with focus on the elephants.

Thus, planning for ECP in the landscape would be a complex exercise as it integrates not only ecological factors but also socio-economic and cultural variables relevant to the landscape. The institutional and legislative framework at various hierarchical levels along with different policies and innovative planning tools have to be envisaged for developing strategies in consonance with the other plans besides applying different methods of landscape analysis and quality assessment to strengthen biodiversity conservation in the elephant reserve by improving ecosystem and management capacity and also contribute to the environmental conservation and harmonized ecological sustainable development in the reserve.

The introductory part describes the various attributes and characteristics of the Elephant Reserve, focusing on the land use-land cover and detailing on the conservation significance of the region in terms of different values. The section also details on the history of past management covering not only elephant as a species but various forest silvicultural practices and utilization along with forest health, forest resources and anthropogenic pressures having bearing on the biodiversity and wildlife conservation, soil and water resources, ecological sustainable development, socio-economic and cultural benefits to local community including administrative setup and communication. The Interface land use situation covers both the protected area as well as managed forests primarily on the issue of human elephant conflict (HEC) and how the same impacts various production sectors in the landscape, directly and indirectly.

The context / situation of the plan focuses on the distribution pattern and abundance status of elephant in the region covering on the habitat quality and utilization, resource dependency of villages, current situation, key stressors of HEC with the assessment of threats and spatial-temporal risk assessment. The section also details on the existing situation in the zone of influence specifying the goal, objectives of management and formulation of strategies in consonance with the existing plans.

Various drivers and pressures are managed through the zonation and elephant-habitat relationship (EHR) in the elephant reserve besides maintaining the habitat integrity and contiguity in the landscape and corridors by having an integrated management through landscape area (bioregional) planning, landscape analysis and developing landscape area management strategy including issues of corridor protection and managing dispersing populations. The section also addresses and monitors various disturbance regimes viz. invasive alien species, forest fire, catchment capability and water scarcity, habitat degradation, NTFP and other leases, linear and other development projects, natural disasters and other site-specific disturbances, climate change etc. Elephant protection and health monitoring envisages identification of vulnerable areas and traditional migratory routes along with implementation of various anti-poaching measures, veterinary surveillance, disease monitoring besides captive elephant management. There would be sustainable waste management and safe sanitation around elephant habitat and involvement of stakeholders including sectoral coordination and awareness creation.

Planning mitigation strategy for human-elephant conflict emphasises on the operational requirements and approaches in mitigation besides establishing synergistic mitigation strategy at conflict hotspots through early warning and rapid response system, monitoring elephant behaviour and movement at the hotspot, developing site-specific barriers and other exclusionary measures, community-based cooperation and conflict management, training and capacity building including institutional capacity development. The section also details on the various emergency response situations viz. pre-emergency, during emergency and post emergency situations besides planning for crowd management and media engagement. The measures envisaged for reducing the impact of HEC on the people affected as the result of loss of human life, livestock, property damage, crop damage, loss of livelihood opportunities through various compensation measures and financial instruments besides reducing the impact of HEC on the animal health and occupational health safety (OHS) measures and addressing health emergencies would be detailed. The economics and efficacy of HEC mitigation measures in terms of socio-economic impact and evaluation of costs and benefits of barriers is also considered relevant.

Ecological sustainable development describes the various aspects of tribal considerations and other forest dwellers in the elephant reserve in terms of forest rights, community resource management, delineation of critical wildlife habitat, relocation of tribal settlements and developing synergy with joint forest management. The section also details on the general principles as well as guiding principles of ecotourism, interpretation and conservation education in terms of ecological concerns and carrying capacity for developing sustainable and community-based ecotourism and evolving various strategies for the development of ecotourism management plan. Ecodevelopment and livelihood improvement focuses on the identification of the key issues as a result of socio-economic and forest dependency survey by participatory planning process for developing ecodevelopment plans and implementing various ecodevelopment activities in the elephant reserve including livelihood support initiatives through village micro-plans, integration of rural development programs besides participatory assessment of impacts of intervention. Mainstreaming of the Zonal master plan in the eco-sensitive zone (ESZ) is also proposed by integration of the environmental and ecological considerations through ecofriendly development and regulation of activities of the Line departments by having a regulatory framework.

Management capacity development describes the various aspects of institutional capacity development by activation of research activities, map preparation, strengthening of infrastructure and mobility, various thematic trainings, use of innovative techniques/ technologies, developing various protocols for monitoring & evaluation including compliance of management effectiveness evaluation (MEE). The section also details on the structure and responsibilities of the organisation including staff adequacy and amenities. The budgetary allocation provides for plan as well as resource mobilisation other than plan schemes with the schedule of operations and regulations.

The Plan will also detail on the list of tables, plates, maps and forms to be kept as annexures besides having the comprehensive glossary of terms and references.

Planning Process

The elephant reserves are constituted into several administrative and functional units, based on their ecological, floral, faunal, geomorphological, and natural significance and include both PAs and managed Forests. Thus, the Elephant reserves have several management regimes governed by the planning document (TCP, Management Plan, Working Plan, Community and conservation reserves management plan and Zonal plans etc). Each of these plans is formulated in consonance with the separate guidelines, management objectives and strategies.

Considering the elephant not only as a keystone species but also an umbrella and flagship species, the plan besides necessitating a landscape-level approach has to be overarching in the implementation areas under different management regimes viz. guidelines of the Tiger Conservation Plan (TCP); management plans for the Protected Areas (PA); traditional forestry management as per Working Plan (WP) prescriptions guided by the National Working Plan Code; and Zonal Master Plan (ZMP) in the fringe areas governed by the Eco-sensitive Zone (ESZ) guidelines. The challenge was to integrate the different planning processes in not only achieving the goals set in the Project Elephant document but also the common goal of sustainable forest management and wildlife conservation with a focus on the elephants.

The preparation of framework for the Elephant Conservation Plan (ECP) needed developing a common understanding on the overall purpose, scope, approach and methodology. This also necessitated on the acquisition of requisite data and information, working plans, management plans, tiger conservation plans, biosphere reserve plans, zonal plans, maps etc besides review of the existing documents and guidelines.

One sample Elephant Reserve from each Region (3-4 ERs) have been proposed to facilitate planning by field visit and also understanding the diverse issues in each region for developing generic framework of the Plan. Proposed management interventions envisaged four key dimensions:

- Biological dimensions- interventions based on the natural behavioural ecology of elephant
- Habitat dimensions- dealing with forest habitats and their capacity to nurture elephant population
- Human dimensions- dealing with the perspectives over human-elephant negative interactions
- Management dimensions- dealing with the enhancement of organizational capacity & frame work

The planning process involved 2 phases:

- 1st Phase - theory of the framework was developed (literature review & discussion with experts)
- 2nd Phase - theoretical framework is validated / adjusted through stakeholder participation (involved situation analysis by field visit & stakeholder validation)

As part of the Plan, first stakeholder consultation workshop on the “Framework for the preparation of Elephant Conservation Plan (ECP) for the Elephant Reserves” was held at Wildlife Institute of India Dehradun on 13th October 2023, where the Template for the ECP Framework was discussed.

Also, field visit was undertaken to Nilgiri Elephant Reserve from 26th to 30th Sept 2023 and Shivalik Elephant Reserve from 8th to 12th Oct 2023, for the purposes of Management Effectiveness Evaluation (MEE) as well as understanding the various issues related to the Elephant Conservation Plan.

The second stakeholder consultation workshop on ECP was held at Wildlife Institute of India Dehradun on 6th February 2024, where the “Draft Report on the Framework for preparation of Elephant Conservation Plan for the Elephant Reserves” was discussed.

The framework so prepared needs to be adopted by the States for the preparation of the Elephant Conservation Plan for the respective elephant reserves.

Rationale for Elephant Conservation Plan (ECP)

The Elephant reserve landscape envisages separate management planning process for Tiger Reserves, Protected Areas, Managed Forests and Eco-sensitive Zones. A mechanism is required to integrate plans for achieving objectives for both resource production and the maintenance of biological diversity and allow a broader landscape as the operational base for meeting ecological goals and human needs.

At the landscape level, provisions could provide for habitat connectivity between potentially isolated areas, establish a network of biological hotspots, direct NTFP activity to areas that would conflict least with other values, identify areas that would be most favourable for wood production, establish guidelines for transportation systems that would be least harmful to biological diversity, coordinate guidelines for key habitats such as riparian areas, and coordinate the siting of facilities for tourists.

Having an integrated landscape plan for an elephant reserve offers several advantages over numerous plans for administrative units within the reserve:

- *Ecosystem Connectivity:* An integrated landscape plan considers the interconnectedness of habitats and ecosystems across the entire landscape, whereas separate plans for administrative units may overlook the need for connectivity. This approach ensures the preservation of critical corridors and linkages essential for the movement of elephants and other wildlife.

- *Holistic Conservation:* Integrated landscape planning promotes holistic conservation by addressing the needs of multiple species and habitats simultaneously. Instead of focusing solely on individual administrative units, the plan takes a comprehensive approach to protect biodiversity, ecosystem services, and ecological processes at the landscape scale.

- *Efficient Resource Allocation:* Consolidating planning efforts into a single integrated landscape plan streamlines resource allocation and reduces duplication of efforts. By coordinating activities across administrative boundaries, the plan maximizes the efficiency and effectiveness of conservation actions, leading to better outcomes for elephant populations and their habitats.

- *Socio-Economic Considerations:* Integrated landscape planning incorporates socio-economic considerations such as land use, livelihoods, and cultural values into conservation decision-making. This approach fosters community engagement, reduces conflicts, and promotes sustainable development within the landscape, benefiting both people and wildlife.

- *Climate Resilience:* An integrated landscape plan is better equipped to address the impacts of climate change by integrating adaptation and mitigation strategies at the landscape scale. This includes measures to enhance habitat resilience, promote carbon sequestration, and mitigate climate-related risks to both biodiversity and local communities.

- *Policy Alignment:* A single integrated landscape plan ensures alignment with national and international conservation policies, frameworks, and goals. This facilitates cooperation and coordination among various stakeholders, including government agencies, NGOs, local communities, and private landowners, to achieve common conservation objectives.

- *Adaptive Management:* Integrated landscape planning enables adaptive management approaches that allow for continuous learning and adjustment based on monitoring data and feedback from stakeholders. This flexibility is essential for responding to changing environmental conditions, emerging threats, and evolving conservation priorities over time.

Adopting an integrated landscape plan for an elephant reserve offers a more comprehensive and effective approach to conservation. By integrating ecological, social, economic, and governance aspects, the plan promotes sustainable management and conservation of elephant populations and their habitats.

How to Use the Framework

The key to using Elephant Conservation Plan (ECP) framework effectively is to understand their purpose, apply them thoughtfully, and be open to adapting them as needed.

- *Understanding the Purpose:* The document has been created to comprehend most appropriate practices, standards, or protocols for the ECP. This document covers anything from drivers and pressures to landscape design to mitigation strategies to academic research methodologies. The framework is meant for the field officers of the different administrative units of the ER. It is important to read the document thoroughly, paying close attention to any rules or recommended practices. All the chapters follow the logical workflow as detailed in the 'executive summary' and 'framework of the plan', providing overarching steps to the existing TCP/ MP/ WP/ ZMP.

- *Applying the Framework:* Once you understand the Framework, you can start applying them to the existing plans (TCP/ MP/ WP/ ZMP) in operation before development of the ECP. This might involve making adjustments to the processes, methodologies, or designs to align with the recommended practices outlined in the document.

- *Adapting the Framework:* In some cases, you may need to adapt the components of this framework to suit the site-specific circumstances. This could involve modifying certain recommendations to better fit your needs or integrating them into an existing framework or workflow.

- *Seeking Clarification:* If you're unsure about how to interpret or apply a particular guideline, don't hesitate to seek clarification. This could involve consulting with colleagues, experts, or the creators of the guidelines themselves.

- *Evaluating Effectiveness:* After applying the framework, it's important to evaluate their effectiveness. This could involve assessing whether they've helped improve the quality, efficiency, or other relevant aspects.

Elephant Conservation Plan (ECP) involves careful consideration of ecological, sociocultural, and economic factors to protect and manage elephant populations sustainably. Each ECP has to be tailored to the specific context, challenges, and opportunities of the reserve where it will be implemented.

Writing of the ECP can vary based on the region and envisages several considerations:

- *Data Considerations:* include elephant population data; habitat data; movement & migration patterns; threat assessment; climate & environmental data; socio-economic data; land use plans; corridor & connectivity data; health and disease data; research findings; conflict data etc.

- *Workflow Considerations:* include defining goals, objectives and related problems; assessing current situation; identifying priorities; developing strategies; creating an implementation plan; stakeholder engagement; and monitoring and evaluation.

- *Administrative Considerations:* include lead agency & coordination; interagency collaboration; stakeholder engagement; human resources and capacity building; communication & public relations; community outreach and education programs.

- *Budgetary Considerations:* include comprehensive budgeting; long-term planning; sustainability & endowment fund; and social and cultural sensitivity.

Developing and implementing ECP requires collaboration, scientific expertise, community involvement, and a commitment to addressing conservation goals. It is essential to maintain a holistic perspective that considers the interconnectedness of elephants with their habitats and human communities.

CHAPTER-1 INTRODUCTION

India is one of the world's mega biodiverse nations, endowed with a rich cultural and natural diversity. It has one-fifth of land under forest cover and a range of biogeographical attributes and has witnessed the extensive alteration of landscapes with resultant ecological and social transformation. The conflicts over resource use have largely been exacerbated due to poverty and impoverishment of rural poor, who live in close proximity to biodiversity rich areas and traditionally depend on them for subsistence.

The Asian elephant (*Elephas maximus*) is the largest terrestrial herbivore species, whose population and areas of occupancy has significantly declined over the years. Elephants are recognized as flagship species and have been conferred the status of 'National Heritage animal'. Elephants continue to face significant challenges including habitat loss and fragmentation, human elephant conflict (HEC), anthropogenic pressures such as grazing, non-timber forest produce collection, development pressure, and civil unrest in their ranging areas.

Elephants are referred to as ecosystem engineers due to their transformative role in the ecosystems where they create water holes that are also used by other wildlife for their survival during dry season, clear understories to promote new plant growth in forests, and facilitate seed dispersal of several important tree species, due to their highly mobile nature.

India supports an estimated 60% of the global Asian elephant population and harbours nearly 29,964 Asian elephants spread over an area of 110,000 km^2 of which 65,000 km^2 is constituted as Elephant Reserves (ER). There are 33 ERs across 23 states, covering 11 elephant landscapes in four distinct regions, connected regionally by 150 corridors. The ERs cover approximately 30% of Protected Areas (PA), 40% of Reserved Forests (RF) and another 30% of private lands.

The country has burgeoning development pressures to sustain the large human population and has to find ways to harmonize conservation with the rapid pace of development. Though, the PA network has expanded over the years but the same is inadequate for meeting the long-term elephant conservation goals due to geographic and sectoral isolation.

In the above context, the landscape approach to conservation is the most appropriate strategy for integration of area development, while maintaining biodiversity values and ensuring ecological integrity. This integration would connect the PAs with adjoining buffers (RFs/ ESZs) into a greater sustainable landscape, most beneficial for long-term conservation. Further, this is also the best strategy to buffer vulnerable communities from the impacts of climate change and ensure the continued provisioning of ecological services.

The future of wild elephants can be secured by protecting the population and habitat based on sound ecological principles of landscape management. Elephants in India are distributed across four large regions, each with several sub-populations from small herds in isolated forest patches to several thousand elephants within large interconnected landscapes.

For conserving the elephant population, the Government of India (MoEF&CC) launched 'Project Elephant Scheme' in 1992 to provide technical and financial support to the elephant range states for the protection of elephants; their natural habitat and corridors; manage anthropogenic pressures and development threats; promote welfare of captive animals; address issues of human-animal conflict; poaching; and develop plans for conservation of elephant habitat and population.

The Project Elephant has identified four Regions viz North Western, Eastern, North Eastern and Southern with 33 Elephant Reserves, which are the basic management units for elephant conservation in the country. The Reserves are delineated state wise though the ecological boundaries of a reserve extend into adjoining reserves of adjacent states which needs to be harmonised. The Elephant Reserve covers Tiger Reserves, Protected Areas (National Parks,

Wildlife Sanctuaries, Community Reserves, Conservation Reserves), Reserved Forests, Forestry plantations and areas under Eco-sensitive Zones.

1.1 DESCRIPTION OF THE REGION / LANDSCAPE WITH ATTRIBUTES

The Elephant landscape is a large, complex, heterogeneous land area, an embodiment of ecological patterns and processes, consisting of a mosaic of 'patches', or landscape elements. A landscape has an assemblage of interspersion of vegetation types and interacting ecosystems juxtaposed and evolving into the natural attributes and unique significance for the area. By understanding the ecological history and land use changes in the elephant reserve, managers can develop strategies that address current challenges and promote the long-term sustainability of both elephant populations and their habitats.

Elephant Reserves (ER) require a comprehensive and multi-scale approach that includes PAs, TRs and the surrounding buffer area (RFs, ESZ) 'matrix'. The matrix contains a variety of land uses and ownerships, not necessarily the biodiversity rich entities only. The matrix plays a critical role in supporting populations of species, regulating the movement of species, buffering critical biodiversity areas and maintaining the integrity of valued ecosystems.

In most cases, the Elephant landscape would encompass biodiversity rich areas (global hotspots, unique endemic species, wetlands, marshes, etc) with PAs lying at the core, the buffer with managed forests and lands, extending to agricultural rural landscape along with urban settings and network of linear infrastructures. The potential of ER to conserve and manage all the biological, ecological and socio-economic attributes has many challenges in conservation planning which envisages identification of specific areas or zones; critical for the conservation of species and ecological processes.

The legal status of various administrative units in the ER landscape (PAs, TRs. RFs & ESZ) is notified under the relevant Acts (Wildlife Protection Act, Indian Forest Act or State Forest Acts & Environment Protection Act etc).

1.1.1 Boundary description

The Elephant Reserves are notified by the State Governments after approval of their proposal by the MoEF&CC and generally contains the names of the District, Protected Area, Forests Division along with the RF, other administrative units and area details. The boundary details as recorded in the notification of the Reserved Forests also needs to be mentioned. The State Govt has prepared maps of the Elephant Reserves without describing the boundaries. The boundaries need to be clearly delineated on the map with geo-coordinates and other features. Any inadequacies in the boundary demarcation relating to administrative, legal, ecological, or resource use have to be addressed.

It is a common fact that administrative or legal boundaries are seldom co-terminus with the ecological boundaries and do not reflect the ecological contiguity of habitat and distribution of the elephant population and integrity of natural features. Thus, it is likely that boundaries may be ecologically inadequate; especially buffer zone boundaries. It is not uncommon that natural features delineating a boundary might be unstable such as rivers which change their course. The presence of ridges, valleys, and corridors along with settlements/habitations make the boundaries irregular and porous.

There is also a need to judiciously review the ecological boundaries on the following grounds:

- that some significant habitats/portions of ecosystems/ corridors lie in proximity to the boundaries.
- their inclusion is desirable in consideration to capturing the range of diversity or ranging patterns of elephants or significant population/s of wild plant and other animal species.
- the population dynamics of elephants, their ranging and distribution have altered and habitats have undergone changes, leading to dispersal of elephants including colonisation of new areas.
- wherever ecological boundaries extend to adjoining states forming a greater ER landscape.

1.1.2 Topographic attributes

The topographical attributes of an Elephant Reserve contribute significantly to the overall habitat and ecological dynamics within the region.

- The key topographical features in an ER include: mountainous terrain; valleys and ravines; plateaus and tablelands; rivers and waterways; caves and caverns etc. The Elephant Reserve topography may be described covering terrain, and landforms of the entire reserve.
- Topographic features also provide unique habitats like the deep valleys and gorges home to endangered species. Terrain together with other environmental and physical factors strongly influences the distribution and density of vegetation communities; also, habitat use by wild animals.

The combination of these topographical attributes creates a mosaic of habitats within the ER, supporting the complex web of life that includes elephants and a diverse range of plant and animal species.

1.1.3 Geological attributes

Understanding and preserving the geological attributes of an Elephant Reserve is integral to ensuring the health and sustainability of the entire ecosystem. Conservation efforts must take into account the geological intricacies to maintain the balance and resilience of the landscape for the benefit of elephants and other species within the reserve.

- The key geological features in an ER include: rock formations; granite outcrops; caves and karst landscapes; riverbeds and alluvial deposits; fault lines and tectonic zones; volcanic features; mineral deposits; sedimentary layers; erosion patterns; aquifers and water sources; and geological history and evolution etc.
- The Plans usually describe geology, rock, and soil in the context of their relationship to forest types and vegetation, water supply, potential for growing species of commercial interest, rocks and minerals of value, etc. The area may also have fossils which needs to be documented in the plan for capturing geological history of the area.

1.1.4 Edaphic attributes

Understanding and managing these edaphic attributes are critical components of effective conservation strategies in Elephant Reserves.

- The edaphic factors are categorized as abiotic component of the ecosystem. The edaphic attributes of an Elephant Reserve refer to the soil-related characteristics that influence the types of vegetation, nutrient availability, and overall habitat suitability for elephants and other wildlife.

The key edaphic attributes in an ER include: soil composition; organic matter (litter); water retention capacity; soil structure; and soil moisture levels etc.

1.1.5 Climatic attributes

Understanding the climatic attributes of an Elephant Reserve is essential for effective conservation planning and to develop strategies that promote the resilience of the ecosystem and ensure the well-being of elephants and other species in the face of varying climatic conditions.

The climatic attributes of an Elephant Reserve significantly influence the overall ecosystem, including the types of vegetation, availability of water, and the behaviour of elephants and other wildlife.

- The key climatic attributes in an ER include: temperature range; seasonal variations; rainfall patterns; monsoons; humidity levels; wind patterns; and altitude effects etc.

- Landscape can also help define regional climate; a region's elevation, proximity to the ocean or freshwater, and land-use patterns can all impact climate and this may vary in the large reserve.

1.1.6 Hydrological attributes

Understanding and managing the hydrological attributes of an Elephant Reserve are integral to ensuring the availability of water resources for elephants and other species. Conservation efforts aim to preserve the natural flow of water, maintain water quality, and address any anthropogenic impacts on the hydrological systems within the reserve.

The hydrological attributes of an Elephant Reserve refer to the characteristics of water-related features within the reserve, including rivers, lakes, wetlands, and other water bodies. These attributes play a crucial role in shaping the habitat, supporting biodiversity, and influencing the behaviour of elephants and other wildlife.

- The key hydrological attributes in an ER include: aquatic habitats; rivers and streams; lakes and reservoirs; wetlands and marshes; water quality and water availability; water table levels; seasonal fluctuations; water temperature; water flow dynamics; erosion and sedimentation; and water management practices etc. The water levels in marshy swamps in different seasons may also be recorded.
- A survey may be made for recording all perennial sources during summer. Local inquiry, information from old topographical maps, and ground verification for their existence are considered desirable. Water sources could be described by their categories e.g. spring or a pool with location by beat/ compartments or local name or by a landmark. All such information may be mapped with geocoordinates. Seasonal water availability in different regions could be mapped to correlate with the distribution of seasonal distribution of elephants.
- Besides this, there are many other features of hydrology such as perennial and non-perennial streams, stream width and depth, discharge, substratum size, which affect the species composition and productivity.
- Seasonal but longer serving sources of water and their distribution should likewise be ascertained and documented. In dry areas, effort needs to be made to establish the relationship between rainfall amount, distribution, the period of availability of seasonal water sources, and impacts on otherwise perennial sources. There are storage dams and large water bodies in the Elephant Reserve used for navigation, fishing, etc. Such details and related issues could also be documented.

1.1.7 Biological attributes

Understanding and conserving the biological attributes of an Elephant Reserve are fundamental to ensuring the long-term health and sustainability of the ecosystem. Conservation efforts focus on preserving habitats, managing human-wildlife interactions, and addressing threats to biodiversity to maintain the ecological integrity of the reserve.

The biological attributes of an Elephant Reserve encompass the diverse array of flora and fauna that inhabit the region. These attributes contribute to the overall biodiversity, ecological balance, and the well-being of elephants and other wildlife.

- The key biological attributes in an ER include: forest types; vegetation zones; floral diversity; keystone plant species; faunal diversity; mammalian diversity; avian diversity; reptiles and amphibians; insect life; microbial communities; endangered and threatened species; plant-animal interactions; ecological interconnectedness; and genetic diversity etc.
- Elephant reserves are critically important habitats in terms of the biological diversity they contain and in terms of the ecological functions they serve. The ecosystem, biomes, biodiversity, and species or population interaction in communities are important aspects of biology.

- *Plants:* The Elephant reserves are covered by TCP, management plans, working plans, etc which contain information on forest types, species, communities, and their distribution. This information along with the biogeographic classification of Rodgers and Panwar (1988) and Champion and Seth's (1968) vegetation types could be used for developing the vegetation profile of the landscape. The floristic elements should include angiosperms, bryophytes, pteridophytes, especially the food species of elephants including grasses and shrubs. Besides, the adaptations related to feeding habits, behaviour, and life history can also be included. Efforts may be made to describe the vegetation structure, composition, community attributes, and distribution including the tree-shrub-herb and grasses levels and aquatic vegetation. Attempt should also be made to quantify at least selected species like grasses, shrubs and herbs. A map showing abundance distribution of selected elephant food species would help in assessing the food availability in different regions and correlate to the seasonal distribution of elephants. There is also need to identify weeds and provide information on weed abundance and distribution.
- *Animals:* There is need to examine the various plans of the Elephant Reserve and document information on the animals in the landscape, including a description of the status of the species, distribution, and habitats. Habitat description for each species of the animal may also include vegetation communities, successional stages, vegetation structure, and any special requirement of micro habitats e.g. presence of snags, dens, etc. The species of conservation importance their distribution and abundance along with habitat quality can be used for developing Elephant Habitat Relationship (EHR). It is important to identify key areas such as endemic areas and describe their attributes, extent, and distribution. The Zoological Survey of India (ZSI) inventory and survey reports along with research conducted by research institutions and organizations can provide additional information. It is important to have abundance information of selected herbivores.

1.2 LAND USE LAND COVER (LULC) CLASSIFICATION

One of the key parameters (component) of a landscape is the land cover, which shapes the land use within and outside the landscape and also shapes the socio-economic situations in the tract. The land cover includes both natural (different types of vegetation) and manmade features (commercial plantations in forests and home gardens, orchards, other agricultural crops, etc). Heterogeneity in natural land cover arises from intrinsic natural attributes such as bio-climate, soil, and topography. The biotic interference especially of humans and cattle has a profound influence on natural vegetation, resulting in modification, even transformation, and various degradation stages. Characterization and classification of land cover, based on dynamics and succession along natural and disturbance regimes is primarily important for setting management strategies at the landscape level.

LULC classification in an Elephant Reserve is an integral part of evidence-based conservation efforts. It provides a comprehensive understanding of the landscape, enabling conservationists to make informed decisions to protect and sustain the diverse ecosystems within the reserve. Land use/land cover and human/natural modifications have largely resulted in deforestation, biodiversity loss, and human elephant conflict in the forest agriculture interface.

Land use land cover (LULC) classification in an Elephant Reserve involves mapping and categorizing different types of land cover and land use within the designated area. This classification is essential for effective conservation and management strategies. A general overview of the LULC classification process in an Elephant Reserve envisages following procedures:

- *Satellite Imagery Acquisition:* The process typically begins with the acquisition of high-resolution satellite imagery. Advanced remote sensing technologies provide detailed and up-to-date information about the landscape, allowing for accurate LULC classification.
- *Pre-processing of Satellite Imagery:* Pre-processing steps include radiometric and geometric corrections to enhance the quality of satellite imagery. Calibration ensures that the data accurately represents the reflectance values of the Earth's surface.

- *Image Segmentation:* Image segmentation involves dividing the satellite imagery into meaningful segments or regions based on spectral characteristics. This step helps identify homogeneous areas with similar properties.
- *Feature Extraction:* Relevant spectral, textural, and spatial features are extracted from the segmented image to characterize different land cover types. These features serve as input data for the classification algorithm.
- *Supervised or Unsupervised Classification:* Classification can be either supervised or unsupervised. In supervised classification, training samples of known land cover types are used to train the algorithm. Unsupervised classification identifies clusters in the data without prior training.
- *Classification Algorithms:* Various classification algorithms, such as Maximum Likelihood, Support Vector Machines, Random Forest, or Neural Networks, may be employed depending on the complexity of the landscape and the characteristics of the data.
- *Validation and Accuracy Assessment:* The accuracy of the classification is assessed by comparing the classified results with ground truth data. Validation points are used to measure the accuracy of the classification, and adjustments may be made to improve the results.
- *Post-Classification Processing:* Post-classification processing involves refining and smoothing the classified map. This step may include filtering out small patches, eliminating misclassifications, and improving the overall visual appearance of the map.
- *LULC Classes:* The final LULC map typically includes different classes representing various land cover and land use categories. Common classes in an Elephant Reserve may include forested areas, grasslands, wetlands, water bodies, agricultural lands, human settlements, linear and other infrastructure.
- *Change Detection:* Comparing LULC maps from different time periods allows for change detection analysis. Monitoring changes in land cover and land use over time helps in understanding trends, assessing the impact of human activities, and planning conservation interventions.
- *Integration with Conservation Planning:* The LULC map serves as a valuable tool for conservation planning within the Elephant Reserve. It helps identify critical habitats, migration (movement) corridors, areas prone to negative human-wildlife interaction, and regions requiring special protection.

1.2.1 Extent and condition of forests and tree cover

Assessing the extent and condition of forests and tree cover in an Elephant Reserve requires a combination of remote sensing technologies, field surveys, and community participation. This holistic approach helps conservationists develop effective strategies to protect and enhance the habitat for elephants and other species within the reserve.

Besides, Forest Survey of India (FSI), Dehradun publishes the State of Forest (SFR) Report, biannually. It would be more prudent to collaborate with the FSI and undertake site-specific analysis by acquisition of the processed data.

This assessment is crucial for understanding the habitat available for elephants and other wildlife, as well as for planning effective conservation strategies. Following measures are crucial in the evaluation of the forests and tree cover within an Elephant Reserve:

- Utilize remote sensing/ satellite imagery to assess the spatial extent of forests and tree cover
- Perform land cover classification to categorize different types of land cover
- Apply vegetation indices (such as NDVI) to assess the health and density of vegetation
- Assess the density and canopy cover of forests within the elephant reserve
- Use satellite data and field measurements to estimate the biomass of forests
- Conduct change detection analysis to identify changes in forest cover

- Evaluate the degree of fragmentation within the forested areas by fragmentation analysis
- Conduct field surveys and ground truthing to validate the accuracy of information
- Analyse the composition of tree/ shrub/ grass/ herb species within the forested areas
- Identify and assess potential threats to the forests and tree cover
- Evaluate the potential for natural regeneration and restoration of degraded areas

1.3 STATEMENT OF CONSERVATION SIGNIFICANCE

The wildlife resource has enormous conservation value and the statement of significance should contain a description of the values protected. The main objective of the management planning is to identify the values based on the existing information from research and other works in the landscape. The next step is to develop a hierarchical list of values prioritizing them for their importance.

A statement of conservation significance in an Elephant Reserve outlines the ecological, cultural, and biodiversity values of the reserve, emphasizing its importance for the conservation of elephants and other wildlife. Such a statement serves as a foundational document for guiding conservation efforts and informing stakeholders about the significance of the reserve.

ER is a unique and vital ecosystem that holds immense conservation significance. Established to safeguard the habitat of the Asian elephant and promote biodiversity conservation, the reserve plays a crucial role in maintaining ecological processes and supporting sustainable utilization.

- *Ecological Importance:* The reserve encompasses diverse ecosystems, including dense forests, grasslands, wetlands, and water bodies and the habitat variety supports rich flora and fauna, contributing to the overall biological diversity of the region.
- *Role in Elephant Conservation:* The reserve is a stronghold for the elephants, providing essential habitats for breeding, foraging, and social interactions. The reserve serves as a critical corridor, facilitating the movement of elephant populations and ensuring genetic diversity within the species.
- *Biodiversity Hotspot:* The reserve is recognized as a biodiversity hotspot, hosting a wide array of mammalian, avian, reptilian, and amphibian species. It is home to numerous endangered and endemic species, underscoring its global significance for biodiversity conservation.
- *Cultural and Heritage Values:* Beyond its ecological importance, the reserve holds cultural and heritage values for local communities. The traditional coexistence of humans and elephants in the region has shaped unique cultural practices and fosters a harmonious relationship between communities and wildlife.
- *International Importance:* The reserve contributes to global conservation efforts and aligns with international commitments to biodiversity conservation, climate change mitigation, and sustainable development goals. Its significance extends beyond national borders, making it a priority for regional and international collaboration (CITES, CMS, MIKE etc).

The statement of conservation significance serves as a foundation for developing and implementing comprehensive conservation plans, policies, and actions tailored to the unique attributes of the Elephant Reserve. The reserve stands as a testament to the importance of conservation in preserving our planet's natural heritage. As a critical habitat for elephants and a biodiversity hotspot, the reserve requires collective efforts to secure its future and uphold its conservation significance for generations to come.

The statement of significance will list out the values, and describe the conservation attributes scientifically.

1.3.1 Categorisation of different values

The values of an Elephant Reserve can be categorized into various dimensions, including ecological, cultural, economic, aesthetic and recreational values. The different values within these categories, include:

Ecological Value envisages mainly values related to the biodiversity conservation, the diversity of ecosystems, the suitability of the habitat for elephant conservation, habitat for endangered species, presence of keystone species, ecosystem services, genetic diversity and carbon sequestration.

- The reserve supports a diverse array of flora and fauna, contributing to global biodiversity conservation efforts.
- Critical habitats within the reserve provide refuge for endangered species, including the Asian elephant and other rare or threatened wildlife.
- The presence of keystone species, such as elephants, plays a crucial role in shaping the structure and function of the ecosystem.
- The reserve provides various ecosystem services, including water conservation, climate regulation, and soil fertility.
- The reserve contributes to the genetic diversity of plant and animal populations, ensuring adaptability to environmental changes.
- Forested areas within the reserve contribute to carbon sequestration, mitigating climate change impacts.

Cultural Value covers various aspects of cultural heritage, coexistence traditions, cultural events and festivals, sacred sites and traditional knowledge.

- The reserve holds cultural significance, embodying traditional practices, folklore, and spiritual values for local communities.
- The traditional coexistence of humans and elephants in the region has shaped unique cultural practices and community relationships.
- Local festivals and events celebrate the relationship between communities and elephants, reinforcing cultural identity.
- Certain areas within the reserve may be considered sacred, playing a role in cultural rituals and beliefs.
- Indigenous knowledge about plants, animals, and ecosystems contributes to sustainable resource use and conservation practices.

Economic Value includes revenue from tourism, livelihood and NTFP etc

- The reserve attracts tourists, generating revenue through ecotourism activities such as guided safaris, wildlife watching, and nature-based tourism.
- Sustainable use of forest resources, including non-timber forest products, provides livelihood opportunities for local communities.
- Economics of the ecosystem services like water conservation, medicinal and food plant conservation, soil conservation, the livelihood on resources, etc.

Recreational and Aesthetic Value envisages primarily recreational opportunities and scenic beauty.

- The reserve offers recreational activities such as hiking, bird watching, and nature walks, enhancing the well-being of visitors.
- The natural landscapes, diverse ecosystems, and wildlife contribute to the aesthetic appeal of the reserve.

Educational and Interpretive Value includes opportunities for learning.

- The reserve serves as an educational resource, providing opportunities for learning about wildlife, ecosystems, and conservation.
- Interpretive programs and educational initiatives within the reserve raise awareness about biodiversity and conservation.

Existence and Intrinsic Value envisages intrinsic value of nature along with existence value.

- The reserve has intrinsic value, emphasizing the inherent worth of nature independent of its utility to humans.
- The mere existence of the reserve and its unique biodiversity holds value for people who appreciate the importance of preserving natural diversity.

Educational and Scientific Value is mainly towards research and education.

- The reserve provides a living laboratory for scientific research and educational programs, contributing to ecological knowledge and conservation science.
- The reserve supports scientific research and education, creating opportunities for employment and capacity building.

Spiritual and Inspirational Value is towards spiritual connection and inspiration for conservation.

- Some individuals may perceive the reserve as a spiritually significant place, fostering a connection to nature and a sense of tranquillity.
- The reserve serves as an inspirational symbol for conservation, motivating individuals and communities to participate in environmental protection efforts.

Categorizing values in this way helps in recognizing the multifaceted importance of an Elephant Reserve, guiding comprehensive conservation strategies that consider ecological integrity, cultural significance, economic sustainability, and recreational benefits.

1.4 ELEPHANT SPECIES RANGE AND CORRIDORS

Elephants the largest living animal, require large quantities of food, suitable shelter, sufficient water, and healthy habitat conditions to sustain. The fragmentation and shrinkage of forests, degradation of habitat and scarcity of water resources, affect the ranging pattern of elephants. The distribution of food and water is not uniform in the habitat. The elephants seasonally migrate and move over a large area and return utilizing a large habitat to meet its food and water requirements. Elephants' movement is conditioned by a range of climatic and environmental variables, like temperature, rainfall, drought, and water availability to embark on their migratory journey through corridors.

Elephant Corridors:

- Elephant corridors are linear, narrow, natural habitat linkages between two forest habitats for the movement of elephants. They are strips of habitat or movement pathways that connect otherwise disconnected viable habitat patches. The migratory/ movement paths of the elephants away from forest habitats into the human domain without connecting to viable habitat patches may not be considered as elephant corridors.

- 150 elephant corridors have been reported from the 15 elephant range states across 4 elephant bearing regions of India; 135 are ‘active’ and 15 ‘impaired’ and require continuous monitoring.

The elephant has distinct range and utilizes corridors for movement within Elephant Reserves. The general range of the species and the ecological significance of corridors, is as under:

Species Range:

- Elephants are distributed across various states in India viz.
  - North eastern region: Assam, Arunachal Pradesh, West Bengal (north), Meghalaya, Nagaland, Tripura, Mizoram and Manipur
  - East central region: Odisha, Jharkhand, Bihar, West Bengal (south), Chhattisgarh, and Madhya Pradesh
  - Northern region: Uttarakhand, Uttar Pradesh, Haryana, Himachal Pradesh
  - Southern region: Karnataka, Kerala, Tamil Nadu, Andhra Pradesh, Maharashtra, and Andaman & Nicobar

- Elephants inhabit a variety of ecosystems, including tropical forests, grasslands, and swampy areas. They are particularly associated with forests and are dependent on water sources.

Home Range:

The home range size for elephants can vary depending on factors such as habitat type, food availability, water sources, population density, and human disturbances. Home ranges for Asian elephants can vary widely but typically range from about 50 to 300 km^2 for males and 20 to 150

km^2 for females. However, in some fragmented or degraded habitats, home ranges may be even smaller.

Following factors influence the home range size:

- Elephants require large amounts of food and water, so home range size is influenced by the distribution of these resources. In areas with abundant food and water, size may be smaller.
- Habitat quality, including vegetation structure, availability of browse, and cover, can influence home range size. Elephants may have larger home ranges in habitats with lower-quality forage.
- Human activities such as agriculture, infrastructure development, and human-elephant conflict can impact elephant movement patterns and home range size. Elephants may avoid areas with high levels of human disturbance, leading to changes in their home range.

Additionally, ongoing habitat loss and fragmentation due to human activities are likely to continue impacting elephant home ranges, highlighting the importance of conservation efforts aimed at protecting and restoring elephant habitats.

Ecological Significance of Corridors:

- Elephants are known for their seasonal migrations/ movements between different habitats in search of food, water, and suitable breeding grounds.
- Corridors are crucial for ensuring larger extent of habitats facilitating access to higher quantity of resources, maintenance of genetic diversity, allowing for seasonal movements, and promoting connectivity between fragmented habitats.
- Well-protected corridors help reduce human-elephant conflicts by providing safe pathways for elephants to move between different areas without causing extensive damage to crops or infrastructure.
- Corridors contribute to the overall health and functionality of ecosystems by allowing for the natural movement of species, seed dispersal, and maintenance of ecological processes.
- In the context of climate change, corridors can be essential for helping species, including elephants, adapt to changing environmental conditions by providing access to diverse habitats.

Conservation efforts in Elephant Reserves often involve the identification, protection, and restoration of corridors to ensure the long-term survival and well-being of elephant populations and the broader ecosystem. These corridors play a crucial role in sustaining healthy and resilient elephant populations in fragmented landscapes.

Fragmentation of Corridors:

Fragmentation refers to the division or disruption of contiguous habitat patches that elephants use to move between different areas for various purposes such as foraging, breeding, and accessing water sources. This fragmentation often occurs due to human activities such as urbanization, agriculture expansion, road construction, and infrastructure development.

- Fragmentation can disrupt the natural movement patterns of elephants, forcing them to travel longer distances or navigate through human-dominated landscapes, which can increase the risk of conflicts with humans and vehicles.
- Fragmentation can isolate elephant populations from each other, leading to genetic isolation and reduced genetic diversity within populations. This can decrease the resilience of elephant populations to environmental changes and increase their vulnerability to diseases and threats.
- Fragmentation often leads to habitat loss and degradation within the corridor areas, as natural habitats are cleared or modified for human activities. This loss and degradation

of habitat can reduce the availability of food, water, and shelter for elephants, further exacerbating human-elephant conflicts and impacting elephant survival and reproduction rates.

- Fragmentation of corridors can bring elephants into closer contact with human settlements, agricultural fields, and infrastructure, increasing the likelihood of conflicts such as crop raiding, property damage, and human injuries or fatalities.
- Over time, the cumulative impacts of habitat fragmentation, human-elephant conflicts, and reduced genetic diversity can lead to population declines and local extinctions of elephant populations in fragmented areas.

To address the fragmentation of elephant corridors and mitigate its impacts, efforts may include:

- Ensuring protected corridors to facilitate elephant movement between habitat patches and implementing land-use planning and zoning regulations to minimize habitat fragmentation and maintain connectivity between key elephant habitats.
- Collaborating with local communities and stakeholders to develop and implement strategies for reducing human-elephant conflicts and promoting coexistence including monitoring to assess the effectiveness of conservation interventions and adapt management strategies as needed.

Viability of Corridors:

Elephant corridors are dynamic landscape elements that can be potentially influenced by myriad factors like elephant distribution, abundance, habitat configuration, and other landscape characteristics. For a long-lived, wide ranging mega-herbivore like elephants that occur in a mosaic landscape comprising of forests interspersed with human-use areas, and often involving two or more states, maintaining the viability of corridors is challenging.

- Demarcation of the boundaries of the corridors may be done using data on forest cover, elephant movement, land use, and human-elephant conflict around the corridors.
- In highly fragmented landscapes where the forests and human-use areas are highly interspersed, the boundaries would be diffuse; hence, delineating the corridors is difficult.
- The location and exact bounds of the identified elephant corridors may be indicated on a map.
- It is necessary that designated corridors must be legally secured and protected.
- Government lands and private lands need to be secured through acquisition, easement, and purchase if necessary.
- The corridors may be protected with the support of the local communities living in proximity to corridors and also providing them with the livelihood opportunities through eco-development.
- Corridors are for movement and nothing that allows the animals to stay in corridors (like water holes/habitat improvement) should be done.
- To protect and further augment elephant corridors and to improve the resilience of elephant habitats, continuous monitoring of the elephant corridors would be critical.
- A strategy for revitalization of the corridor by reducing/eliminating threats to its existence may be formulated.
- Corridors degrade over time and must be assessed to maintain their integrity for the habitat values and ecological functions they perform which are crucial for 'habitat connectivity'.
- The anthropogenic pressures, physical obstructions, encroachment, and linear projects in proximity to the corridors are the challenges that have to be resolved.

1.5 LEGAL IMPLICATIONS

Elephants are protected under Schedule I of the Indian Wildlife (Protection) Act, 1972 and are listed as 'Endangered' in the IUCN Red List. They are also listed under Appendix I of CITES which prohibits trade in live animals and even their products.

1.5.1 Laws relevant for Elephant Conservation

The following legislations are considered relevant for elephant protection and conservation: –

- Indian Forest Act 1927; Van (Sanrakshan Evam Samvardhan) Adhiniyam 1980; Wildlife Protection Act 1972; Drugs & Cosmetics Act 1940; Narcotics Drugs & Drugs Psychotropic Substances Act 1985; Insecticides Act 1968; Prevention of Cruelty to Animals Act, 1960; Environment Protection Act 1986; Biological Diversity Act 2002; Scheduled Tribes & other Traditional Forest Dwellers (Forest Rights) Act, 2006; Indian Arms Act 1959; Bhartiya Nyaya Sanhita 1860; Bhartiya Sakshya Adhiniyam 1872; Nagarik Suraksha Sanhita 1973; Indian Easement Act 1982; Land Acquisition Act 1894; Electricity Act 2003; Railways Act 1989; National Highways Act 1956; and Disaster Management Act 2005.

1.5.2 Implications & Synergy of various Legislations in Elephant Conservation

The synergy in various conservation laws having human elephant interaction manifestation allows to investigate and address the issues and related processes in multi-dimensional way in order to get generalized and specific redressal measures.

A. Wildlife related Legislation

Prohibition on Hunting of Elephants

- As per Section 9 of the Wildlife Protection (Amendment) Act, 2022, no person shall hunt any wild animal listed in Schedules I and II except as provided under sections 11 and 12 of the Act.

Hunting of Elephants to be permitted in certain cases

- As per Section 11 (1) (a), if the Chief Wildlife Warden (CWLW) of any State is satisfied that such an animal has become dangerous to human life or is so disabled or diseased beyond recovery then he may, by order in writing and stating the reasons therefor, permit any person to hunt such animal or cause such animal to be hunted.
- As per the Proviso to Section 11 (1) (a), no order for killing can be passed unless the CWLW is satisfied that such an animal cannot be captured, tranquilised or translocated. Also, no such captured animal shall be kept in captivity unless the CWLW is satisfied that such animal cannot be rehabilitated in the wild and reasons for the same are recorded in writing. The process of capture or translocation, as the case may be, of such animal shall be made in such manner as to cause minimum trauma to the said animal.
- [*Explanation*: The provision of according permission for hunting Schedule I animal can be invoked only by the CWLW for safe-guarding human life; differentiating the same from Schedule II which could also be invoked by the Authorised officer and could also include safe-guarding property (including standing crops on any land)].
- Also, Section 11 (2) provides for the killing and wounding in good faith of any wild animal in defence of oneself or any other person provided that when such defence becomes necessary, the person should not be committing any act in contravention of any provisions of the WLPA or any rule or order made thereunder.

Grant of Permit for Special Purposes

- As per Section 12, the CWLW with the previous permission of the Central Government may grant a permit, by order in writing stating the reasons therefor, to hunt, subject to such conditions as may be specified therein, for the purpose of (a) education; (b) scientific research; (bb) scientific management (translocation to an alternative suitable

habitat or population management without killing or destroying); and (c) collection of specimens for recognised zoos subject to 38-I.

- [*Explanation*: In the context of HEC management, hunting under this section envisages capture and translocation without killing or poisoning or destroying elephant].

Destruction/removal of Wildlife from Sanctuary and National Park

- Any activity undertaken within the limits of a Wildlife Sanctuary (WLS) or National Park (NP) is in accordance to the approved management plan by the CWLW. Any action needed beyond a management plan, which is not prescribed or contemplated and arises due to HEC is covered under sections 29 and 35 (6) of the WLPA in respect of WLS and NP respectively.
- The above sections authorize the CWLW to give permission to "destroy, exploit or remove any wild life including forest produce OR destroy or damage or divert the habitat of any wild animal (elephant included) OR divert, stop or enhance the flow of water into or outside the WLS / NP" with the prior approval of the State Government in consultation with the State Board for Wildlife that such removal of wildlife from the WLS / NP or the change in the flow of water is for the "improvement and better management of wildlife therein".
- As per the proviso, the forest-produce so removed may be used for meeting the personal *bonafide* needs of the people living in and around the WLS / NP and shall not be used for any commercial purpose.
- For the purposes of this section, grazing or movement of livestock permitted under section 33 (d) or hunting under section 11 and 12, or the exercise of any rights permitted to continue under section 24 (2) (c), shall not be deemed to be an act prohibited under this section.
- The applicability of this section has been interpreted by the Hon'ble Supreme Court of India in W.P. (C) No. 202/1995: TN Godavarman Thirumalpad vs. UoI and Ors (IA 548). The order of the Hon'ble Supreme Court dated 02.07.2004, putting a virtual ban on removal of any wildlife from a PA without its prior permission, was modified by the Court and powers were delegated to CEC in case of FCA cases, and NBWL in case of WLPA cases vide its order dated 05.10.2015.
- [*Explanation*: Thus, if any activity is planned in context of management of HEC within an ER which is not part of the management plan of the PA viz. creation of enclosures for soft release of animals, barricading some area, channelizing water from or towards a PA etc, prior approval from Government and consultation with the NBWL/SBWL will be required, excepting those mentioned in the proviso and explanation of the section].

Rehabilitation / Rescue of Elephants

- As per Proviso (2) of Section 11 (1) (a) of the WLPA, the first priority is to rehabilitate the captured elephant into wild before keeping into captivity.
- As per Section 39 (4) of the WLPA, in case of live elephants, the State Government shall ensure that it is housed and cared for by a recognised zoo or rescue centre when it cannot be released to its natural habitat.
- [*Explanation*: Elephant camps of the Forest Department are currently an ex-situ facility and do not qualify as recognised zoo or rescue centre under CZA].
- As per Schedule 3 (7) of Rule 10 of Recognition of Zoo Rules, 2009, no zoo shall accept any rescued elephant unless it has appropriately designed enclosure and upkeep facilities for the animal as well as facilities for keeping it in isolation during quarantine period.
- Also, as per Schedule 3 (8) of Rule 10 of Recognition of Zoo Rules, 2009, whenever any zoo decides to accept any rescued elephant for housing, a detailed report regarding the source from which the animal has been received, legality of its acquisition and the facilities available at the zoo for housing, upkeep and healthcare shall be sent to the

CWLW of the State; and a copy of the report shall also be sent to the Central Zoo Authority (CZA).

- [*Explanation*: Acquisition of the rescued elephants is also subject to Section 38-I of the WLPA].

Measures in the interest of elephants

As per Section 33 and 33-A of the WLPA, the CWLW is the authority who shall control, manage and maintain all WLS and NPs and for that purpose (elephants included) –

a) shall take such steps as will ensure the security of wild animals
b) may take such measures in the interest of wildlife as he may consider necessary for the improvement of any habitat
c) may regulate, control or prohibit, in keeping with the interests of wildlife, the grazing or movement of livestock
d) may take measures towards immunisation against communicable diseases of the livestock kept within 5kms of a WLS or NP

[*Explanation*: The above measures are considered quite critical in the management plan prescriptions as well as in undertaking preventive measures towards elephant conservation including HEC].

Ownership of Captive Elephants

- As per Section 42 of the WLPA, the CWLW may, for the purposes of section 40, issue a certificate of ownership to any person who, is in lawful possession of any captive elephant provided that the applicant has adequate facilities for housing, maintenance and upkeep of the animal.
- Also, as per Section 42A (1) of the WLPA, any person having a certificate of ownership in respect of any captive elephant, who is not desirous of keeping it in his control, custody or possession may, after giving notice to the CWLW, surrender the same to him and any such certificate of ownership shall stand cancelled from the date of such surrender.
- The terms and conditions for transfer has to be in accordance with the Rule 7 of the Captive Elephant (Transfer or Transport) Rules, 2024.
- [*Explanation*: The ownership certificate has to be issued/ reviewed keeping in view the 'Captive Elephant Management Guidelines' for housing, maintenance and upkeep including genetic profile of the elephant].

Regulation of Transfer of Captive Elephants

- As per Section 43 (1) of WLPA, no person having in his possession captive elephant, in respect of which he has a certificate of ownership shall transfer by way of sale or offer for sale or by any other mode of consideration of commercial nature.
- As per Section 43 (2), where a person transfers or transports from the State in which he resides to another State or acquires by transfer from outside the State, any such captive elephant, in respect of which he has a certificate of ownership, he shall, report the transfer or transport to the CWLW or the authorised officer.
- Provided that the transfer or transport of a captive elephant for a religious or any other purpose by a person having a valid certificate of ownership shall be subject to such terms and conditions as may be prescribed by the Central Government.
- The conditions for transport have to be in accordance with the Rule 9 of the Captive Elephant (Transfer or Transport) Rules, 2024.
- [*Explanation*: Both transfer and transport of the captive elephants with the valid ownership certificates, can be affected for religious or any other purpose subject to the terms and conditions prescribed by the Central Government].

B. Forestry Related Legislations

Prohibitions as per Indian Forest Act 1927 or various State Acts

- As per Section 26 of the Indian Forest Act (IFA) 1927, various activities which may impact elephant conservation, directly or indirectly, have been prohibited in the reserved forests without permit viz. kindle fire, cattle trespass, tree-felling, removal of forest produce, hunting etc.
- [*Explanation:* Similar provision also exists in many State Acts, which could be enforced].

Development of Forests and Wildlife as per Forest Conservation Act 1980

- As per Section 2 of the Forest Conservation Act (FCA) 1980, restrictions on the de-reservation of forests or use of forest land for 'non-forestry purpose' have been imposed, where, 'non-forestry purpose' specifically means breaking or clearing of any forest land or portion thereof for any purpose other than reafforestation but does not include any work relating or ancillary to conservation, development and management of forests and wildlife.
- [*Explanation*: The provision could be used to maintain the contiguity and integrity of the corridors for wildlife, especially elephants].

Promoting Conservation as per Biological Diversity Act 2002

- As per Section 41 of the Biological Diversity Act (BDA) 2002, every local body shall constitute a Biodiversity Management Committee within its area for the purpose of promoting conservation, sustainable use and documentation of biological diversity including preservation of habitats.
- *[Explanation*: The BMCs could always be involved in addressing the issues related to elephant conservation in their jurisdictions].

Declaration of critical wildlife habitat as per Scheduled Tribes & other Traditional Forest Dwellers (Recognition of Forest Rights) Act, 2006

- As per Section 2 (a) of the Forest Rights Act (FRA), 2006, critical wildlife habitat means such areas of National Parks and Sanctuaries where it has been specifically and clearly established that such areas are required to be kept as inviolate for the purposes of wildlife conservation according to the procedural requirements as per Section 4 (1) and (2).
- As per Section 4 (2) of the FRA, the rights recognised under the Act in critical wildlife habitats of National Parks and Sanctuaries may subsequently be modified or resettled for the purposes of creating inviolate areas for wildlife conservation when it has been established under WLPA that the activities or impact of the presence of holders of rights upon the wild animals is sufficient to cause irreversible damage and threaten the existence of said species and their habitat.
- *[Explanation*: The above section is quite critical in addressing the elephant conservation in the tribal settlements or forest enclaves]

C. Animal Welfare Related Legislation

- As per the explanation to proviso 11 (1) (a) of the WLPA 1972, it has been stated that the process of capture or translocation has to be made in such manner as to cause 'minimum trauma' to the said animal, which can be related to the 'cruelty' with reference to the Prevention of Cruelty to the Animals Act 1960 and 'mischief' with reference to Indian Penal Code 1860.

Welfare of animals under Prevention of Cruelty to the Animals Act 1960

- As per Section 11 (1) of the Prevention of Cruelty to the Animals Act 1960, certain acts of omissions and commissions in respect of animals which could be termed as cruelty include:
    - beats, kicks, tortures or treats any animal to unnecessary pain or suffering;
    - wilfully and unreasonably administering an injurious substance to any animal;
    - confining any animal to a cage which does not permit reasonable movement;
    - keeping any animal chained or tethered for an unreasonable time / manner; and
    - conveying or carrying any animal in a manner as to subject it to unnecessary suffering;
- Prevention of Cruelty (Capture of Animals) Rules, 1972 also prohibits capture of animals except by 'Sack & Loop method', tranquilliser guns or any other method which renders the animal insensible to pain before capture.
- [*Explanation:* To take maximum advantage of capture, the elephants known to be indulging habitually in human elephant conflict or those playing a major role in the conflict (e.g., unattached elephant bulls) could form the main targets of capture. Translocation may be carried out as per veterinary protocols].
- However, as per section 11 (a) & (c), nothing shall apply to the castration or branding or nose-roping of any animal, or the extermination or destruction of any animal under the authority of any law for the time being in force.

Invoking Indian Penal Code (IPC) 1860 for welfare of the Elephants

- Whoever with intent to cause, or knowing that he is likely to cause, wrongful loss or damage to the public or to any person, causes the destruction of any property, or any such change in any property or in the situation thereof as destroys or diminishes its value or utility, or affects it injuriously, commits "mischief" (Section 425).
- As per Section 428 and 429 of the IPC, whoever commits mischief by killing, poisoning, maiming or rendering useless any animal or animals (including elephants) is liable for the punishment.

D. Environment Related Legislation

EPA 1986: Provisions relevant for Elephant Conservation

- EPA 1986 vests the Central Government with powers to regulate activities in certain areas facing the environmental threats. This may have impact on the elephant conservation because of the human activities and related developments in certain areas and therefore, regulation of such activities is considered significant in the management of HEC.
- Section 3 (1) of the EPA 1986 gives power to the Central Government to take all such measures as it deems necessary or expedient for the purpose of protecting and improving the quality of environment and preventing, controlling and abating environmental pollution.
- Section 5 (1) of the Environment (Protection) Rules (EPR) 1986 states that the Central Government can prohibit or restrict the location of industries and carrying on of processes and operations in different areas on the basis of considerations like: -
    - the biological diversity of the area which needs to be preserved (clause v)
    - environmentally compatible land use (clause vi)
    - proximity to a protected area notified under WLPA 1972 (clause vii)
    - any other factor as may be considered by the Central Government to be relevant to the protection of the environment in an area (clause x)
- [*Explanation:* The above provisions and rules can be relevant in framing a long-term strategy for avoidance of conflicts by facilitating co-existence through regulating land

use in the areas of potential HEC due to proximity to habitats and scope of fragmentation due to certain land uses, which may have relevance in addressing HEC issues like:

- Regulating cropping pattern in high conflict Zones
- Animal mortality on Railway tracks
- Mining in high conflict zones
- Infrastructure development in high conflict Zones].

Eco-sensitive Zone (ESZ) around Protected Areas

- In exercise of the powers conferred by Section 3 (1) read with clause (v) & clause (xiv) of section 3 (2) and section 3 (3) of the EPA, 1986, the Central Government has been empowered to issue draft notification as required under Rule 5 (3) of the EPR, 1986, the Eco-sensitive Zone specifying the area and extent.

- Concept of Eco-sensitive zones (ESZ) near PAs had been developed based on these provisions, for the purpose of conservation of wildlife where the habitats extend beyond the forests and where some areas outside PAs are needed to function as "shock absorbers".

- [*Explanation:* Through the ESZ concept we can have more effective interface with the fringe communities in adopting the land use practices particularly crops, which would not exacerbate human elephant conflict, and planning infrastructure and dwellings in areas with threats of elephant conflict].

E. Drugs Related Legislation

Drugs and Cosmetics Act 1940

- As per Section 26-A of the Drugs and Cosmetics Act, Central Government has the powers to regulate, restrict or prohibit, manufacture, etc., of drug and cosmetic in public interest.

- [*Explanation*: Central Government had banned / prohibited manufacture, sale and distribution of Diclofenac and its formulations for animal use, by a Notification G.S.R.499 (E) dated 04.07.2008].

- The Central Government in consultation with the DTAB may amend any Rule in 'The Drugs and Cosmetics Rules, 1945' in the interest of wild animals (elephants included).

The Insecticides Act 1968

- As per Section 27 of the Act, the Central Government or the State Government is of opinion that the use of any insecticide is likely to involve such risk to human beings or animals (including wildlife) as to render it expedient or necessary to take immediate action then the Government may by notification prohibit the sale, distribution or use of the insecticide, in such area, to such extent and for such period as may be specified pending investigation into the matter.

- [*Explanation*: Many insecticides, pesticides etc used, may have detrimental effect on the wild animals (elephants included) and could impact the habitat]

Narcotic Drugs and Psychotropic Substance Act 1985

- As per Section 8 (c) of NDPS Act, 1985, there are restrictions on the possession, acquisition, production, use, consumption, sale and transport of any narcotic drug or psychotropic substance, except for medical or scientific purposes.

- All prohibitions and restrictions imposed on the transhipment of narcotic drugs and psychotropic substances under the Customs Act, 1962; the provisions of this Act shall apply accordingly.

- [*Explanation*: During tranquilizing operations, drugs like Etorphine (M99), Xylazine, Ketamine, Narcan, Yohimbine etc are used and therefore the same may attract the above Acts]

Role of Veterinarians

- The veterinarian should be aware of Section 31 of the Indian Veterinary Council Act, 1984, specifying standards of professional conduct and etiquette and a code of ethics for veterinary practitioners which becomes relevant while dealing with the capture, treatment and translocation of elephants during HEC.

F. Crime and Procedure Related Legislation

- As per Section 50 of the WLPA 1972, various procedures and steps have been prescribed in the prevention and detection of the offences.
- The process in the investigation of the offences dealing with the elephant protection and conservation can be related to various provisions of Indian Penal Code (IPC) 1860, Criminal Procedure Code (CrPC) 1973 and Evidence Act 1872 including other Acts.

Applicability of Indian Penal Code 1860

- As per Section 59 of the WLPA 1972, every officer exercising the powers under the Act shall be deemed to be a public servant within the meaning of section 21 of the IPC 1860. Therefore, the lawful authority of public servants could be enforced at the time of investigation.
- *Contempt of the Lawful Authority of Public Servants:* During the course of investigation or for that matter dealing with the elephant protection case/s, the officer exercising powers under WLPA may also enforce sections 172 to 189 of IPC, as applicable
- *Right of Private Defence:* Though Section 11 (2) of the WLPA provides for the private defence of oneself or of any other person against the wild animal by killing or wounding but forest officials can also exercise their right of private defence under section 96 to 106 of the IPC for safeguarding wildlife provided extent to which the right may be exercised within the ambit of section 99.

Applicability of Criminal Procedure Code 1973

- As per Section 50 of the WLPA 1972, the officers have been empowered for entry, search, arrest and detention as part of investigation of the case.
- *Dealing with the Arrests:* The procedure laid down in the following sections of CrPC may be followed while dealing with the arrests: s.41, 46, 47, 49, 50, 51, 52, 56 & 57.
- *Compel Appearance & Production of Things:* The procedure laid down in the following sections of CrPC may be followed while issuing summons for appearance and production of things while dealing with the case: s.61, 62, 70, 91 & 93.
- *Maintenance of Public order & Tranquillity*: During the HEC scenario, it is very essential to maintain public order and tranquillity by crowd management and therefore dispersal of unlawful assemblies and public nuisances including urgent cases of nuisance or apprehended danger is important as per Section 144 of CrPC.
- [*Explanation*: As per section 21 of the CrPC, State Government may appoint Special Executive Magistrates for such term, for particular areas or for the performance of particular functions, and is considered relevant in dealing with HEC cases]
- *Investigation:* The steps in the investigation followed by the police may also be followed by the forest officers within ambit of s.50 of WLPA as: s.157, 158, 160, 161, 162, 163, 164, 172 & 173.
- *Conditions requisite for initiation of proceedings:* The following sections are relevant while dealing with elephant protection and conservation: s. 190 & 195.

Applicability of Indian Evidence Act 1872

- As per Section 50 (9) of the WLPA 1972, any evidence recorded under section 50 (8) (d) of the Act shall be admissible in any subsequent trial before the Magistrate provided that it had been taken in the presence of accused person unlike the confession before the police officer under section 162 of CrPC.
- The following sections are considered significant under Evidence Act while dealing with elephant protection and conservation cases: s.36, 45, 46, 51 & 83.

Applicability of Arms Act 1959

- As per Section 34 of the WLPA 1972, every person residing in or within 10 kms of any sanctuary or national park and holding a license granted under Arms Act 1959 for the possession of arms shall register his name with the CWLW or the authorised officer and no new license shall be granted or renewal done without the concurrence of the CWLW.
- As per Section 51 (4) of the WLPA, where any person is convicted of an offence against this Act, the Court may direct that the license, if any, granted to such person under the Arms Act for possession of any arm with which an offence against this Act has been committed, shall be cancelled including making him ineligible for license for a period of 5 years.
- [*Explanation:* In case of possession of illegal arms, action may be taken under Arms Act under s.3 (licence for acquisition/ possession) and/ or s.7 (prohibition of acquisition / possession)]

G. Land Related Legislation

Habitat / Corridor Acquisition as per Land Acquisition Act 1894

- As per Section 24 (2) (b) of the WLPA 1972, there is a provision to acquire land or rights, between the owner of such land or holder of rights and the Government, on payment of such compensation, as is provided in the Land Acquisition Act, 1894.
- [*Explanation*: Significant in declaration of Sanctuary and National Park]

Conservation Easement as per Easement Act 1982

- A 'conservation easement' is a voluntary, legal agreement that permanently limits uses of the land in order to protect its conservation values and allows landowners to retain ownership and management responsibilities for their land, but requires that they (and all future owners) observe certain prohibitions and limitations on development and use in order to protect the land's conservation values. The applicability of the Act has restricted extent and recognizes two rights:
- As per Section 4, an 'Easement' is a right which the owner or occupier of certain land possesses, as such, for the beneficial enjoyment of that land, to do and continue to do something, or to prevent and continue to prevent something being done, in or upon, or in respect of, certain other land not his own.
- As per Section 52, a 'License' is a right where one person grants to another, or to a definite number of other persons, a right to do, or continue to do, in or upon the immovable property of the grantor, something which would, in the absence of such right, be unlawful, and such right does not amount to an easement or an interest in the property.
- [*Explanation*: The ecological contiguity of forest in a landscape is through the private agricultural lands, gram Sabha lands and Government lands under the control of Revenue Department and Easement can be invoked for preserving the conservation value of any Elephant Corridor].

H. Sectoral Related Legislations

- As per the MoEF&CC D.O. No.2-12/2012-PE dated 14-6-2018, grave concern has been expressed that a number of wild animals were getting killed due to the accidents under and across power lines; on railway tracks; and on roads and highways. It has also been suggested to follow the guidelines developed by the Wildlife Institute of India named "Eco-friendly measures to mitigate impacts of linear infrastructure on wildlife (WII, Dehradun, 2016)", duly approved by the Standing Committee of National Board of Wildlife, while designing new projects as well as dealing with the existing ones. As many Line departments are directly involved in mitigation of the HEC issue, therefore we need to understand the relevant provision of their Acts.

Dealing with the Electrocution cases under Electricity Act 2003

- As per Section 135 (1) of the Electricity Act, whoever commits theft of electricity or dishonestly uses electricity for the purpose other than for which the usage of electricity was authorised is liable for the punishment under this Act.
- As per Section 161 of the Act, if any accident occurs in connection with the generation, transmission, distribution, supply or use of electricity in or in connection with, any part of the electric lines or electrical plant of any person and the accident results or is likely to have resulted in loss of human or 'animal life' or in any injury to a human being or an animal, such person shall give notice of the occurrence and of any such loss or injury actually caused by the accident.
- [*Explanation*: All new proposals of power transmission lines should be in conformity to the WII guidelines and cases of unauthorised use of electricity or any death of wild animal should be reported to the Electrical Inspector]

Dealing with Railway conflict cases under Railways Act 1989

- As per Section 11 (a) of the Act, railway administration may, for the purposes of constructing or maintaining a railway, make or construct such temporary or permanent inclined-planes, bridges, tunnels, culverts, embankments, aqueducts, bridges, roads, lines of rail, ways, passages, conduits, drains, piers, cuttings and fences, in-take wells, tube wells, dams, river training and protection works as it thinks proper.
- Also, as per Section 29 (2) (c), the Central Government may by notification make rules for regulating the mode in which, and the speed at which rolling stock used on railways is to be moved or propelled.
- [*Explanation*: At places where elephant corridors and railway tracks intersect, the construction of underpasses or overpasses can be planned to enable the animals to cross over without any difficulty as per WII guidelines 'Eco-friendly measures to mitigate impacts of linear infrastructure on wildlife'. Besides, action could be pursued for reducing the train-speed in such tracts in coordination with the railway authorities]

Dealing with Road accident cases under National Highways Act 1956

- As per Section 5 of the National Highways Act, it shall be the responsibility of the Central Government to develop and maintain in proper repair all national highways; and by notification, the same may also be exercisable by the State Government.
- [*Explanation*: WII linear infrastructure guidelines viz. 'Eco-friendly measures to mitigate impacts of linear infrastructure on wildlife' may be followed in respect of both new as well as existing roads for reducing the accidents]

I. Mitigation Related Legislation

Preparedness & Management under Disaster Management Act 2005

- As per Section 2 (d) of the Act, 'disaster' means a catastrophe, mishap, calamity or grave occurrence in any area, arising from natural or man-made causes, or by accident or negligence which results in substantial loss of life or human suffering or damage to, and destruction of, property, or damage to, or degradation of, environment, and is of

such a nature or magnitude as to be beyond the coping capacity of the community of the affected area.

- As per Section 2 (e) of the Act, "disaster management" means a continuous and integrated process of planning, organising, coordinating and implementing measures which are necessary or expedient for (i) prevention of danger or threat of any disaster; (ii) mitigation or reduction of risk of any disaster or its severity or consequences; (iii) capacity-building; (iv) preparedness to deal with any disaster; (v) prompt response to any threatening disaster situation or disaster; (vi) assessing the severity or magnitude of effects of any disaster; (vii) evacuation, rescue and relief; (viii) rehabilitation and reconstruction.

State Disaster Management Authority & District Disaster Management Authority

- Section 14 provides for the establishment of the State Disaster Management Authority (SDMA) and section 25 for the constitution of the District Disaster Management Authority (DDMA).
- As per Section 30, the DDMA will act as the district planning, coordinating and monitoring body in accordance with the guidelines laid down by NDMA and SDMA and will prepare the District Disaster Management Plan (DDMP) for the district as per section 31 and will also ensure that the guidelines for prevention, mitigation, preparedness and response measures laid down are followed by all the Departments of the State Government at the District level and the local authorities in the district.
- [*Explanation*: HEC is also a natural phenomenon and the DDMA should take measures to reduce or mitigate conflict including capacity building].

1.5.3 International Laws and Conventions relevant to Elephant Conservation

Elephant conservation is a matter of international concern, especially in countries like India, which are home to a significant population of Asian elephants (*Elephas maximus*). Some key international laws and conventions relevant to elephant conservation are:

- *Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES):* CITES is an international agreement between governments aimed at ensuring that international trade in specimens of wild animals and plants does not threaten their survival. The Asian elephant is listed in CITES Appendix I, which includes species that are threatened with extinction and prohibits their international commercial trade.
- *Convention on Migratory Species (CMS) and its associated agreements:* India is a signatory to the CMS Memorandum of Understanding (MoU) on the Conservation and Management of Asian Elephants, which aims to promote conservation and management measures for the Asian elephant and its habitats across its range countries.
- *The Ramsar Convention on Wetlands:* India is a party to this convention, and it recognizes the importance of wetlands for the conservation of various species, including elephants that may rely on these habitats.
- *The Convention on Biological Diversity (CBD):* India is a party to this convention, which focuses on the conservation of biological diversity, the sustainable use of its components, and the fair and equitable sharing of benefits arising from the utilization of genetic resources. The conservation of elephants and their habitats is part of India's obligations under this convention.

These international laws and conventions highlight the global importance of conserving elephants and their habitats, recognizing their ecological significance and the need for international cooperation to protect them.

1.6 HISTORY OF PAST MANAGEMENT

The planning documents of the PAs and Forest Divisions of Elephant Reserves have a separate section on past history, which provides valuable information on the conservation history of the

landscape. Besides, efforts could also be made in incorporating information from various published research papers in this regard.

1.6.1 Forest resource productivity and utilization

The productivity of forests connotes how much the forest can produce in terms of trees, grass, non-timber forest produce (NTFP), etc. This depends on the forest structure and composition, its distribution, the plant species diversity, the status of biodiversity conservation of forests, the status of species prone to over exploitation, conservation of genetic resources, degradation and loss of species, standing volume of forest crop, etc.

The working plan has detailed information on forest resource assessment and utilization with prescriptions on crop treatment and felling series as per the silvicultural systems. The assessment of the growing stock of wood/bamboo, increments in biomass, enhancement of forest productivity through quality plantations, carbon stock, carbon sequestration, and mitigation are used for developing the working plan prescriptions. The tiger conservation plan and the management plans of the Protected Areas contain less information because of their conservation objectives.

The elephant conservation plan should accordingly have information relevant to the objectives of the existing plans keeping zonation of the elephant reserve into consideration.

1.6.2 Forest leases including NTFP collection

There are several kinds of leases for quarrying, supply of pulpwood, NTFP collection, fishing, etc in the reserved forest areas. The harvesting of forest produce is entrusted to the forest production divisions and forest corporations. The impact of the leases on the forest ecosystem also has consequences on the forest diversity and ecological functions and there is a need to have information on the yield assessments, volume of timber, fuel wood, fodder, bamboo/ rattans, and locally important NTFPs harvested including valuation of the products from the working plan of the forest divisions.

In the PAs there is no removal of forest biomass including NTFPs, but in the buffer areas, the exploitation of the resources detrimental to wildlife interest e.g. grazing, lopping, tendu leaf collection, fires for new flush of grass, and tendu leaf collection, if any, may be documented.

The elephant conservation plan should accordingly have information relevant to the objectives of the existing plans keeping zonation of the elephant reserve into consideration.

1.6.3 Forest health and protection including anthropogenic pressures

There are anthropogenic and developmental pressures on forests and the threats are further exacerbated by the poor status of regeneration, forest fires, damage due to forest disease and pests, natural calamities, grazing, lopping practices, and invasive weed species leading to forest degradation, which needs to be mentioned.

1.6.4 Biodiversity and wildlife conservation

The information on the biodiversity and status of wildlife conservation are provided in the various planning documents which also needs to be supplemented with the various research works done in the elephant landscape. The insights into the status of species, their distribution, and abundance in the different habitats needs to be documented for development of wildlife habitat relationship (WHR) matrix.

1.6.5 Management of soil and water resources

Forest productivity and functioning depend on soil and water resources. However, forest management activities can alter forest soils, water quality, and the capacity of habitats to sustain wildlife populations. There is a strong linkage between soils and hydrological functions therefore forest management usually combines soil and water conservation objectives.

The water sources include rivers, streams, springs, seeps, lakes, ponds, marshes, and natural depressions. Also, the essential ecological processes in the landscape are being affected due to climatic and environmental factors. The threat to the landscape on account of widespread

erosion, catchment degradation, discharge of effluents, and mining of sand and boulders from rivers are major threats to ecological functions. The information on the above needs to be documented.

1.6.6 Ecological sustainable development including ecotourism

The guiding principle in the planning guidelines for the PAs and forest division is to ensure sustainable development of forests by conserving and enhancing the natural resources so that ecological processes on which life depends, are maintained, and human welfare dependent on this resource is ensured. Ecological sustainable development (ESD) is the cardinal principle for sustainable forest management to sustainably manage the forest, water and ecosystem processes. Any strategy for meeting the objectives shall weigh upon the damaging effects that may degrade the resource.

The information related to various sustainable activities viz. ecodevelopment and tribal development, being implemented in the Tiger reserves, Protected areas and Forest divisions may be documented.

Ecological and sustainable forest management can also be a source of sustainable tourism. Sustainable tourism can grow and flourish if the forest resources are preserved and protected. Sustainable ecotourism uses as few of an area's natural resources as possible to maximize long-term benefits for the local communities by minimizing negative impacts on the environment.

Ecotourism emphasizes respect for local cultures and conservation of natural resources (landscapes, rivers, forests, and wildlife). Ecotourism sites are unique sites displaying natural and historical attributes that enrich the visitor experience and the existing practices may be documented.

1.6.7 Socio-economic and cultural benefits to local community

The forest dependent marginalized communities have strong association with forest for poverty alleviation and sustaining livelihoods. Forests provide basic needs; are a source of energy, employment, traditional medicine and other subsistence needs for the majority of local communities. The contribution of forests, to the total household income of local communities is immense with some people depending on forests as their only source of subsistence, while others are partially dependent.

Local culture presents unique options for locally based economic and other development. The local communities would not only want to preserve culture but showcase their heritage in relation to eco-tourism and conservation efforts. The preservation efforts are for renovation and architectural rehabilitation of their village, their deities and restoration of historic sites to serve as a focal point for tourists, The traditional arts, crafts and skills are to be promoted and developed by generating employment based on the production of items which are symbolic of the local culture (organization of cultural activities, festivals, exhibitions). The traditional uses of natural resources or events symbolize local cultural ties to environmental processes (solstice festivals, harvest festivals). The income generated from heritage eco-tourism can lead to an improved state of community and social well-being. The unique culture and heritage have numerous economic and social benefits viz. activities of visitors in consuming cultural products and taking part in cultural activities and experiences.

The existing information and practices in the elephant reserve needs to be documented.

1.6.8 Administrative setup and communication

The various planning documents have information on the organizational patterns, the responsibilities of officials at various levels and their functions, manpower requirement of each administrative unit with sanctioned posts and vacancies. The frontline staff including special security personnel in the tiger reserves, special anti-poaching / rapid response teams in the vulnerable hot spots, necessary for protection, needs to be documented. Special units in the elephant reserve like Veterinary unit, Anti depredation squads, and Research section also needs to be included.

Elephant reserves have territorial forest divisions, special divisions and PAs (tiger reserves, wildlife sanctuary and national park, community and conservation reserves). However, in the

buffer zones of tiger reserves, there exists a system of dual control with the overlapping jurisdiction of the Field Director and territorial Conservator of Forests. This dual jurisdiction control needs to be documented.

The details of the existing communication infrastructure (vehicle, arms and ammunition, wireless network, telephone and mobile communication etc) and setup needs to be documented.

1.6.9 Research, Monitoring and Training

Research and monitoring are the critical components in the forest management. The plan of the various administrative units of the Elephant Reserve has a separate research plan with identified areas and topics for research including purpose and funding. The information on the collaboration with various research institutes and organizations is also presented in the plan.

The purpose of monitoring is to help managers in decision-making regarding a resource and appropriate course of action for future management. The plans of different administrative units of the Elephant Reserve have detailed protocols for ecological and socio-economic monitoring. The methodology and schedules have been laid down distinctly in the TCP guidelines, management plan of the PAs and working plans.

The population estimation and monitoring of tigers and elephants in the Elephant Reserve is done as per the 'Field guide on monitoring tigers, co-predators and prey' and 'All-India coordinated population estimation of elephants', respectively. The information on the population, its distribution, dispersal and habitat factors for each cycle including trends in population and habitat conditions may be documented.

The Elephant reserves are to be evaluated based on the criteria and indicators formulated for the Management Effectiveness evaluation. MEE is a rapid assessment tool that has six elements and 44 indicators for the evaluation of the reserve. The MEE ER report will reflect on several aspects of management and would be considered for future improvements of the Reserve. The results of the MEE may be presented here.

The plan document of various administrative units has the detailed training plan with the training need assessment; various themes; personnels to be trained; and annual training calendar.

The training of the officers and field staff comprises of field-based training on various aspects of management and protection. Training is also imparted to the EDC/ ETMC members on ecodevelopment and eco-tourism activities besides training to the ministerial staff on computerisation and office procedures.

On the Job training is given to the field staff on various specialized themes: Legal provisions; wildlife crime and intelligence; weapon training; wireless and communication; fire management; human-wildlife conflict; ecological restoration; tourism; field techniques; invasive species etc.

Training for Officers on management themes: Leadership skills; decision making; planning; protection; information technology; and personal management etc.

All the information on existing training needs to be documented.

1.7 INTERFACE LAND USE SITUATION

The land use situation in the interface area is driven by the expansion of human activity and infrastructure development near biodiversity rich forest landscapes. The interface area adjoining forests including enclaves is a human dominated landscape with multiple land use including cultivated lands, grazing grounds, village lakes and ponds and small scale to medium sized industrial complexes, buildings, tourism resorts and a network of linear infrastructure (roads, railway lines, canals, etc). Their expansion has vastly increased the extent of fragmented landscapes where a wide range of interactions take place between natural and human-modified habitats. The spillover of the dispersing population into the adjoining agro-pastoral landscape has increased negative interaction between humans and wildlife.

Managing land use within an elephant reserve requires a delicate balance between conservation efforts and human activities. The interface of land use typically looks within an elephant reserve:

- Core Conservation Areas
- Human Coexistence Areas

- Human Settlement Areas
- Corridors

The interface of land use in an elephant reserve aims to strike a balance between conserving elephant populations and their habitats while addressing the needs of local communities and promoting sustainable development.

Thus, interface is crucial for understanding the dynamics of human-elephant interactions, potential conflicts, and the overall impact on the conservation of elephants and biodiversity. The key aspects of the interface land use situation in an Elephant Reserve are as under:

- *Land Cover and Land Use Types:* includes identification of the extent of forest cover within the ER, including the types of forests and their health; assessment of the presence and extent of agricultural activities within and around the reserve; identification of the location and density of human settlements in the vicinity of the reserve; and examining the impact of infrastructure development, such as roads, railways, and mining, on the land cover.
- *Ecological Corridors:* includes identification and assessment of the condition of ecological corridors connecting different parts of the reserve including evaluation of their continuity, width, and the level of human disturbances.
- *Human-Elephant Conflict Areas:* includes focusing on the areas, where human-elephant conflicts are frequent which could include locations with high incidents of crop raiding or conflicts leading to human injuries and elephant casualties.
- *Agricultural Practices:* includes examining the types of crops grown and agricultural practices in the region including identification of any encroachment into elephant habitats for agriculture.
- *Water Bodies:* includes evaluation of the impact of water bodies, such as rivers and lakes, on elephant movement and habitat. Water sources are crucial for elephants, and alterations can affect their behaviour.
- *Tourism Infrastructure:* includes assessment of the presence and impact of tourism infrastructure, such as resorts and viewing points, on elephant habitats. Sustainable tourism practices need to be considered to minimize disturbance.
- *Forest Management Practices:* includes evaluation of the management practices within the forest areas of the reserve, including logging activities, fire management, and anti-poaching measures.
- *Co-existence Zones:* includes examining the effectiveness of buffer zones/ interface areas around the reserve in minimizing human-elephant conflicts and regulating land use practices.
- *Traditional Land Use Practices:* considers traditional land use practices of local communities, such as shifting agriculture or pastoralism, and assessment of their impact on the reserve.
- *Conservation Initiatives:* includes identification and evaluation of the effectiveness of conservation initiatives, including reforestation programs, community-based conservation projects, and efforts to reduce human-elephant conflicts.
- *Land Use Change Over Time:* includes analysis of the historical land use changes and their implications for the current land use situation. This can provide insights into trends and potential future challenges.
- *Legal and Policy Framework:* reviews the legal and policy framework governing land use within and around the Elephant Reserve. This includes land acquisition laws, environmental impact assessment regulations, and policies related to conservation and sustainable development.
- *Community Engagement:* includes assessment of the level of engagement and cooperation between local communities and conservation authorities. Involving local communities in decision-making processes is crucial for sustainable land use practices.

Understanding the interface land use situation is essential for developing effective conservation strategies that balance the needs of both wildlife and human communities. It requires a holistic approach that considers ecological, social, and economic factors to ensure the long-term viability of Elephant Reserves in development of the conservation plan.

1.7.1 Historic land-use changes and linkage with current management including HEC

The historical land use within elephant reserves and its changes over time, as well as its linkages with current management, particularly in addressing Human-Elephant Conflict (HEC), are complex issues.

- The historical land use within elephant reserves often involves a mix of agriculture, settlements, and forest resources utilization by local communities. Prior to the formal establishment of elephant reserves, human activities were more widespread within these areas.
- Over time, the expansion of human settlements, agriculture, and infrastructure development have fragmented elephant habitats. This fragmentation has led to an increase in HEC and overall disturbance to the elephants' natural behaviour and ecology.
- Human-elephant conflict (HEC) causes various direct and indirect negative effects arising from humans and elephants' interaction over resources. The conflict affects both people and elephants, around 500 people are killed by elephants every year in India, and around 100 elephants die due to electrocutions (both sagging lines and live wire), train collisions, sometimes poisoning and poaching for ivory. The loss of crops and damage to property by elephants impacts the local communities economically, and people find it difficult to guard their crops and property from elephants. The perpetual apprehension of threat of elephants in the villages including damage to the crop and property and their free movement, creates immense stress and psychological trauma in the communities.
- Current management of elephant reserves is often aimed at mitigating the impacts of HEC and ensuring the long-term conservation of the species and its habitat. Advancements in technologies like satellite tracking and GIS mapping can provide valuable data for understanding elephant movements and their interaction with the landscape, aiding in effective management strategies.

Overall, managing elephant reserves requires a multi-faceted approach that balances the needs of local communities with the conservation of elephants and their habitats.

The necessary information relevant to the HEC needs to be documented for development of the strategies in chapter-4 of the Conservation Plan.

1.7.2 Protected area and interface situation

The PAs are surrounded by a rural/semi-urban agricultural landscape with villages, lakes, ponds, buildings and linear development projects. The buffer area to the PAs has been declared as Eco-Sensitive Zones (ESZs) to create "shock absorbers" by regulating and managing the activities around such areas and prevent negative impacts to the Eco-fragile areas due to the impact of developmental activities and would minimize forest depletion and human-animal conflict.

The necessary information relevant to the ESZ area needs to be documented along with the socio-economic details of the peripheral villages for development of the strategies as detailed in chapter-5 of the Conservation Plan.

1.7.3 Managed forests and interface situation

The managed forest interface situation are about biophysical, social and socio-ecological interactions between managed forests and outlying areas with intense human activities. These are interactions between social and ecological components within or outside managed forest areas. The influence of humans on their local environment, through road expansion, agricultural practices, and animal husbandry impacts the various ecosystem services of the forest.

The necessary information relevant various drivers and pressures needs to be documented for development of the zonation and strategies as detailed in chapter-3 of the Conservation Plan

1.8 PRODUCTION SECTORS IN THE REGION

The Elephant reserves have a human dominated landscape in the periphery with several production sectors that impact on the reserve. These include: (i) Forestry and allied industries(ii) Agriculture (iii) Mining (iv) Eco-Tourism (v) Fisheries (vi) Tea/Coffee Estates (I) (vii) Road / Rail transport (viii) Industry (ix) Hydro-electric Project (x) Thermal power (xi) Religious tourism and Communication projects. The production sector in the zone of influence should be listed and its impact evaluated. There is a need to list out the production sectors in the area, the nature extent and manpower deployment in each sector and Govt regulations required for the continuance of such activity. The mainstreaming of elephant conservation in the production sector to reduce its impact is to be considered.

In an Elephant Reserve, the 'Production sectors' typically refer to the various economic activities and sectors that contribute to the region's development and livelihoods of the local communities. Balancing these production sectors with conservation efforts is crucial to ensure sustainable development and the well-being of both humans and elephants. Some key production sectors, that may exist in an Elephant Reserve region are:

- *Agriculture & Horticulture:* Local communities may engage themselves in agriculture, cultivating crops such as paddy, maize, sugarcane, or other food crops besides cultivation of fruit and vegetables in certain areas, contributing to local livelihoods.
- *Tea & Coffee Estates:* Many areas in the Elephant Reserve have tea and coffee estates which contribute to the economic prosperity of the region.
- *Animal Husbandry:* Livestock farming, including cattle, goats, and poultry, may be practiced by local communities for meat, dairy, and other products.
- *Agroforestry and Non-Timber Forest Products (NTFPs):* Sustainable timber harvesting and logging, through agroforestry and programs like tree cultivation in private lands (TCPL), may contribute to the local economy. Besides, collection and sale of non-timber forest products, such as medicinal plants, honey, and bamboo, can be important for livelihoods.
- *Mining:* Many areas in the Elephant Reserve have mines in the landscape which provide livelihood opportunities to the local communities and adds to the economic resources of the nation.
- *Roads & Railways:* Many areas in the Elephant Reserve have road and rail network in the landscape which provides communication links for economic activities in the region.
- *Ecotourism:* Elephant Reserves often attract tourists for wildlife safaris, nature walks, and other eco-friendly activities, generating revenue for local communities. Supporting services, including accommodation facilities, and guide services, contribute to the tourism sector.
- *Handicrafts and Artisanal Production:* Local artisans may produce traditional handicrafts using materials sourced sustainably from the region. Production of locally-made products, such as textiles, pottery, or handmade items, for sale to tourists or in regional markets.
- *Inland Fisheries:* If there are rivers or water bodies within the reserve outside the PA, communities may engage in sustainable inland fisheries.
- *Conservation-Linked Enterprises:* Promotion of agriculture practices that are compatible with wildlife conservation, minimizing negative impacts on elephants including enterprises linked to conservation, such as nurseries for native plant species etc.
- *Education and Research:* Conservation research and monitoring programs that contribute to scientific knowledge and may attract funding including educational institutions and training centres that provide education and capacity-building opportunities.

- *Hydro-electric and Thermal Projects:* Implementation of both hydel and thermal projects, contribute to the energy requirements and overall economic development.
- *Renewable Energy Projects:* Implementation of sustainable energy projects, such as solar or wind energy, contributing to both economic development and environmental sustainability.
- *Community-Based Initiatives:* Community-led initiatives for sustainable forest management and resource utilization along with the formation of self-help groups engaged in various income-generating activities and community development projects.
- *Government Services:* Employment opportunities in government services, including forest department and district administration.
- *Small and Medium Enterprises (SMEs):* Small businesses that cater to the needs of local communities, including shops, small-scale manufacturing, and services.

Balancing these production sectors with conservation considerations is a delicate task, requiring the development of sustainable practices, community engagement, and the incorporation of wildlife-friendly approaches. This ensures that economic development benefits local communities while also preserving the ecological integrity of the Elephant Reserve.

1.8.1 Direct impact on wildlife

The Production sectors in Elephant Reserves can have 'direct impacts' on wildlife, particularly on elephant populations and other biodiversity. These impacts are often the result of habitat alteration, human-wildlife conflicts, and disruptions to ecological processes. Some of the direct impacts of production sectors on wildlife in Elephant Reserves include:

- Expansion of agriculture, settlements, and infrastructure projects can lead to habitat loss and fragmentation, restricting the movement of elephants and disrupting their natural behaviours.
- Elephants are known to raid crops, leading to conflicts with local farmers. Crop damage can result in retaliatory killings of elephants and is a significant threat to both elephants and human communities. Besides, roads and other infrastructure projects can create barriers for elephant movement and increase the likelihood of encounters with humans.
- Logging and timber extraction can result in deforestation, reducing the availability of suitable habitats for elephants and other wildlife. Also, unsustainable collection of non-timber forest products can impact the vegetation and disrupt the balance of the ecosystem.
- Unregulated tourism can lead to disturbances, altering the natural behaviour of elephants. Noise, proximity of vehicles, and excessive human presence can cause stress and affect the well-being of elephants.
- Certain inland fishing practices can lead to disturbances in water bodies, affecting aquatic ecosystems and impacting wildlife, including elephants that rely on these water sources.
- Expansion of human settlements into elephant habitats can lead to habitat loss, increased human-wildlife conflicts, and disruption of traditional elephant migration/ movement routes.
- Changes in land use patterns, driven by production sectors, can contribute to climate change, affecting the availability of water, food, and habitats for elephants.
- Linear infrastructure such as roads and railways can act as barriers, leading to accidents, injuries, and fatalities among elephants attempting to cross these paths.
- Agricultural runoff, industrial effluents, and other pollutants can contaminate water sources, affecting the health of elephants and other wildlife.
- Production sectors (like tea-coffee estates, hydro-thermal projects, mines etc) can disrupt ecological corridors, essential for the seasonal migration and movement of elephants. Fragmentation can isolate populations, reducing genetic diversity.

- Practices such as overharvesting of timber, non-timber forest products, or unsustainable agriculture can lead to degradation of the ecosystem, affecting wildlife habitats.
- Increased human presence associated with production sectors can facilitate illegal activities, including poaching, posing a direct threat to elephants.
- Certain agricultural practices may involve the introduction of invasive plant species, which can negatively impact native vegetation and disrupt the balance of the ecosystem.

Mitigating the direct impacts of production sectors on wildlife in Elephant Reserves requires a comprehensive approach that includes sustainable land use planning, community engagement, and the enforcement of conservation regulations. Striking a balance between economic development and wildlife conservation is essential for the long-term well-being of both human communities and elephant populations.

1.8.2 Indirect impact on wildlife

'Indirect impacts' of Production sectors on wildlife in Elephant Reserves are often associated with changes in the landscape, ecosystems, and human-wildlife interactions. These indirect effects may not involve direct physical harm to wildlife but can have significant consequences for the overall ecological balance and the well-being of elephant populations. Some common indirect impacts are:

- Intensive agriculture, including the use of pesticides and fertilizers, can lead to changes in the water quality, soil composition and soil depletion (destruction of soil structure, erosion, salinization, desertification, acidification, nutrient leaching, destruction and alteration of soil biota), indirectly affecting the health of vegetation and wildlife habitats.
- Large-scale irrigation projects or water diversion for agriculture can alter natural water courses, degradation of water (redirected flows, depletion of surface and groundwater, wetland drainage, organic enrichment, destruction and alteration of aquatic biota) impacting the availability of water for wildlife and its habitat.
- Changes in land use patterns driven by production sectors causing deforestation and habitat loss, degradation of land and water biota, garbage burning contribute to climate change, which affects temperature, rainfall patterns, and overall ecosystem health.
- The introduction of non-native plant species for agricultural or forestry purposes can lead to the spread of invasive plants, which may outcompete native vegetation and alter ecosystems.
- Removal of vegetation through deforestation or intensive agriculture can lead to soil erosion, impacting water quality and the stability of ecosystems.
- Roads, railways, and other infrastructure projects associated with production sectors can introduce noise and disturbances and environmental pollution that affect wildlife, including disrupting communication and breeding behaviours of elephants. Further, the roads and rails have an impact on the vegetation on the fringes leading to an alteration of the vegetation structure sometimes attracting the animals to the road/railway line fringes leading to death and artificial distribution of animals.
- Pesticides and fertilizers used in agriculture causes chemical contamination and pollution of water bodies, leading to water pollution and negatively impacting aquatic ecosystems and wildlife.
- Changes in traditional fire regimes, often associated with certain agricultural practices, can impact the natural fire ecology, affecting vegetation composition and habitat structure.
- Roads and urbanization can fragment habitats, isolating populations of wildlife, including elephants, and reducing genetic connectivity.
- While not directly impacting elephants, resource extraction activities associated with production sectors can indirectly lead to habitat loss, affecting the availability of forage and water for elephants.

- Uncontrolled grazing by domestic animals can degrade vegetation and compete with native herbivores, potentially affecting the food resources available to elephants.
- Changes in water management practices, such as dam construction or water diversion, can alter natural hydrological processes, affecting aquatic ecosystems and wildlife that depend on them.
- Roads and urban development can disrupt traditional migration routes, forcing elephants to alter their movements, potentially impacting their access to seasonal resources.
- Expansion of human settlements associated with production sectors can lead to increased human presence in and around Elephant Reserves, indirectly affecting wildlife behaviour and causing disturbances.
- Unscientific and unsustainable development practices by line departments including Local Self Governments can have indirect impact, especially on the habitat.

Addressing these indirect impacts requires a holistic and integrated approach to sustainable land use planning, conservation strategies, and community engagement. Balancing the needs of economic development with wildlife conservation is essential for maintaining the ecological integrity of Elephant Reserves.

1.8.3 Assessment of inputs of line agencies

Assessing the inputs of Line agencies and Departments in Elephant Reserves involves evaluating the contributions and actions of various government bodies responsible for wildlife conservation, forest management, and related sectors. These agencies play a crucial role in implementing policies, managing resources, and ensuring the well-being of both elephants and local communities.

An assessment of the inputs of key line agencies and departments in Elephant Reserves include:

1. *Forest Department:* Assess and evaluate habitat protection; anti-poaching measures; fire management strategies; assess elephant behaviour and health; evaluate strategies for managing conflicts, including early warning systems, conflict resolution, and compensation mechanisms; implementation of conservation programs aimed at the protection and well-being of elephants.
2. *State Biodiversity Board:* Assess the board's role in promoting biodiversity conservation around Elephant Reserves, including the protection of flora and fauna.
3. *State Pollution Control Board:* Evaluate the board's efforts in monitoring and controlling pollution, ensuring the health of ecosystems and water sources used by elephants.
4. *Water Resources Department:* Assess the department's role in sustainable water management to ensure the availability of water for elephants and other wildlife. Also, evaluate measures taken to protect natural water bodies critical for elephants.
5. *Department of Agriculture:* Assess initiatives promoting sustainable agricultural practices that minimize negative impacts on elephant habitats and evaluate measures to reduce human-elephant conflicts related to crop raiding.
6. *Department of Animal Husbandry:* Assess the initiatives and efforts of the Veterinary department in vaccination of the cattle in the ER as well as reducing the livestock pressure on the habitat.
7. *Department of Rural Development:* Assess programs aimed at engaging local communities in conservation efforts and sustainable development practices and evaluate initiatives that provide alternative livelihoods to reduce dependence on activities that negatively impact elephants.
8. *Department of Tourism:* Assess the promotion of eco-friendly tourism initiatives that contribute to conservation and minimize disturbances to elephants and evaluate efforts to educate tourists about responsible behaviour in wildlife areas.

9. *Transportation Department:* Assess the consideration of wildlife corridors and measures to mitigate the impact of roads and transportation infrastructure on elephant movements.
10. *Police Department:* Assess the efforts of the Police department in crowd management and mitigation during conflicting situation.
11. *Department of Tribal Affairs:* Assess the department's efforts to engage and collaborate with tribal communities residing in or around Elephant Reserves for sustainable conservation practices.
12. *Revenue Department:* Evaluate the role of the Revenue Department in land use planning to minimize habitat fragmentation and encroachment in elephant habitats.
13. *Department of Education:* Assess initiatives for integrating environmental education, especially related to wildlife conservation, in the curriculum to raise awareness among students.
14. *National and State Disaster Management Authorities:* Assess the preparedness and response mechanisms in place for natural disasters that might impact elephant habitats.
15. *Department of Science and Technology:* Assess the use of technology, such as GIS and remote sensing, for monitoring and managing Elephant Reserves.
16. *Local Self-Government Institutions & Autonomous Councils:* Assess the involvement of local self-government and autonomous councils in conservation planning and community engagement.

A comprehensive assessment of these inputs can provide insights into the strengths, weaknesses, and areas for improvement in the conservation efforts within Elephant Reserves. It can also inform strategies for enhancing collaboration and achieving sustainable outcomes for both wildlife and local communities.

CHAPTER-2
CONTEXT AND SITUATION

2.1 DISTRIBUTION PATTERN AND ABUNDANCE STATUS OF ELEPHANT

Asian elephants (*Elephas maximus*) are among the most endangered species in the world. Currently, elephants occur in highly fragmented populations across 13 range countries in Asia. Among these countries, India holds the largest (> 60%) and one of the most stable elephant populations; estimated at 28,000 to 30,000 or nearly 60% of the population. The population occurs in 1,00,000 to 1,20,000 km^2 of diverse habitats across four major elephant-bearing regions in the country. Being a highly mobile species with large home range, spanning 100 to 3000 km^2, the integrity of elephant habitat rests on maintaining contiguity between habitat patches.

Historically, the significance of the elephant in Indian culture and mythology, as well as its economic and military role in sub-continental armies, has also contributed to a remarkable level of tolerance and support of people towards its survival and conservation. Wild elephants occur in four broad geographic regions namely the Northern, North-east, East-central and Southern with discrete regional meta populations. Additionally, there is a small population of feral elephants in the Andaman & Nicobar Islands.

Elephant habitats are notified as Elephant Reserves (ER) which are basic management unit for elephant conservation and management. A total of 33 ERs have been notified in the country with an area of 80,777.778 sq. km. The ERs are distributed across the four major regions in India as given below:

- *North-eastern India:* Elephant distribution in this region extends along the Himalayan foothills from northern West Bengal, eastward into the states of Assam, Arunachal Pradesh, Nagaland, Manipur, Mizoram, Tripura and Meghalaya. Some of these ranges are contiguous to Bhutan, Bangladesh and possibly Myanmar. The region is estimated to hold approximately 10,139 elephants The elephants of this region are spread across 32,600 km^2 but divided into perhaps as many as 14 sub-populations, with only four of them [North Bank of Brahmaputra in Assam and Arunachal Pradesh (3,250 elephants); and South Bank - Eastern Areas in Assam and Arunachal (1,200 elephants); Central Areas of Kaziranga-Karbi Anglong - Nagaland (2,950 elephants) and Western Areas of Assam extending into Meghalaya (3,000 elephants)] remain fairly large, over larger areas. The prospects for the conservation of elephant in the north-eastern India are seriously affected by habitat loss, fragmentation and increasing human elephant conflict.

- *Northern India:* The elephant range is spread in west-east direction along the foothill forests and floodplains of the Himalayas in the states of Uttarakhand and Uttar Pradesh, partly adjoining Nepal. The region is presently believed to support about 2,085 elephants and the numbers have shown an increasing trend over the years. Rajaji and Corbett National Parks and Lansdowne Forest Division are the important elephant habitats of this region. Before independence, the range of the elephant was probably contiguous along the terai-bhabbar tract from the river Yamuna in the west to the river Sharda in the east. Post-independence, large scale developmental projects in the form of irrigation and power generation projects, expansion of human settlement and cultivation along the major rivers, and introduction of monoculture plantations have fragmented the habitat apart from creating bottlenecks to elephant movement in many locations.

- *East-central India:* The elephants of eastern India are distributed over 23,500 km^2 mostly in the Chota Nagpur plateau across the states of Orissa and parts of Jharkhand. Since 1986, some of these elephants have also been moving into neighbouring states, particularly to south-west Bengal, Chhattisgarh and, more recently, to Madhya Pradesh and north-eastern Andhra Pradesh, where they are in serious conflict with the people. Recent estimates (Synchronized Elephant Census 2017) place the figure at around 3,128 elephants with elephants of Orissa constituting over 70% of them (1,976 elephants) followed by Jharkhand (679 elephants), Chhattisgarh (247 elephants) and southern West Bengal (194 resident

elephants). The elephant habitats of this region are a diffused mosaic of natural forest, often degraded or fragmented, village forest, as well as cultivation and mining areas. Large-scale mining for minerals such as iron, manganese and chromate is the single largest threat to the conservation of elephants in northern Orissa and southern Jharkhand. The most viable habitat and population of this region is undoubtedly the Mayurbhanj Elephant Reserve (that includes the Simlipal Tiger Reserve) in Orissa, while other sizeable populations are also found in the Mahanadi and Sambalpur Elephant Reserves of the same state, as well as the isolated population in Palamau Tiger Reserve in Jharkhand where elephants were introduced by the Rajah of Sarguja during early 20th century.

- *Southern India:* The elephants in southern India range over forested hilly tracts of the Western Ghats and its adjacent Eastern Ghats in the states of Karnataka, Kerala and Tamil Nadu, and more recently in a small area of Andhra Pradesh, Maharashtra and Goa. Their distribution has shrunk to within the Ghats owing to increase in human population and its resultant opening of new land for the expansion of agriculture, commercial plantations, and hydroelectric and irrigation dams. At present, elephants are found in five major landscapes in southern India as under:
    - Uttara Kannada and crestline of the ghats, mainly in the forests of Dandeli as the important elephant habitat, that includes a few elephants that move into Maharashtra and Goa.
    - The Malnad plateau, in particular the Bhadra Wildlife Sanctuary, to the east of the ghats holds an isolated population.
    - The Brahmagiri–Nilgiri–Wyanad–Mysore landscape with the Nagarahole, Bandipur, Wyanad and Mudumalai complex of reserves harbours one of the highest elephant densities (about 2 individuals / km^2), followed by significant numbers in the Biligiri rangans and the hilly tract along the Cauvery River of the Eastern Ghats. This landscape is estimated to support over 11,960 elephants. A small population of elephants that dispersed from here in the 1980s now ranges as scattered groups over isolated hills to the east in Andhra Pradesh and Tamil Nadu.
    - Anamalai-Nelliyampathy-High Ranges landscape with Anamalai, Parambikulam, Malayattur and Vazahchal Forest Divisions being the most important elephant habitats supporting over 3,000 elephants, which includes 225 isolated elephants in Idukki Sanctuary and Kothamangalam Forest Division.
    - Periyar-Agasthyamalai landscape with Periyar, Ranni, and Srivilliputhur as the most important elephant habitats harbouring nearly 2,000 elephants including 250 elephants isolated to the south of Shenkota pass in the Agasthyamalai hills. This is the largest population habitat in the country, with over one-fourth of the habitat being Protected Areas and signs of growing numbers in some populations.
- *Island Population:* There are 25 feral elephants in the Andaman and Nicobar Islands (Synchronized Elephant Census 2017) confined to Diglipur Forest Division in North Andaman and the Interview Island Sanctuary). These elephants were taken from the mainland for timber extraction and abandoned by the company in 1962.

2.1.1 Population estimation and monitoring framework

Wild elephants in India occupy the following geographical regions of the country: 1) Northern region (Uttarakhand, Uttar Pradesh, Haryana, Himachal Pradesh) 2) East-Central region (Odisha, Jharkhand, Bihar, southern Bengal and Chhattisgarh) 3) Northeastern region (Assam, Arunachal Pradesh, northern Bengal, Meghalaya, Nagaland, Tripura, Mizoram and Manipur) 4) Southern region (Karnataka, Kerala, Tamil Nadu, Andhra Pradesh, Maharashtra and Andaman & Nicobar).

The ever increasing anthropogenic and development pressures has led to the fragmentation of Asian elephant habitats, affecting their numbers, demography and ranging patterns across their range. Reliable baseline information on the distribution, demography and population dynamics of free-ranging Asian elephants has been made available after Project Tiger under the All-India Tiger Estimation (AITE) began conducting All India Synchronised Elephant Population Estimation of elephants with the help of Project Elephant.

Population estimation and monitoring of elephants in Elephant Reserves involve systematic and scientific approaches to assess the number, distribution, and health of elephant populations. The framework which is commonly used for population estimation and monitoring of elephants is:

- *Census and Surveys:* Ground-based surveys involve direct observation and counting of elephants by trained personnel. This method is now also being used in conjunction with aerial surveys by drones for validation. However, aerial surveys by drones covers large areas efficiently and is quite effective for identifying and counting elephants. Besides, the indirect method of dung count, is also considered as good in monitoring the population, measuring seasonal distribution of the elephants etc.
- *Identification and Individual Recognition:* Creating photographic catalogues of individual elephants, especially those with distinct markings or features, aids in the identification of individuals during surveys besides DNA analysis of elephant dung can provide information on individual elephants, helping in population estimation and genetic studies.
- *Remote Sensing and Technology:* Deploying camera traps at strategic locations to capture images of elephants and other wildlife helps in estimating population density and monitoring movement patterns. Use of GPS collars and satellite technology to track the movement of individual elephants, provides valuable data on their home range, migration routes, & behaviour.
- *Population Modelling:* Employing statistical models to estimate population size based on survey data, including mark and recapture models and distance sampling methods. Also, spatially explicit population models using advanced modelling techniques to account for spatial distribution and habitat characteristics in population estimates.
- *Community Participation:* Engaging with local communities to gather information on elephant sightings, movements, and interactions. Community involvement enhances data accuracy and promotes conservation awareness. Encouraging citizen science initiatives where local residents contribute to data collection, reporting elephant sightings and participating in monitoring activities.
- *Database Management:* Establishing a centralized database to store and manage data collected from various sources, ensuring easy access for analysis and reporting. Besides, integrating data from surveys, technology-based monitoring, and community reports to provide a comprehensive understanding of elephant populations. The database may also be formulated into an '*Elephant conservation book*' with record on site specific elephant sightings, population size, age structure, habitat suitability, HEC incidences, elephant movements, events and activities and the data/ book maintained by all the administrative and relevant management units of the elephant reserve for analysis and interpretation.
- *Regular Monitoring Cycles:* Implementing regular monitoring cycles to track changes in population dynamics, habitat conditions, and maintaining a long-term monitoring framework to assess trends over extended periods and adapt conservation strategies accordingly.

The Project Elephant initiated the synchronised All-India elephant population estimation exercise to be conducted every five years by the forest departments of elephant range states. The method used is the total direct count method and the indirect dung count method.

The population monitoring at the landscape level has many constraints, the most crucial being the methodology to be used, i.e. direct count and indirect count methods. There is a need to standardize the methods. Besides count, the visibility, habitat, terrain and field logistics are the key constraints. While knowing elephant numbers may be important for managing local populations, demographic parameters and distribution patterns are perhaps more crucial to ascertain long-term trends for conservation.

- There has been a pressing need to improve and harmonize the population estimation methods along more scientific lines in various states across India. The conventional "total count" method, which has limited or no scientific basis for large landscapes and elephant populations, was modified to "sample block counts" with a restricted area (about 5 km^2) to maximize the probability of detection of elephants by a small team of enumerators.
- The choice of population estimation methods should be broadly uniform across the country and as the total direct count has severe limitations it has been decided that the next cycle of population estimation will be done using DNA-based Capture-recapture population surveys. The Wildlife Institute of India has commenced the population estimation exercise during 2023 and the WII/State Forest Departments are collecting dung samples in the statistically computed grids all over the elephant range states.
- The DNA-based estimations of elephant population characteristics involve dung sample collection and individual identification in a capture-recapture framework. While this method

usually generates reliable estimates once dedicated laboratories with skilled technicians can standardize the molecular techniques. The constraints typically involve the logistics of collection, handling and storage of dung in the field, which would ensure the availability of non-degraded, uncontaminated faecal samples for sound laboratory analyses.

Implementing this comprehensive framework involves a multidisciplinary approach, collaboration among stakeholders, and the use of advanced technologies to ensure accurate and up-to-date information for effective population estimation in Elephant Reserves. Additionally, periodic reviews and adjustments to the framework are essential to address evolving challenges and improve monitoring strategies. The ECP shall document all information with respect to the population estimation and monitoring in the past.

2.1.2 Spatial database development

The spatial database on the occurrence of elephants in the elephant-ranging states, its distribution, movement and dispersal are very important for the management of elephants. This data on elephant ranging and distribution patterns can be processed using software and file formats. These data can be further complemented by a wide range of other information about the animals' environment. Management of these large and diverse datasets for modelling animal behaviour and ecology can prove challenging. There is a need for dedicated data management based on a modular software architecture with a spatial database at its core, with interoperability and data model design and integration.

The development of a spatial database for Elephant Reserves involves creating a geospatial information system (GIS) that integrates various layers of spatial data to support effective management and conservation efforts. A step-by-step guide for developing a spatial database in the ER envisages:

- Identify the specific objectives of the spatial database, such as monitoring elephant populations, managing habitats, and addressing human-wildlife conflicts. Determine the data requirements for each objective, including spatial and attribute data.
- Collect spatial data from reliable sources, including satellite imagery, aerial photographs, topographic maps, and existing GIS datasets. Gather attribute data related to elephant populations, habitat characteristics, human settlements, land use, and infrastructure.
- Create separate layers for different thematic data, such as: elephant distribution and movements; habitat types and conditions; water bodies and rivers; human settlements and infrastructure; ecological corridors; and land use and land cover.
- Georeference raster datasets and scanned maps to ensure they align correctly with the spatial reference system of the GIS.
- Integrate spatial and attribute data into a comprehensive database. Ensure consistency in data formats, projections, and attributes.
- Design a spatial database schema considering the relationships between different layers and attributes. Choose an appropriate relational database management system (RDBMS) such as PostgreSQL, MySQL, or SQLite.
- Standardize attribute data formats and units to maintain consistency across the database.
- Develop metadata for each dataset, describing the source, date of acquisition, accuracy, and other relevant information. This helps in quality control and data validation.
- Conduct spatial analyses to derive additional information, such as habitat suitability modelling, connectivity analysis, and hotspot identification.
- Use remote sensing techniques for image processing and classification to generate land cover and land use maps.
- Incorporate GPS tracking data from collared elephants to monitor and analyse their movements.
- Include data on human-elephant conflicts, such as conflict incident reports and locations.
- Consider integrating the spatial database with a web enabled GIS platform for easy access, visualization, and sharing of information.

- Involve local communities in data collection and validation, enhancing community engagement and data accuracy.
- Provide training to relevant stakeholders on the use and maintenance of the spatial database.
- Establish a system for regular monitoring and updates of the spatial database to incorporate new data and changes in the landscape.
- Implement security measures and access controls to protect sensitive information within the spatial database.
- Ensure that the spatial database is interoperable with other systems and can exchange data with relevant authorities and organizations.
- Document the processes, procedures, and workflows involved in the development and maintenance of the spatial database.
- Establish Quality Assurance and Quality Control (QA/QC) procedures to validate the accuracy and reliability of spatial data and database functionalities.
- Periodically review the spatial database's performance, identify areas for improvement, and adapt the database structure based on changing requirements.

Developing a spatial database for Elephant Reserve requires a multidisciplinary approach, involving wildlife biologists, GIS specialists, conservationists, and local communities. The database should be designed to facilitate evidence-based decision-making, conservation planning, and sustainable management of Elephant Reserves.

Similarly, for the development of a genetic database of captive elephants across India through DNA sampling, Project Elephant has initiated an exercise to collect a database of more than 300 captive elephants. The database has been created and recorded through the Gaj Soochna App. which has been developed in collaboration with the Wildlife Institute of India.

2.2 HABITAT QUALITY AND UTILIZATION

Elephants (*Elephas maximus*) require ample space, forage and water to maintain sustainable populations and play a key role in ecosystem functioning. Elephant populations have declined over its historical range; the current elephant range is highly fragmented due to land use change.

India harbours ~60% of the current global elephant population, although extensive habitat loss and fragmentation threaten its long-term population viability. Almost ~25% of elephant habitat has been destroyed since the 1930s and land degradation has been associated with increasing incidents of human-elephant interactions.

The information on habitat quality and utilization patterns of elephants occupying an elephant reserve can be estimated by launching surveys in different seasons. This is an extensive exercise for which the data of the All India coordinated population estimation on the distribution of elephants along with the line transect data on vegetation survey, can provide useful data. Elephant foraging species can provide information on habitat quality and its utilization over the years.

Assessing habitat quality and utilization in Elephant Reserves is crucial for effective wildlife management and conservation. Elephant habitats need to provide the necessary resources for their survival, including suitable food, water, and cover.

An overview of the evaluation of habitat quality and utilization envisages:

- *Habitat Quality Assessment:*
    - Conduct detailed vegetation surveys to assess the composition, structure, and diversity of plant species. This includes identifying key forage species preferred by elephants.
    - Evaluate the abundance, distribution and nutritional values of preferred food sources. Quality habitat should have a variety of nutritious plants available throughout the year.
    - Assess the abundance/distribution and status of invasives, which are causes for habitat degradation.
    - Assess the availability and reliability of water sources, as elephants require access to water for drinking and bathing.

  - Evaluate the availability of suitable cover and shade, such as dense vegetation or forested areas, to protect elephants from extreme weather conditions.

- *Habitat Utilization Studies:*
  - Use GPS collars to track the movements of individual elephants for analysing the data to identify core areas of habitat utilization, migration routes, and seasonal movement.
  - Deploy camera traps to capture images of elephants and monitor their presence in different parts of the reserve as this helps to identify high-usage areas.
  - Conduct surveys to identify and analyse elephant dung and signs (such as feeding signs and footprints) to understand their distribution and habitat use.

- *Seasonal Variations:*
  - Evaluate how habitat quality changes with seasons as different seasons may influence the availability of water, food, and cover, affecting movements and habitat preferences.
  - Study seasonal migration/ movement patterns, especially if the Elephant Reserve encompasses multiple habitats or if elephants migrate/ move between different areas in search of resources.

- *Behavioural Studies:*
  - Observe and analyse the feeding behaviour of elephants, including their preferences for certain plant species and their feeding intensity in different areas.
  - Study areas where elephants rest, socialize, and engage in other behaviours as the same provides insights into habitat utilization for various activities.

- *Human-Elephant Conflict Hotspots:*
  - Identify and map locations where human-elephant conflicts are frequent as this can indicate areas where elephants are interacting with human settlements due to limitations in habitat quality or availability.

- *Corridor Utilization:*
  - Assess the utilization of ecological corridors by elephants as corridors are essential for connectivity between different habitat patches, allowing for gene flow and maintaining population health.

- *Health and Reproductive Success:*
  - Monitor the health of elephants in different parts of the reserve to understand how habitat quality influences their well-being.
  - Study reproductive success, including calf survival rates, which can indicate the availability of suitable habitats and resources for breeding females.

- *Community Involvement:*
  - Involve local communities in habitat assessments, as they often have valuable traditional knowledge about elephant habitat use.
  - Conduct surveys to gather information from local communities on elephant movements, habitat preferences, and potential areas of conflict.

- *Conservation Management Recommendations:*
  - Based on the assessment, develop and implement habitat management strategies. This may include habitat restoration, protection of critical habitats, and mitigating factors contributing to habitat degradation.

- *Long-Term Monitoring:*
  - Establish long-term monitoring programs to track changes in habitat quality and elephant habitat utilization over time.
  - Use adaptive management principles, adjusting conservation strategies based on ongoing monitoring and new information.

Assessing habitat quality and utilization in Elephant Reserves requires a holistic approach, combining ecological studies, technology, and community engagement. By understanding how elephants interact with their habitat, we can implement measures to enhance habitat quality, reduce human-elephant conflicts, and ensure the long-term well-being of both elephants and ecosystems.

2.3 RESOURCE DEPENDENCY OF VILLAGES

The Elephant reserves are large landscapes and have interfaces with several villages and communities located inside or in proximity to the reserve. The resource dependency of communities on natural resources viz fuel wood, NTFP. livestock grazing, etc of the reserve exists on varying

extents. There is conflict on account of the community's access to resources, distribution of resource revenues as well as other benefits. Poverty, climate change, population pressure, governance of land resources, competition over scarce resources, mining, linear development, hydro-electric projects and low awareness of conservation are major drivers of the conflict.

Understanding resource dependency is essential for implementing effective conservation strategies that balance the needs of both people and elephants. The key aspects of resource dependency in villages situated within elephant reserves includes:

- *Agricultural Dependence:* Many villages in and around elephant reserves are agriculturally dependent. Local communities rely on crop cultivation for sustenance and income. Human-elephant conflicts often arise due to elephants raiding crops, leading to economic losses for farmers and creating a direct conflict between conservation and livelihoods.
- *Water Resources:* Villages in these areas depend on water resources for domestic use, agriculture, and livestock. Competition for water can lead to conflicts between humans and elephants, especially during dry periods.
- *Livestock Grazing:* Livestock, such as cattle and goats, are significant assets for rural communities. Grazing areas may overlap with elephant habitats, leading to conflicts and potential loss of livestock.
- *Fuelwood and Non-Timber Forest Products:* Villagers often rely on nearby forests for fuelwood. Balancing this need with forest conservation is crucial. Communities may depend on the collection of non-timber forest products (NTFPs) for subsistence and income, but over-exploitation can impact ecosystems.
- *Tourism and Hospitality:* In some areas, tourism related to wildlife and elephants can be a source of income for local communities through activities like ecotourism, homestays, and guide services.
- *Employment Opportunities:* Some villagers may be employed in activities related to forestry, conservation, or eco-tourism. Agricultural activities, including seasonal labour in neighbouring farms, can contribute to household incomes.
- *Social and Cultural Values:* Elephants may hold cultural and religious significance for local communities. Balancing conservation measures with cultural values is crucial for community cooperation.
- *Government Support and Policies:* The dependency of villages on natural resources is often influenced by government policies, support programs, and initiatives aimed at sustainable development and conservation.
- *Community-Based Conservation:* Engaging local communities in conservation initiatives, providing them with incentives, and involving them in decision-making processes can help balance resource use and conservation goals.
- *Alternative Livelihoods:* Promoting alternative livelihoods, such as beekeeping, handicrafts, or sustainable agriculture practices, can reduce dependency on resources within elephant habitats.
- *Education and Awareness:* Educating communities about the importance of elephant conservation, sustainable resource use, and conflict mitigation strategies is vital for fostering cooperation.
- *Participatory Resource Management:* Involving local communities in the management and decision-making processes related to natural resources can lead to more sustainable and equitable outcomes.

There are several schemes and programs of the State Forest Department to reduce resource dependency. The approach has been to adopt participatory resource management programs (JFM, Eco-development etc). The program focus includes better livelihood opportunities, and reducing the dependency of forest-fringe communities on forests (e.g., cattle grazing, fuelwood and fodder collection, NTFP collection, right of way) by participatory forest management; animal husbandry practices (promoting stall feeding practices or incentivizing improved livestock breeds); and addressing livelihood needs of communities by skill development, poverty alleviation and alternate income generation schemes of the government. The cross-sector linkages for community development (coordination and cooperation with line departments), integrating and dovetailing schemes of line departments for HEC mitigation measures and schemes for community development also facilitate elephant conservation.

Balancing the resource needs of local communities with the conservation of elephants and their habitats is a complex challenge. Successful conservation strategies often involve a combination of community engagement, alternative livelihood development, and the implementation of sustainable resource management practices. Collaboration between conservation organizations, government agencies, and local communities is essential for achieving a harmonious coexistence between humans and elephants in these regions.

2.4 CURRENT STATUS, CHARACTERISTICS, CAUSES AND EMANATING CHALLENGES OF HEC

The anthropogenic & developmental pressure has resulted in widespread loss and shrinkage of elephant habitat, degraded forage resources, reduced and unviable landscape connectivity, and the dispersal of elephants into adjoining landscapes. Among these, the increase in human population in the interface area, land use change in proximity to elephant habitat, including linear infrastructure, mining, change in cropping pattern and above all habitat fragmentation, loss and degradation have the greatest impact.

Elephants are long-lived animals, and their survival depends upon regular migration over large distances in search of food, water, and social and reproductive partners They require a large foraging area with an abundance of variety of grasses including bamboos, shrubs, and tree leaves, roots, and fruits. The loss and degradation of habitat and reduced connectivity between the forest tract and adjoining areas through the corridors have limited their dispersal and such bottlenecks have exacerbated the human elephant conflict. The nature and intensity of HEC varies from state to state, ranging from very low to high conflict. The conflict is characterised by the behavioural pattern of elephant populations; the interface between humans and elephants; a diffuse boundary; elephant habitats with a proximal human-dominated landscape; linear infrastructure projects passing through elephant habitats etc.

- It is estimated that approximately 500 persons and more than 100 Elephants are killed annually. Nearly 0.8 to 1 million ha of agricultural land may be impacted by crop damage due to Elephants, and nearly a million families are adversely affected due to HEC. The challenge extends to the transboundary Elephant populations of Bhutan, Nepal and Bangladesh.

2.4.1 Common Characteristics, Causes and Solutions of HEC

Common Characteristics, causes and solutions of HEC in Elephant Reserves include:

- *Crop Raiding:* Elephants often venture into agricultural areas, causing damage to crops which is a significant source of conflict, especially during periods of food scarcity for elephants.
- *Habitat Fragmentation:* Human activities such as agriculture, settlements, and infrastructure development can lead to habitat fragmentation, increasing the likelihood of conflict.
- *Corridor Disruptions:* Disruptions in traditional corridors due to roads or other developments can force elephants to navigate through human-dominated landscapes, leading to conflicts.
- *Water Source Conflicts:* Competition for water sources can result in conflicts, particularly during dry seasons when water is scarce.
- *Injury and Loss of Life:* HEC incidents can result in injuries or fatalities for both elephants and humans; direct confrontations pose risks and challenges for conservation and community safety.
- *Loss of Livelihood:* Communities dependent on agriculture may suffer economic losses due to crop damage and may contribute to negative attitudes towards elephant conservation.
- *Property damage:* The HEC incidents may result in property damage viz. houses, buildings, vehicles etc.
- *Community Safety Concerns:* The presence of elephants near human settlements raises safety concerns for communities; efforts are needed to ensure the safety of both elephants and people.
- *Mitigation Measures:* Various mitigation measures are implemented to reduce HEC, including the use of barriers, early warning systems, and community-based approaches. Effective waste management is crucial to avoid attracting elephants to human settlements.

- *Community Engagement:* Successful HEC mitigation often involves community engagement, awareness programs and educating local communities.
- *Research and Monitoring:* Data on elephant movements, behaviour, and conflict incidents is crucial for designing effective conservation and management strategies.
- *Recent Initiatives:*
    - Efforts are made to protect and maintain critical elephant corridors to facilitate their movement and reduce conflicts.
    - Initiatives involving local communities in conservation planning and decision-making processes to foster a sense of ownership and responsibility.
    - Voluntary relocation of people in the enclosures
    - The use of technology, such as early warning systems and GPS tracking, to monitor elephant movements and provide timely alerts to communities.
- *Future Challenges and Strategies:*
    - Developing strategies for sustainable land use to minimize habitat fragmentation and conflicts between elephants and human activities.
    - Implementing programs to support alternative livelihoods for communities living in proximity to elephant reserves to reduce dependency on agriculture.
    - Collaborating with neighbouring countries and international organizations to address transboundary issues related to elephant conservation and movement.

Current conflict management approaches have been provided in the Guidelines issued by MoEF&CC which focus on prevention through exclusion and on-site deterrents, and mitigation by barriers, elephant translocation or hunting of 'elephants-in-conflict' and monetary compensation for losses. The approach also addresses the drivers and pressures of human-elephant conflict.

2.4.2 Key Drivers and Stressors of HEC and Emanating Challenges

The general drivers of HEC are human-related factors/activities and/or natural-system dynamics that help drive ecological resource conditions in the ER whereas the stressors are the specific physical, chemical, or biological disturbances to which the elephant reserve and resources respond.

Human-Elephant Conflict (HEC) in elephant reserves is influenced by various drivers and stressors that arise from the overlapping needs of elephants and human communities. It includes an exponential rise in human population, antipathy towards elephant conservation (due to crop damage, injury/loss of life and loss to property), the socio-economic conditions, land use changes in interface areas (especially the cropping pattern), linear infrastructure and rural development works, mining, urban development, habitat fragmentation, and degradation including local overabundance of elephants.

Understanding these drivers and stressors is crucial for developing effective strategies to mitigate conflicts and promote coexistence.

- To record the perception of people on the key stressors, the communities most affected may be surveyed and their choices scored (1-10 scale) for elucidating the main drivers for HEC.

Once the key stressors aforementioned are identified, the next step is to address these drivers which should be a priority in state-level planning to avoid future impacts. Similarly, at the district-level planning, the impact of these drivers is to be ascertained to avoid escalating HEC in the area.

Addressing the drivers and stressors includes responses that are directed towards:

- Management-relevant response for addressing the drivers and stressors
- Institutional capacity development for addressing the drivers and stressors

The key stressors contributing to HEC and the challenges they emanate in elephant reserves are:

- *Habitat Fragmentation and Loss:*
    - *Stressor:* Rapid urbanization, agriculture expansion, spread of invasives and infrastructure development lead to the fragmentation and loss of elephant habitats.
    - *Challenge:* Reduced and fragmented habitats force elephants to move through human-dominated landscapes, increasing the likelihood of conflicts.

- *Crop Raiding:*
  - *Stressor:* Elephants raiding agricultural crops in search of food, especially during periods of scarcity or due to changes in land use.
  - *Challenge:* Crop losses result in economic hardships for farmers, leading to negative perceptions of elephants and conservation efforts.
- *Water Scarcity:*
  - *Stressor:* Competition for water resources, especially during dry seasons, can intensify conflicts between elephants and local communities.
  - *Challenge:* Ensuring access to water for both elephants and humans while minimizing conflicts is a complex balancing act.
- *Corridor Disruptions:*
  - *Stressor:* Disruption of traditional elephant corridors due to infrastructure development can impede natural movements.
  - *Challenge:* Corridor disruptions can lead to increased conflicts as elephants navigate through areas not suitable for their movement.
- *Human Population Growth:*
  - *Stressor:* Increasing human populations result in the expansion of settlements and agricultural activities into elephant habitats.
  - *Challenge:* Elevated human-elephant interactions and conflicts as communities encroach upon traditional elephant territories.
- *Lack of Community Engagement:*
  - *Stressor:* Insufficient community involvement in conservation planning and decision-making processes.
  - *Challenge:* Without community support, implementing effective and sustainable conflict mitigation strategies becomes challenging.
- *Inadequate Mitigation Measures:*
  - *Stressor:* Insufficient or ineffective measures to mitigate conflicts, such as poorly designed barriers or lack of early warning systems.
  - *Challenge:* The absence of adequate mitigation measures increases the likelihood of negative interactions between elephants and humans.
- *Poaching and Retaliation:*
  - *Stressor:* Illegal activities, including poaching of elephants for ivory, can disrupt populations and trigger retaliatory actions by communities.
  - *Challenge:* Retaliatory killings of elephants in response to conflicts perpetuate a cycle of violence and hinder conservation efforts.
- *Climate Change:*
  - *Stressor:* Climate change can alter vegetation patterns, affecting food availability and water sources for elephants.
  - *Challenge:* Changing climate conditions may force elephants to adapt their movements, potentially bringing them into closer proximity to human settlements.
- *Lack of Livelihood Alternatives:*
  - *Stressor:* Limited alternative livelihood opportunities for communities dependent on agriculture.
  - *Challenge:* In the absence of viable alternatives, communities may resist or resent conservation efforts that restrict their traditional activities.
- *Poorly Managed Tourism:*
  - *Stressor:* Unregulated or poorly managed tourism can contribute to disturbances in elephant behaviour and habitats.
  - *Challenge:* Negative interactions between elephants and tourists, as well as disturbances to natural behaviours, can escalate conflicts.
- *Insufficient Awareness and Education:*
  - *Stressor:* Lack of awareness and education about elephant behaviour and the importance of conservation.
  - *Challenge:* Inadequate understanding leads to fear and misunderstanding, contributing to negative attitudes towards elephants.
- *Limited Research and Data:*
  - *Stressor:* Insufficient data on elephant movements, behaviour, and ecological requirements.

- *Challenge:* Lack of comprehensive information hinders the development of targeted and evidence-based conservation strategies.

Addressing these stressors and challenges requires a holistic and multidisciplinary approach that involves collaboration among conservationists, government agencies, local communities, and other stakeholders. Solutions may encompass habitat management, community engagement, education, alternative livelihoods, and effective mitigation measures to achieve sustainable coexistence.

2.5 ASSESSMENT OF THREATS INCLUDING SPATIAL-TEMPORAL RISK ASSESSMENT

The Elephant reserves are large landscapes with a spectrum of vegetation types; the threats emanate from anthropogenic pressures from communities for resource use and development projects. There is a general understanding of the nature and level of threat and some data is available in the planning documents (TCP, Management Plan & Working Plan). The planning documents not only have assessed threats, but also prioritization of them including formulation of strategies for mitigation.

The critical threats in the landscape include:

Loss of Biodiversity:

- The conservation of biodiversity is impeded by a variety of direct and indirect constraints. The direct constraints, almost entirely anthropogenic, degrade, even destroy the forest while, the indirect emanate from the basic social, economic, political, cultural and historical factors.
- The forest composition, structure, growth and regeneration are most affected after years of recurring, fires, droughts and human activities illegal cutting, livestock grazing, encroachment, and man-made fires. There is a growing threat to the Communities, Species, Habitats and Ecological Processes. There are old growth stable forest areas, recovering forest areas and deteriorating and degraded forest areas that require to be insulated from threats based on their vulnerability. With changes in the land use pattern and interventions for enhanced development, the threat to the reserve changes over time and requires a regular monitoring mechanism.

Essential Ecological Process:

- The essential ecological processes and functions may be threatened in the landscape; the erosion of river banks, damage to riparian forest and grassland, drying of marshland, invasive species, mining, quarrying and effluent discharge can impair the forest ecosystem and impact the ecology which require listing for initiating mitigation measures.

Linear Development Projects:

- The presence of linear development projects (highways, rail, canal etc) in the elephant reserves fragment and disrupt the contiguity of habitats. There could be instances where there are a host of illegal settlements by encroachment on Govt land and reserved forests. The sum total of these developments could be a total disruption of habitat contiguity amounting to ecological bisection of the extremely biodiversity-rich landscape.

Monoculture Plantations:

- There could be a large number of commercial plantations of eucalyptus, teak and other pulpwood species, responsible for accelerated soil erosion and degradation of vital watersheds, not to mention the direct impacts on biodiversity and habitats.

Reservoirs, irrigation and hydel projects:

- The landscape has prime watersheds, catchments of rivers, and hill-valley terrain that offer potential sites for multipurpose reservoirs providing water for drinking and irrigation, and hydro-power. There could be extensive submergence in the multipurpose reservoir area in the most productive riparian forests and wildlife-biodiversity habitats. The canal system for irrigation and the colonies for maintenance of infrastructure cause fragmentation of habitats.
- The economic value of these reservoirs is immense; however, their disturbance and damage also need to be appraised. There are several labour settlements and staff colonies in the landscape which impacts habitat with livestock rearing, firewood collection etc and needs to be addressed.

Commercial plantation of tea, coffee, spices and rubber:

- These occupy high potential biodiversity and wildlife habitats including corridors in the biodiversity rich forest area. The impact of labour habitations on nearby forests including firewood and livestock grazing is an issue in several cases.

Tourism and Pilgrimage:

- The eco-tourism and pilgrimage potential of the landscape attract entrepreneurs to open resorts which may enhance disturbance and damage.

Tribal Settlements:

- The tribal settlements are expanding resulting in enhanced biotic pressure on the forested habitat. Also, forest lands are gradually being expanded by the tribals. Livestock grazing, poaching, Illicit tree felling, sand mining, firewood collection, and pilgrimage are threats for which strategies for reduction under the tribal development programs are to be initiated.

Marginalization and impoverishment of communities:

- The communities are also affected by the shrinkage and degradation of natural ecosystems. Loss of productivity in forests and ecosystem services (aquifers in particular) impairs the productivity of farms and pastures and undermines the availability of NWFP, making life difficult for those dependent on these resources. The strategy for improving livelihood opportunities has to focus on the skill development, alternate income generation sources, community-based eco-tourism, self-help groups and micro-credit schemes as part of ecological sustainable development.

Improper and irrational land use:

- The conservation of natural ecosystems is essential for ecological, food and water security, which in turn ensures economic security. The vicious cycle of the disadvantaged and poor degrading the resource through unsustainable use will continue to destroy the resource. The strategy for has to be holistic and must integrate schemes addressing the issue at grassroot level.

Assessing threats to elephants in elephant reserves involves a comprehensive analysis that considers various factors, including spatial and temporal dimensions. An overview of how a threat assessment, including spatial-temporal risk assessment can be conducted, envisages:

- *Spatial-Temporal Mapping:*
  - *Spatial Mapping:* Utilize Geographic Information System (GIS) technology to map the spatial distribution of elephant populations, critical habitats, and potential threats.
  - *Temporal Trends:* Analyse temporal trends in land use changes, human activities, and elephant movements over time.

- *Identification of Threats:*
  - Identify areas with a history of human-elephant conflicts, including locations with frequent crop raiding incidents.
  - Assess the spatial distribution of areas prone to poaching, illegal logging, or other activities that directly threaten elephants.
  - Identify regions facing habitat loss and fragmentation due to agriculture, urbanization, or infrastructure development.

- *Climate Change Impacts:*
  - *Spatial Analysis:* Evaluate the spatial impact of climate change on elephant habitats, considering factors like changes in vegetation, water availability, and temperature.
  - *Temporal Trends:* Analyse how climate change may alter the temporal patterns of resource availability for elephants.

- *Ecological Corridors:*
  - *Spatial Connectivity:* Assess the status of ecological corridors connecting different elephant habitats and identify areas where corridors are intact, disrupted, or require restoration.
  - *Temporal Dynamics:* Examine how the use of ecological corridors by elephants varies seasonally or annually.

- *Land Use and Land Cover Change:*
    - *Spatial Analysis:* Evaluate changes in land use and land cover within and around the elephant reserves and identify areas undergoing transformation that may impact elephant habitats.
    - *Temporal Trends:* Study how land use changes have evolved over time and their implications for elephants.

- *Anthropogenic Disturbances:*
    - *Spatial Assessment:* Identify areas with high levels of human activities, such as settlements, agriculture, and infrastructure development, that may disturb elephant behaviour.
    - *Temporal Variability:* Analyse temporal variations in anthropogenic disturbances, considering daily, seasonal, and annual patterns.

- *Human Population Density:*
    - *Spatial Analysis:* Evaluate the spatial distribution of human populations around elephant reserves with higher population densities indicating increased potential for conflicts.
    - *Temporal Changes:* Track changes in human population density over time and its correlation with elephant movements and conflicts.

- *Tourism Impact:*
    - *Spatial Mapping:* Assess the spatial impact of tourism activities on elephant behaviour and habitats.
    - *Temporal Patterns:* Study temporal variations in tourist activities and their potential influence on elephant stress levels.

- *Resource Availability:*
    - *Spatial Assessment:* Evaluate the spatial distribution of key resources like water, forage, and suitable habitats for elephants.
    - *Temporal Dynamics:* Consider how resource availability changes seasonally and its impact on elephant movements.

- *Remote Sensing and Satellite Data:*
    - *Spatial Monitoring:* Utilize remote sensing data to monitor land cover changes, vegetation health, and other spatial parameters affecting elephants.
    - *Temporal Analysis:* Use time-series satellite data to analyse temporal trends and changes in the landscape.

- *Community Dynamics:*
    - *Spatial Distribution:* Assess the spatial distribution of human communities in relation to elephant habitats.
    - *Temporal Trends*: Examine changes in community dynamics, land use patterns, and agricultural practices over time.

- *Data Integration:*
    - *Integration of Spatial and Temporal Data:* Integrate spatial and temporal data layers for a holistic understanding of how threats evolve over time and space.

- *Modelling and Predictive Analytics:*
    - *Spatial-Temporal Models:* Develop models that predict spatial-temporal patterns of elephant movements and potential conflict areas based on historical data and environmental variables.

- *Adaptive Management Strategies:*
    - *Spatial-Temporal Adaptive Management:* Implement management strategies that consider changing spatial-temporal dynamics of threats and their impacts on elephants.

A spatial-temporal risk assessment may provide a nuanced understanding of the dynamic nature of threats faced by elephants in reserves. Continuous monitoring and adaptive management based on the assessment, are crucial for the effective conservation and management of elephant populations.

2.6 EXISTING SITUATION IN THE ZONE OF INFLUENCE

The Elephant reserve has a large irregular, porous boundary with the adjoining agricultural landscape, hence a zone of influence must be delineated to contain the impacts and insulate from the harmful activities from this area. This zonation is a management entity demarcated for managing the deleterious impacts of this area. The distance of the zone of influence can extend to the range of movements of elephants in this landscape which is interspersed with villages and towns.

The zone will have regulations for safeguarding against effluents and pollutants, garbage and waste accumulation, religious tourism impacts, mining and boulder collection, the spread of invasive species, environmentally damaging land-use changes, spates of boundary defacement and encroachment, poaching pressure, vandalism, prophylactic veterinary care etc.

The impacts in this zone have to be assessed based on several secondary data viz, EIA assessments under EPA, Planning permissions, Pollution control board permissions for establishing mining, chemical and other industries. The PAs have Eco-sensitive Zones (ESZ) to buffer the impacts in this zone but for non-PA areas, the zone of Influence may provide requisite information for prescribing safeguards.

The situation in the zone of influence can vary widely based on factors such as location, local community dynamics, conservation efforts, ongoing developments and challenges. The key components include:

- The zone of influence typically includes diverse habitats and ecosystems that support elephants.
- Local communities residing in and around the reserve contribute to the zone of influence and their activities, livelihoods, and interactions with elephants, are crucial factors.
- Crop raiding and other forms of conflicts that arise due to HEC and economic challenges faced by local communities, particularly those dependent on agriculture, due to conflicts.
- Elephant corridors that facilitate the movement of elephants between different parts of the landscape, connecting fragmented habitats, and the need for maintaining or restoring corridors.
- Designated tourism zone contributing to the economy of the region and how tourism activities are managed to balance economic benefits with conservation needs of elephants and their habitats.
- Impact of human infrastructure, such as roads, settlements, and other developments, on the landscape and wildlife and the implementation of mitigatory measures, which may include barriers, early warning systems, and community-based initiatives.
- Existing gaps in conservation efforts, law enforcement, and management practices that may affect the well-being of elephant populations including the effectiveness of policies, regulations, and governance structures to address conservation challenges and human-wildlife conflicts.

This zone of influence is purely to devise a management strategy to mitigate threats to the forest resources not only from forest-dependent communities but from the development activities in the area as detailed in the ‘elephant human management zone’.

2.7 PROPOSED MANAGEMENT: VISION, GOALS, OBJECTIVES, PROBLEMS AND STRATEGIES

Managing an elephant reserve requires a comprehensive approach that considers ecological, social, and economic factors. By implementing a holistic management approach that integrates ecological conservation, community engagement, research, law enforcement, sustainable development, policy advocacy, and adaptive management, the elephant reserve can effectively protect and conserve its iconic wildlife while promoting the well-being of local communities and ecosystems.

2.7.1 The Vision

The vision typically encompasses several key objectives aimed at conserving and protecting elephant populations and their habitats.

- The vision of an elephant reserve is to ensure the long-term survival of elephant populations, preserve biodiversity and maintain the ecological integrity of the reserve while fostering sustainable coexistence with human communities and promoting the conservation of natural habitats for the benefit of current and future generations.

2.7.2 The Goal

A goal is an articulation of broad generalized management objectives in consonance with the conservation policy for securing the elephant population and habitat. The conceptual goals for the conservation of elephants are provided in the Project Elephant document and National Elephant Conservation Action Plan, 1999.

- The primary goal of elephant reserve management is to ensure the conservation and sustainable management of elephant populations and their habitats. This involves addressing ecological, social, and economic aspects to achieve a balance between the needs of elephants and those of human communities.

In the context of Elephant Reserves the two overarching goals could be:

1. Ensure the long-term survival of viable (demographically and genetically) populations of elephants through land-use planning, regulation and consolidation in the larger natural landscapes of the state based on sound scientific theory and social principles.
2. Substantially reduce the levels of human-elephant conflict to relieve human suffering from loss of crops, property and life, in a manner that would promote greater tolerance and acceptance of elephants in the larger landscape by local communities, protect their livelihoods, and ensure their effective participation in conservation.

2.7.3 Objectives of management

The basis of the planning process is identifying the values of the elephant conservation landscape and then securing the values by setting management goals and objectives. The prioritization of values will be the guiding factor for setting the objectives.

A management objective is a clear description of a measurable standard, future desired state, threshold value, amount of change, or trend to achieve for a particular population or habitat during the plan period. Thus, objectives should be precise/specific, achievable and realistic, time-related, measurable, reflect the purpose, significance and exceptional values of the area and must spell out the ends desired, adequately address the issues accompanied by a rationale and written in priority order.

The National Elephant Conservation Action Plan and Project Elephant document has set the goals and strategies for the Elephant Reserves which are to protect and conserve viable elephant populations; to protect elephant habitat and corridors; to mitigate the threat of genetic isolation of small populations; mitigate conflict and humane treatment of elephants in captivity.

Considering the values and threats in the four regions of the country relating to elephant population dynamics and habitat characteristics, the overarching objectives of elephant reserve management typically may include:

- Ensure the long-term viability and health of elephant populations within the reserve; and preserve and promote genetic diversity to maintain the adaptive capacity of the elephant population.
- Preserve and protect critical elephant habitats, including feeding grounds, migration corridors, and breeding areas; and implement measures to restore degraded habitats and maintain connectivity between different habitat patches.
- Implement strategies to reduce conflicts between elephants and local communities, including crop protection, early warning systems, and community-based initiatives; and foster positive relationships between local communities and authorities through education, awareness, and community participation in conservation efforts.
- Promote sustainable land use practices that balance the needs of both elephants and local communities, minimizing negative impacts on ecosystems; and develop and support alternative livelihood options for communities living in and around the reserve to reduce dependency on resources within the reserve.
- Protect and maintain ecological corridors that facilitate movement of elephants between different habitats; and restore and rehabilitate disrupted or degraded corridors to enhance connectivity.
- Conduct research on elephant behaviour, movement patterns, habitat preferences, and ecological requirements; and implement long-term monitoring programs to track changes in elephant populations, habitat conditions, and human-elephant interactions.

- Develop and implement strategies to help elephant populations and their habitats adapt to the impacts of climate change, including changes in vegetation, water availability, migration patterns.
- Implement guidelines and management practices for tourism to minimize negative impacts on elephants and their habitats.
- Conduct educational programs and awareness campaigns to inform local communities about the importance of conservation and the ecological role of elephants; and educate tourists about responsible wildlife viewing practices to minimize disturbances to elephants and their habitats.
- Develop and implement emergency response protocols to address immediate threats to elephant populations, such as disease outbreaks or natural disasters including management of elephants in captivity.
- Collaborate with neighbouring countries and international organizations for the conservation of shared elephant populations and ecosystems; and share best practices and research findings with the global conservation community.
- Empower local communities to actively participate in conservation decision-making and management processes; and ensure that communities receive tangible benefits from elephant conservation efforts, fostering a sense of ownership and cooperation.
- Build the capacity of local communities, conservation professionals, and government agencies involved in elephant reserve management.

The ultimate goal is to create a sustainable and harmonious coexistence between elephants and humans, ensuring the conservation of biodiversity, maintaining ecosystem health, and supporting the well-being of both elephant and local communities. Adaptive management strategies, continuous monitoring, and collaborative efforts are key to achieving these objectives in the dynamic and ever-changing landscape of elephant reserves.

2.7.4 Problems in achieving objectives

The objectives once set meticulously have to be accomplished by a set of management actions to be described in detail in the 'Strategies'. The objectives are based on the values to be protected and threats to be mitigated but there are impediments as the natural forest resource to be secured is impacted by the drivers and pressures emanating from the landscape.

- It is necessary to list all such impediments against the objectives and the options available to achieve them. 'Objectives-Problem Matrix' analysis will guide designing viable strategies.

While the objectives of managing elephant reserves are designed to promote conservation, biodiversity, and human-elephant coexistence, several challenges and problems can hinder the successful achievement of these objectives. These problems are often complex and interconnected, requiring multifaceted strategies for resolution. Some common problems include:

- *Human-Elephant Conflict (HEC):* Elephants entering agricultural areas can lead to economic losses for farmers and contribute to negative attitudes towards elephants; and incidents of elephants damaging property, such as houses or infrastructure, exacerbate conflicts.
- *Habitat Loss and Fragmentation:* Agricultural expansion, urbanization, and infrastructure development can result in habitat loss and fragmentation, restricting elephant movements; and development projects can disrupt traditional elephant corridors, impacting migration patterns.
- *Insufficient Resources and Funding:* Inadequate financial resources for implementing conservation programs and infrastructure development within reserves; and competition for limited resources among various conservation priorities.
- *Climate Change Impacts:* Changes in climate conditions can affect vegetation, water availability, and migration patterns, impacting the natural behaviour of elephants; and elevated temperatures and altered precipitation patterns can contribute to stress in elephant populations.
- *Poaching and Illegal Activities:* Poaching for ivory and other illegal activities pose a direct threat to elephant populations; and conflicts with humans may lead to retaliatory killings, further threatening elephant populations.

- *Lack of Community Engagement:* Insufficient communication and engagement with local communities can result in misunderstandings and resistance to conservation efforts; and lack of involvement of local communities in decision-making processes and conservation initiatives.
- *Inadequate Enforcement of Laws:* Insufficient enforcement of existing laws, leading to increased threats to elephants.
- *Tourism Pressures:* Unregulated or poorly managed tourism can disturb elephant behaviour, habitats, and contribute to stress; and high tourist numbers without proper regulation can exceed the carrying capacity of the reserve.
- *Limited Research and Data:* Insufficient data on elephant movements, behaviour, and ecological requirements for informed decision-making; and limited scientific studies to guide conservation strategies based on the specific needs of the elephant population.
- *Population Pressure:* Increasing human populations around reserves can lead to habitat encroachment and conflicts; and growing communities may intensify competition for limited resources, exacerbating conflicts.
- *Lack of Alternative Livelihoods:* Communities dependent on natural resources within reserves may resist conservation efforts without viable alternatives; and unequal distribution of benefits from conservation initiatives, leading to dissatisfaction among local communities.
- *Climate Vulnerability:* Vulnerability to extreme weather events such as droughts or floods that can directly impact elephant habitats and food sources; changes in vegetation patterns and water availability may necessitate adjustments in elephant movement patterns.
- *Limited Regional / International Cooperation:* Lack of collaboration and coordination between states and countries for the conservation of crossing elephant populations; and challenges in sharing information and resources with regional and international partners for conservation.

Addressing these problems requires a holistic and adaptive approach, involving collaboration between stakeholders and multipronged strategies.

2.7.5 SWOT analysis

Strength, Weakness, Opportunities and Threats (SWOT) analysis is a strategic planning tool that can be used by Natural Resource managers to do a situational analysis of the natural resource.

SWOT analysis is an immensely interactive process and requires effective consultation with the stakeholders on natural resource management. The SWOT analysis/Matrix will help in the formulation of four types of strategies:

1.
2. SO (strengths-opportunities) Strategies
3. WO (weaknesses-opportunities) Strategies
4. ST (strengths-threats) Strategies
5. WT (weaknesses-threats) Strategies

The purpose of the SWOT is to build and enhance strengths, resolve and reduce weaknesses, expand opportunities, and avoid, reduce and mitigate threats.

In Elephant reserves with large areas and multiple threats a SWOT analysis, prepared in consultation with stakeholders will enhance the management to formulate viable strategies for elephant reserve management.

SWOT analysis for an elephant reserve envisages:

Strengths:

- ERs host diverse ecosystems and wildlife, contributing to overall biodiversity conservation.
- Elephants often hold cultural and ecological significance, enhancing the reserve's importance.
- Symbolic and charismatic flagship species can attract public support.
- Provides opportunities for scientific research on elephant behaviour, ecology & habitat dynamics.

- Presence of conservation programs and initiatives aimed at protecting elephants & their habitats.
- Designation as a PA enhances legal safeguards for elephants and associated biodiversity.

Weaknesses:

- High potential for HEC, leading to negative perceptions and challenges in coexistence.
- Crop raiding and property damage may strain relations with local communities.
- Fragmentation of elephant habitats due to human activities, affecting natural movement patterns.
- Disrupted migration corridors may impact the overall health of the population.
- Insufficient financial and human resources for effective conservation and management.
- Limited capacity for law enforcement and monitoring activities.
- Vulnerability to climate change impacts affecting vegetation, water availability & habitat quality.
- Reliance on external funding and international cooperation for conservation projects.

Opportunities:

- Opportunities to engage local communities in conservation efforts through education and sustainable development initiatives.
- Sustainable eco-tourism can generate revenue for conservation and raise awareness about elephant conservation.
- Opportunities for collaboration with research institutions and universities for scientific studies and monitoring.
- Development of alternative livelihoods for local communities to reduce dependence on natural resources within the reserve.
- Potential for international support and collaboration for transboundary conservation efforts.

Threats:

- Threats from habitat loss/ degradation due to agriculture, logging and infrastructure development.
- Persistent threats from poaching for ivory and other illegal activities.
- Retaliatory killings in response to human-elephant conflicts.
- Vulnerability to changes in government policies affecting conservation efforts.
- Negative impacts of tourism, including habitat disturbance, if not managed responsibly.
- Increasing vulnerability to climate change, leading to changes in vegetation and water availability.
- Weaknesses in law enforcement and monitoring, leading to illegal activities within the reserve.
- Lack of public awareness about the importance of elephant conservation and role of the reserve.
- Disruption of ecological corridors and limited connectivity between habitats.

Recommendations:

- Strengthen community engagement and involve local communities in decision-making.
- Implement responsible tourism to minimize negative impacts on elephants and their habitats.
- Seek diversified funding sources & explore public-private partnerships for sustainable financing.
- Implement climate-resilient conservation strategies to address climate change impacts.

- Strengthen law enforcement efforts to combat poaching and illegal activities within the reserve.
- Support the development of alternative livelihoods for local communities to reduce dependency.
- Enhance collaboration with neighbouring countries for transboundary conservation initiatives.
- Conduct extensive awareness campaigns to highlight the importance of elephant conservation.
- Invest in research & monitoring programs to gather essential data for informed decision-making.
- Prioritize habitat restoration initiatives to mitigate the impacts of habitat loss and fragmentation.

The recommendations aim to address weaknesses and threats while leveraging strengths and opportunities to achieve conservation objectives effectively.

2.7.6 Formulation of strategies in consonance with the existing plans

Any strategy to be successful should have a sound basis, employ the standard technique and procedure, be well tried and proven, time frame determined for achieving the full implementation with annual targets, costs, and funding mechanism. There should be an inbuilt monitoring mechanism to determine the efficacy of the strategy and to make corrections if necessary. Management strategies prescribed may fail if they are introduced to the area, not suited to the site condition and not as per the result of pilot test.

Considering the elephant not only as a keystone species but also an umbrella and flagship species, the plan besides necessitating a landscape-level approach has to be overarching in the implementation areas under different management regimes viz. guidelines of the Tiger Conservation Plan (TCP); management plans for the Protected Areas (PA); traditional forestry management as per Working Plan (WP) prescriptions guided by the National Working Plan Code; and Zonal Master Plan (ZMP) in the fringe areas governed by the Eco-sensitive Zone (ESZ) guidelines.

The challenge is to integrate the different planning processes in not only achieving the goals set in the Project Elephant document but also the common goal of sustainable forest management and wildlife conservation with a focus on the elephants. The Elephant Conservation Plan has to be aligned with the existing approved plans and therefore the theme plans on various activities as described in the National Elephant Conservation Action Plan and Project Elephant document, will apply to the entire elephant landscape.

Formulating effective strategies for the management of an elephant reserve involves addressing the unique challenges and opportunities presented by the reserve's ecological, social, and economic context. The key strategies which can be considered, include:

- *Human-Elephant Conflict (HEC) Mitigation:*
  - Implement and enhance early warning systems to alert communities about elephant movements, minimizing surprise encounters.
  - Develop and promote effective crop protection measures, including barriers, deterrents, and alternative crops.

- *Habitat Conservation and Restoration:*
  - Strengthen protection of ecological corridors and implement measures to restore and reconnect fragmented habitats including maintaining viability of corridors
  - Establish a robust habitat monitoring system to track changes and assess the health of the elephant habitats.

- *Anti-Poaching Measures:*
  - Strengthen anti-poaching efforts through increased patrolling, surveillance, and the use of technology such as drones and camera traps.
  - Implement strict law enforcement and penalties for poaching and illegal wildlife trade.

- *Community Engagement and Livelihood Development:*
  - Engage local communities in conservation decision-making processes and empower them to actively participate in conservation initiatives.
  - Develop and support alternative livelihood options to reduce dependence on resources within the reserve including tribal development

- *Tourism Management:*
  - Implement and enforce guidelines for responsible wildlife tourism to minimize disturbances to elephants and their habitats.
  - Integrate educational components into tourism activities to raise awareness about elephant conservation.

- *Research and Monitoring Programs:*
  - Conduct and support scientific research on elephant behaviour, migration patterns, and habitat dynamics.
  - Implement comprehensive monitoring programs to track elephant populations, demographics, and health.

- *Climate Change Adaptation:*
  - Develop adaptive management strategies to help elephants and ecosystems adapt to the impacts of climate change.
  - Identify and prioritize climate-resilient conservation practices.

- *Transboundary Collaboration:*
  - Foster collaboration with neighbouring countries and international organizations for transboundary conservation efforts.
  - Establish mechanisms for sharing information, research findings, and best practices with relevant international partners.

- *Capacity Building:*
  - Conduct training programs for local communities, conservation professionals, and law enforcement agencies to enhance their skills and knowledge.
  - Implement educational initiatives to build awareness and understanding of the importance of elephants and biodiversity.

- *Public Awareness Campaigns:*
  - Conduct public awareness campaigns using various media to educate the general public about the importance of elephant conservation.
  - Integrate conservation education into school curricula to instil a sense of responsibility from an early age.

- *Collaboration with NGOs and Conservation Organizations:*
  - Form partnerships with non-governmental organizations (NGOs) and conservation organizations for financial and technical support.
  - Collaborate on joint projects to leverage expertise and resources for effective conservation.

- *Emergency Response and Crisis Management:*
  - Develop and regularly update emergency response protocols for immediate intervention during crises.
  - Involve local communities in emergency response planning and preparedness.

- *Diversification of Funding Sources:*
  - Actively pursue grants from government agencies, foundations, and international donors.
  - Explore opportunities for public-private partnerships to secure additional funding for conservation initiatives.

- *Integration of Indigenous Knowledge:*

  - Integrate indigenous knowledge into conservation planning and management, respecting the wisdom of local communities.

- *Technology Integration:*
  - Utilize Geographic Information System (GIS) and remote sensing technologies for effective monitoring, mapping, and analysis.
  - Implement technology solutions such as camera traps and drones for monitoring and enforcement activities.

These strategies should be tailored to the specific conditions and needs of the elephant reserve, and their implementation should involve collaboration with local communities, governments, conservation organizations, researchers, and other stakeholders. Regular monitoring and adaptive management are essential to assess the effectiveness of these strategies and make adjustments as needed.

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Chapter-3 Managing Drivers and Pressures

3.1 ZONATION IN ELEPHANT RESERVES

A zone is an area set apart for meeting management objectives. It is not a legal category but a management entity. The Elephant Reserve is a mosaic of forest areas under different management regimes. There are areas that are distinguishable, recognized on account of their ecological, faunal, geomorphologic, natural or zoological significance and categorized as a Protected Area (PA) constituted by national park, wildlife sanctuary, conservation reserve and community reserve; Tiger Reserve constituted by PA and non-PA (reserved forests and other non-forest lands like revenue land etc); and Forest divisions, which are reserved forest/reserved lands.

The units of Elephant reserves are managed as PA and non-PA and have delineated zones for meeting diverse objectives. The number and kinds of zones required depend on objectives and how different the objectives are with respect to each other to necessitate their separation by areas. In PA we have the Core, buffer, multiple use, tourism, relocation and administrative zones and in the non-PA areas, we have the working circle delineated to meet the specific management objectives. Separate zones need to be created because some of the management objectives may not necessarily be compatible.

The creation of a zone/ working circle must be based on specific objectives to be realized in the zone. A self-contained sub-plan needs to be developed with regard to such objective/s that should identify issues/problems, and evolve strategies and a monitoring and evaluation mechanism. All of these need to specify procedures, techniques, targets and areas including how the data will be analysed and how and where necessary corrections will be applied. Zones cannot be managed in isolation but must relate realistically to the functions of other zones and where relevant, to areas outside the PA e.g. buffer zone.

In ERs, the TCP, Management plan & working plans guide the management of the area and the zones and working circles created will continue to serve the purpose dictated by the specific strategy formulated for the zone/working circle. In case the Elephant Reserve has an overlapping Biosphere reserve, the zones of the biosphere reserve will be aligned with the PA management zones and working circle.

The Elephant Conservation Plan, therefore has to consider all the zones/ working circles in the reserve and formulate a consolidated map aligning with the overall elephant reserve management zones viz Elephant conservation zone, Elephant-human coexistence zone & Elephant human management zone.

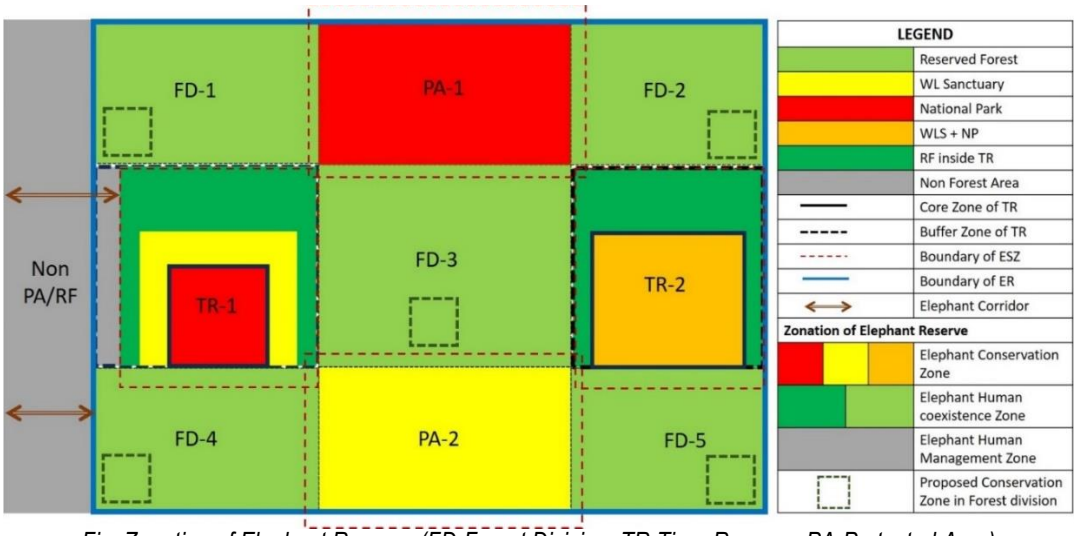

Fig: Zonation of Elephant Reserve (FD-Forest Division; TR-Tiger Reserve; PA-Protected Area)

It's important to note that the specific zonation plan can vary from one elephant reserve to another, as it depends on factors such as the size of the reserve, local ecology, and presence of human settlements.

3.1.1. Elephant conservation zone

This would encompass the larger and more secured inviolate forested habitats that hold a substantial proportion of the elephant population of the Reserve. This zone is devoid of any human intervention and is well protected. It exists to conserve natural ecosystems, wildlife, habitat, and species and genetic variation. Natural resources, flora, and fauna are allowed to thrive on their own and nature takes its evolutionary course. This area is largely undisturbed with natural successions of vegetation and nature being preserved. It has reliable water resources, generally devoid of human settlements and anthropogenic impacts.

The emphasis within this zone would be maintaining habitat integrity at the landscape scale by protecting and strengthening corridors, preventing elephants from moving into agricultural land and settlements both along the periphery and within enclaves, and affording maximum protection to elephants against any poaching. The core areas of Tiger reserves, National Park and Wildlife sanctuaries will be considered as part of this zone, apart from other areas which meet the criteria and qualify for inclusion.

3.1.2. Elephant-human coexistence zone

Elephant populations in small numbers, either isolated or connected to the major conservation zones, but ranging over a restricted or a fragmented habitat in which conflicts exist would qualify for inclusion in the coexistence zone.

The area immediately surrounding the core zone is referred to as the buffer zone. Several interventions/activities for ecological restoration are permitted, area is more prone to fire and invasion of alien species. This area is open for tourism, nature education and research and largely falls in coexistence zone.

Some of the buffer zones are part of the PAs and are located within the boundaries of the PA or outside the boundaries of the PA in adjoining Forest divisions. In the Tiger reserves, there has been an expansion of the buffer areas where the entire Tiger reserve is declared as core and all adjoining surrounding divisions have been merged in the TR as buffer areas. There are instances where the buffer though merged with the TR is still managed under the dual system with separate administrative management and both the TCP and working plan prescriptions apply. The buffer has separate management strategies, and the conservation approach is the coexistence of humans and wildlife.

In the Forest divisions of elephant reserves, the criteria of habitat quality and elephant population viability may be adopted to explore areas to be considered as core and buffer. The core areas identified may be integrated preferably into the other core areas, otherwise can be considered as stand-alone areas. These areas are extremely rich in biodiversity and have viable populations of Elephants and other animals and qualify as source areas for elephants. The working circles based on the above criteria can be distributed to the core and buffer depending on their values and objectives of management. Activities in the buffer should not impede the conservation objectives of the core area, but rather supplement it. There are tribals and human settlements in the buffer and strategies have to be formulated for mutual coexistence with active participation of communities.

3.1.3. Elephant human management zone

The elephant human management zone would include areas where small or isolated groups of elephants, with questionable viability, or solitary bulls' range over a predominantly human-settled landscape, and the social and economic costs of maintaining the elephants here are unacceptably high. These areas have a high level of human elephant conflict. The elephants have to be driven or removed from this zone by capture and translocation. Instances of problem/aggressive elephants are not uncommon and have to be managed as per the provision of the Wildlife (Protection) Act,1972

The fringe area beyond the boundaries of the PAs and territorial reserved forest are the vast agricultural landscape, rural/ semi urban areas identified and notified as eco-sensitive zones (surrounding PAs) and zones of influence (surrounding territorial reserved forest). This interface area has small insular forest habitats and vast agricultural lands where isolated small elephant populations are residents and remain there for the most part of the year. These populations have a negative interaction with communities and are a source of perpetual conflict. Human activities are rampant here including dependency on forests, cultivation of crops attracting elephants, mining and linear infrastructure which disrupts the free movement of animals. The coexistence between humans and nature though fragile is to be supported by participatory forest management.

The mainstreaming of conservation in the sectoral plans of line departments/ agencies in this zone will contribute to ecological sustainability. Tribals, local population, scientists, Govt department, Railways,

Animal Husbandry, NHAI, businesses, etc. have to align their activities and work together to manage and use the area in a sustainable way that will benefit the people who live here and reduce conflict.

3.2 ELEPHANT-HABITAT RELATIONSHIP (EHR) IN THE REGION

Elephant-Habitat Relationship (EHR) refers to the intricate and dynamic connection between elephants and their habitat. This relationship is essential for the survival and well-being of elephant populations. Understanding the EHR is crucial for effective elephant conservation and management.

Elephant-habitat relationships is a data set of vegetation, habitat elements, and environmental conditions used by elephants. Factors that contribute to this relationship include habitat requirements; feeding patterns; migration and home range; human-elephant conflict; conservation strategies; ecological role; and climate change impact etc.

An EHR database can be characterized and assessed by the following factors:

- Elephant-habitat and its classification
- Elephant population, distribution and dynamics
- Elephant life history and ecological attributes
- Elephant reserve boundaries (legal, ecological and administrative)
- Topographic variables including elevation, terrain ruggedness index (TRI), and distance to river;
- Climatic variables including mean annual precipitation (MAP) & mean annual temperature (MAT);
- Vegetation variables including land-use/land-cover (LULC) and normalized different vegetation index (NDVI); and
- Anthropogenic variables including human footprint, distance to road and water source.

EHR databases and models are expected to aid in:

- assessment of present, and prediction of future, habitat conditions, by distribution and abundance
- assessment of current potential, and prediction of future, distributions of elephant populations
- assessment of environmental impacts from various interventions/ disturbances affecting habitat

Overall, there may be three stages to developing a EHR information base and prediction system.

- *Stage 1. Develop the species (elephant) and habitat information base*
- *Stage 2. Develop and test species (elephant) and habitat response models*
- *Stage 3. Integrate the wildlife information base and habitat response models with spatial models*

Building the Information Base

In brief, an elephant-habitat relationships database can include the following kinds of information:

- Common (vernacular) name, scientific name, and other taxonomic information
- Legal status or management significance
- Distribution (occurrence by geographic location, and possibly range maps)
- General habitat requirements (vegetation communities)
- Special habitat requirements (specific habitat elements and substrates)
- Breeding information
- Territory and home range information
- Movement within the area of interest (e.g., residency and migration)
- Key literature references

Four kinds of information are needed for making resource planning and decision-making:

- *Scientific data* on species (elephants) and habitats are derived from direct field observations and therefore apply to specific situations.
- *Ecological theory* helps in developing the structure of the species-habitat relationships matrix.
- *Professional judgment* consists of an expert understanding of species requirements, habitat conditions, and consequences to both species and habitat conditions from a variety of forest management activities and disturbances.
- *Personal experience* helps to recognize promising approaches to problems and also to deal effectively with errors and incomplete data, when scientific inventories and studies are lacking.

Gathering Elephant Habitat Relationships Data

- Data on elephant habitat relationships can include information from habitat inventories, species inventories, correlation studies of species-habitat relationships, and other sources.

Correlational studies of species-habitat relationships

One of the more important basic kinds of empirical information needed on species and habitats is how presence and abundance of species (elephants) correlate with kinds and amounts of habitat conditions.

- Simple correlation coefficients would provide valuable insights into potential associations of species and species groups with various habitat conditions.
- Partial correlation coefficients would provide the degree to which a particular habitat type or component accounts for variation in a presence or abundance of a species, given that the effects of other habitat components have first been accounted for.
- Correlation models such as linear regressions, multiple linear regressions, logistic regressions, and other multivariate models (e.g., principal components analysis and discriminant function analysis) provide further insight into how combinations of habitat conditions account for presence and abundance of species (elephants).

Use of EHR Species-Habitat Relationships Information

EHR information is most useful in helping make general habitat allocation decisions at a broad scale of land resource planning.

- The elephant's habitat use is influenced by the presence of grasslands, forests, landscape heterogeneity, topographic variables of slope and elevation and water resources.
- The elephant habitat relationship is positively influenced by elevation, distance to water sources, and annual precipitation which are important variables for predicting elephant habitat suitability.
- Elephants require a large quantity of water for drinking and the presence of water sources will be a strong predictor of the movement and distribution of elephants.
- Elephants prefer to use mixed forest habitats more than the primary forests as the available forage is more abundant; they also use forests consisting of short trees, bushes, and shrubs.
- The open areas in secondary forests stimulate the growth of successional plants which are preferred by elephants; they prefer grassland and bamboo forests however wherever grass habitats are scarce and reduced their intake of browse increases.

Efforts to understand and manage the Elephant-Habitat Relationship (EHR) involve collaboration with the conservationists and researchers. This holistic approach aims to balance the needs of elephants with the requirements of sustainable development and biodiversity conservation in the region.

3.3 MAINTAINING HABITAT INTEGRITY AND CONTIGUITY IN THE LANDSCAPE & CORRIDORS INCLUDING ECOSYSTEM BASED MANAGEMENT

The spatial connectivity of elephant populations between multiple forest habitats and protected areas at the landscape level is necessary to maintain habitat integrity. The corridors are under great threat and loss of connectivity impedes migration and such isolated populations become endangered. To maintain habitat integrity and quality there is need to assess the data on the following:

- Data on the habitat quality in the landscape
- Data on carrying capacity, the ranging and foraging pattern
- Identified corridors in the landscape and new potential corridors
- Status of the corridor and functionality; the impact of forest dependency on people; impacts of development projects; rural/semi-urban development; and disturbance from linear projects.

The key strategies for ensuring habitat integrity and contiguity in the landscape and corridors of elephant reserves envisages identification of critical corridors; corridor protection and management; land-use planning; community engagement; cross-boundary collaboration; habitat restoration; monitoring and research; legal protection; education and capacity building; climate change adaptation.

3.3.1 Integrated management through landscape area strategy

The Elephant reserve landscape envisages separate management planning process to prepare plans for Tiger Reserves, Protected Areas, Managed Forests and Eco-sensitive Zones. A mechanism is required to amalgamate and integrate plans for achieving objectives for both resource production and the maintenance of biological diversity and allow a broader landscape to be viewed as the operational base for meeting ecological goals and human needs.

At the scale of landscapes that include multiple Managed Forests and Protected Areas, provisions could provide for habitat connectivity between potentially isolated areas, establish a network of biological hotspots, direct NTFP activity to areas that would conflict least with other values, identify areas that would be most favourable for wood production, establish guidelines for transportation systems that would be least harmful to biological diversity, coordinate guidelines for key habitats such as riparian areas, and coordinate the siting of facilities for tourists.

- Integrated management through landscape area strategy, especially in the context of bioregional planning, is a comprehensive approach to conservation and recognizes the interconnectedness of ecosystems, wildlife habitats, and human activities.
- The thrust areas for the integrated management envisage bioregional planning; ecological connectivity; multi-stakeholder consultation; zonation and land use planning; habitat restoration and enhancement; community-based conservation; buffer zone and transition areas; climate change resilience; and monitoring and adaptive management.
- Integrated management through landscape area strategy seeks to create a harmonious balance between conservation objectives, sustainable development, and well-being of local communities.

Developing a Landscape Area Management Strategy for an elephant reserve involves a comprehensive and collaborative approach. The strategy is to be for the entire reserve and may have sub-plans representing all the administrative units which have separate values unique to the area, objectives and strategy. The strategy for achieving objectives has to be formulated for the various zones of the elephant reserve, harmonising and aligning with the plans of the different administrative units.

The key components include:

- Conducting a detailed ecological assessment of the landscape to identify key habitats, biodiversity hotspots, water sources, and migration corridors used by elephants using scientific methods, including satellite imagery, GIS mapping, and field surveys.
- Developing ecological classifications that integrate soils, landform, geology, vegetation, climate, hydrology and animal influences including multi-resource inventories based on remote sensing with management focus on biological diversity across entire landscapes.
- Implementing a zonation strategy to categorize different areas within the landscape based on their ecological significance and conservation priorities and prioritizing core areas for elephant habitats, critical migration corridors, and buffer zones for human-elephant coexistence.
- Developing and implementing habitat management plans, including measures to enhance vegetation, protect water sources, and address issues like soil erosion including overall health and resilience of the landscape.

- Identifying and protecting key elephant corridors that facilitate the movement of elephant populations between different habitats and implement measures to minimize human activities that may disrupt or fragment these corridors.
- Integrating conservation objectives into land use planning to ensure that development activities are compatible with elephant conservation goals and envisage measures for sustainable land use practices, especially in areas surrounding the elephant habitats.
- Developing and implementing community-based conservation programs that involve local communities in the management and protection of the elephant reserve and provide incentives for sustainable livelihoods and practices that align with conservation goals including ecotourism.
- Implementing strategies to mitigate human-wildlife conflicts, especially in buffer zones and areas with high human activity and develop and promote effective conflict resolution mechanisms to reduce negative interactions between elephants and local communities.
- Establishing a robust monitoring system to track changes in the landscape, elephant populations, and the effectiveness of conservation measures and support research initiatives to gather additional data on elephant behaviour, ecology, and the impacts of human activities.
- Efforts are made for sectoral and intersectoral linkages with Govt departments/line agencies including involvement of the local communities, NGOs, and private landowners.
- Conducting training programs for local communities, conservation professionals, and officials to build capacity for effective landscape management and implement educational campaigns to raise awareness about the importance of elephant conservation and sustainable land use.
- Ensuring that the landscape area strategy is aligned with existing wildlife protection laws and regulations and strengthen enforcement mechanisms to prevent illegal activities such as poaching, logging, and encroachment.
- Implement an adaptive management approach that allows for flexibility and adjustments based on new information, changing climate conditions, and the success of conservation measures.

Developing and implementing a Landscape Area Management Strategy requires collaboration, ongoing commitment, and adaptive management to address the dynamic nature of ecosystems and the challenges faced by elephant populations. It is essential to maintain a balance between conservation objectives and the socio-economic needs of local communities within the landscape.

3.3.1.1 Delineation of Landscape Management Areas

- Landscape management area boundaries may be selected based on watershed conditions, distribution and extent of significant biological communities, viability of populations including connecting corridors between habitats, and resource needs of villages and local communities.
- Delineation of Landscape Management Areas may be done at the district or regional level. All lands that come under the jurisdiction of the ER may be planned as a single unit. The goal is to produce, a coordinated management plan rather than separate plans (TCP/ MP/ WP).
- The ER landscape map may also contain eco-sensitive zones and the zone of influence.

3.3.1.2 Collecting inventory on the Landscape Management Area

The inventory required for a Landscape Management Strategy is determined by the established requirements for tiger conservation plans, PA management plans and working plans of forest divisions. The issues that drive selection of the area also determines priorities for inventory items to be collected.

- Within this framework, some standard inventory items would be required for the ECP. For the working forest portions of the landscape, inventory requirements must follow existing policies. A similar level of vegetation inventory would be required for the PA, but the necessary details of this inventory would be determined by requirements for habitat evaluation and management rather than solely by established requirements for silvicultural or other resource planning.
- It is also important that the inventory for the working area be presented in a way that allows interpretation for wildlife and diversity as well as other management purposes.
- Certain minimum data on wildlife are required for each plan. The most basic requirement is a species list for the area showing the known and expected/ predicted occurrence of all wildlife species; their distribution; and the primary habitats in which they are found.
- The presence and availability of water sources may also be included.

- In addition, special and unique habitats may be included as part of the vegetation/habitat inventory for the entire landscape area.
- The requirements for additional inventory may be identified based on conditions within the area. For wildlife and biodiversity, these requirements would center on the biological elements (population estimates including age and sex structure; birth rates; death rates and causes; trends on demographics; movement patterns; biotic interactions; and key limiting factors or threats).
- Where new or updated inventory is required, the inventory may be coordinated across the entire area and the inventory may be designed to collect basic data rather than classified data.
- Landscape strategy can be used as information gathering for overall spatial planning, impact mitigation, or assessments of the abiotic and biotic environment in the landscape. The inventory of the landscape includes information on: terrain, climate, geology, geomorphology, hydrological analysis, soil survey, vegetation mapping, fauna, and socio-cultural-economic resources etc.

3.3.1.3 Assessing current situation, trends, potentials and human use

After the inventory has been collected, the current situation on the landscape area may be summarized and an estimate made of the capability of the area resources to respond to the issues and situations.

- The important items considered during selection of the area, include existing biological and physical situation; human populations; resource needs and demands; and resource potentials; dependency of village communities and the consequent degradation of forests; and historical land/ forest-use-associated drivers.
- The specific steps for assessment are characterization of current landscape mosaics using land use inventory and mapping; reconstruction of historical land cover from satellite image time series; identification of trajectories of landscape composition and structure dynamics; and development of indicators of exposure, sensitivity and adaptive capacity that quantify expansion of agriculture, degradation and fragmentation dynamics and current landscape intensification.

3.3.1.4 Setting overall multi-use goals

Goals must be established for all resources and, to the extent possible, they should be quantified. If goals are not quantified, it will be difficult to determine how well the final plan responds to them.

- The Elephant Reserves extends over large multi-use land areas that encompass a variety of land uses and benefits. Each administrative unit in the Elephant Reserve has goals, objectives and management strategies that are suited for implementing interventions to address the management issues.
- The possible goals and strategies envisaged for the landscape include: conserve biodiversity and maintain biological integrity of corridors; protect and manage forests, essential ecological processes, ecosystems and watersheds; provide ecotourism opportunities; forest production and utilization etc.

3.3.1.5 Devise a reasonable array of alternatives to meet overall goals

The objective of the landscape management strategy is to develop integrated resource management actions that will meet the goals established.

- To accomplish this, it is recommended that the landscape area be broken into subunits i.e. 'Management Areas' using ecological, watershed, economic and administrative criteria, that can serve as logical areas for developing and implementing management actions. They may be watersheds, seasonal wildlife ranges, human demand areas, or combination. An integrated management strategy may be developed for each management area.
- The development of a 'management area' strategy envisages:
    - Delineating Management Area boundaries.
    - Determining overall standards and guidelines for resource conditions that are needed.
    - Developing resource inventory for Management Area based on existing/new information.

- Determining which landscape area goals are appropriate for the Management Area.
- Develop a management strategy for each Management Area.
- Crosschecking strategies with overall landscape area goals to minimize conflicting uses.

3.3.1.6 Evaluation of alternatives and decision making

- Evaluation of alternatives for Management Area strategies begins with a determination of the anticipated effects of strategies within each Management Area. In evaluating possible effects, it is important to focus on those effects related to key issues and concerns for the Landscape Area which may have a significant influence on decision making. The evaluation process may include refining alternatives to develop the final alternative or option.

3.3.1.7 Develop Management Area strategies and schedule actions

- Translate the strategy into a set of actions i.e. Implementation Schedule for each Management Area and the prescriptions developed and evaluated for the strategy need to be identified through specific actions that protect, restore, or produce the desired conditions and uses.
- The strategy must help to improve the effective conservation of biodiversity, prevent threats to the natural ecosystems, improve the well-being of the local community towards poverty reduction and minimize climate change effects on the sustainable provision of ecosystem services.

3.3.1.8 Develop a monitoring system and evaluation process

The function of monitoring is to supply information to determine if management is producing the desired outcome. The task is to design a system that is practical, focused on specific issues and goals, and provides information that is timely and sufficiently accurate.

- The monitoring plan includes ranking each of the specific items based on risk; establishing accuracy and precision standards needed to track the output, standard, or activity; and determining the appropriate monitoring techniques and frequency of measurement to yield the information at the specified accuracy level.

3.3.2 Components of Landscape analysis

Landscapes or 'landscape elements' have three kinds of structures: a matrix, corridors and patches. An important ecological feature of the matrix is that it is thought to exert strong control over landscape flows because of the connectivity of the habitat it provides. The pattern of the matrix, patches and corridors in landscapes is of primary interest since it is the spatial arrangement of these elements that determines the function of a landscape as an ecological system.

Landscape analysis in an elephant reserve involves a comprehensive study of the physical, ecological, and anthropogenic factors influencing the landscape.

Components of landscape analysis in an ER:

- Studying the physical features of the landscape, and analysing how topography influences water drainage, vegetation distribution, and elephant movement.
- Using remote sensing and GIS technologies to assess land use/ land cover and identify different types of vegetation, agricultural areas, settlements, and infrastructure within the landscape.
- Conducting detailed vegetation mapping to understand the distribution of different plant species and analyse the composition & structure of the vegetation, including food sources for elephants.
- Identifying and map water bodies, including rivers, lakes, ponds, and water holes and analyse the availability and distribution of water sources critical for elephants.
- Identifying and map corridors and migration routes used by elephants and assess the connectivity between different habitats to understand the landscape's suitability for elephant movements.
- Mapping human settlements, agricultural areas, and infrastructure (roads, railways) within and around the ER and analyse the impact of human activities on elephant habitats/ migration routes.

- Identifying ecological hotspots and biodiversity-rich areas within the landscape and prioritize areas with high conservation value for targeted protection and management.
- Analysing climate data, including rainfall patterns, temperature variations, and seasonal changes and assess how climate influences vegetation, water availability, and elephant behaviour.
- Identifying areas where human-wildlife conflicts are prevalent and analyse the factors contributing to conflicts, such as crop raiding or habitat encroachment.
- Gathering historical and current data on elephant populations, distribution, and behaviour and use data from camera traps, and surveys to understand elephant movements and preferences.
- Assessing anthropogenic pressures such as poaching, illegal logging, and habitat degradation and understand the magnitude and impact of human activities on the landscape.
- Considering socio-economic factors such as population density, livelihood patterns, and cultural practices of local communities and analyse how they are influenced by elephant conservation.
- Using GIS modelling to integrate and analyse spatial data for decision-making and model potential landscape changes and assess their impact on elephant habitats and movements.

The integration of ecological, anthropogenic, and spatial data allows for informed decision-making to ensure the sustainable coexistence of elephants and their habitats with human activities.

3.3.3 Ecosystem Based Management

Ecosystem-based management (EBM) in an elephant reserve involves adopting a holistic approach that considers the entire ecosystem, its components, and the interactions between them. This approach aims to balance conservation goals with the sustainable use of natural resources, taking into account the ecological, social, and economic aspects of the reserve. The critical aspects of ecosystem-based management in an elephant reserve envisages:

- *Ecosystem Assessment:* Conduct a comprehensive assessment of the elephant reserve's ecosystem, including biodiversity, vegetation types, water resources, soil health, and landscape connectivity and analyse the interdependencies and interactions between elephants, other wildlife species, and the surrounding environment.
- *Stakeholder Engagement:* Involve all relevant stakeholders, including local communities, government agencies, NGOs, researchers, and businesses, in the decision-making process and foster collaborative partnerships to ensure a shared understanding of conservation goals and resource management.
- *Spatial Planning and Zoning:* Develop a spatial plan that designates areas for conservation, human activities, and infrastructure development within the reserve and implement zoning strategies that consider the needs of elephants and other wildlife, while also addressing the requirements of local communities.
- *Elephant Corridor Protection:* Identify and safeguard key corridors that facilitate the movement of elephants between different parts of the reserve and mitigate barriers to elephant movement, such as roads and human settlements, through strategic planning and conservation initiatives.
- *Integrated Habitat Management:* Implement integrated habitat management practices that focus on maintaining and restoring diverse habitats, ensuring a sustainable balance between vegetation and wildlife and consider natural processes such as fire regimes, water cycles, and nutrient cycling in ecosystem management plans.
- *Sustainable Resource Use:* Promote sustainable land-use practices that balance the needs of local communities with the conservation objectives and encourage sustainable agriculture, forestry, and water management practices that minimize negative impacts on the ecosystem.
- *Community-Based Conservation:* Engage local communities in conservation initiatives, ensuring that they have a stake in the sustainable management of natural resources and integrate traditional ecological knowledge into conservation strategies and involve communities in monitoring and decision-making processes.
- *Economic Valuation of Ecosystem Services:* Assess and quantify the ecosystem services provided by the reserve, including carbon sequestration, water purification, and tourism and

use economic valuation to highlight the importance of these services and promote conservation as a valuable investment.

- *Climate Change Adaptation:* Incorporate climate change considerations into management plans to enhance the resilience of the ecosystem and implement adaptive strategies that address potential impacts of climate change on elephant habitats and migration patterns.

Ecosystem-based management in an ER requires a multidisciplinary and collaborative effort.

3.3.3.1 Emphasizing connectivity within and between habitats

Connectivity ensures that elephants and other wildlife can move freely across landscapes, facilitating natural behaviours such as migration, foraging, and breeding. The strategies to emphasize connectivity in an elephant reserve envisages:

- Conducting landscape assessments to identify existing elephant corridors and potential areas for corridor restoration and prioritizing the protection of these corridors to maintain connectivity between different habitats.
- Utilizing advanced technologies such as GIS, remote sensing, and GPS tracking to map and monitor elephant corridors and assess the effectiveness of existing corridors and identify any emerging threats.
- Implementing wildlife-friendly infrastructure such as underpasses, overpasses, and culverts to enable safe passage for elephants across roads and highways and collaborate with transportation agencies to design and construct effective wildlife crossings.
- Restoring and rehabilitating degraded habitats within and along wildlife corridors and planting native vegetation to enhance food availability and create suitable habitats for elephants.
- Establishing buffer zones and greenbelts around protected areas and elephant corridors to minimize the impact of human activities and working with local communities to implement sustainable land-use practices in these areas.
- Incorporating corridor considerations into regional and local land-use planning and collaborate with planning authorities to ensure that development activities do not impede wildlife movement.
- Collaborating with private landowners to secure permissions for elephant corridor access and protection and establish incentive programs or conservation easements to encourage private landowners to contribute to corridor conservation.
- Implement strategic fencing to guide elephants and other wildlife toward designated crossings and away from potential conflict areas and consider flexible and permeable fencing designs to minimize barriers to elephant movement.
- Working with neighbouring regions or countries to ensure transboundary connectivity for elephant populations and collaborate on conservation initiatives, corridor protection, and data-sharing to enhance overall regional conservation efforts.

By emphasizing connectivity within and between habitats in an ER, conservation efforts can contribute to the resilience and viability of elephant populations and the broader ecosystem.

3.3.3.2 Protection and restoration of ecosystem's structure, functions and processes

The protection and restoration of the ecosystem's structure, functions, and processes in an elephant reserve are essential for maintaining ecological integrity, biodiversity, and the overall health of the ecosystem. The strategies to achieve these goals include:

- *Habitat Protection:* Implement strict conservation measures in these areas to safeguard critical habitats and maintain the natural structure of the ecosystem.
- *Biodiversity Conservation:* Implement species-specific conservation strategies, including protection of key habitats, management of invasive species, and habitat restoration.
- *Restoration of Degraded Habitats:* Implement habitat restoration programs, including reforestation, soil conservation, and removal of invasive species, to restore the natural structure and functions of degraded ecosystems.
- *Wetland Protection and Restoration:* Implement measures to protect and restore wetlands, such as controlling pollution, preventing encroachment, and restoring natural water flow.
- *Erosion Control:* Implement erosion control measures, such as reforestation, cover cropping, and terracing, to prevent soil erosion and maintain the stability of the ecosystem.

- *Fire Management:* Develop and implement controlled fire management strategies to prevent uncontrolled wildfires that can disrupt ecosystem processes.
- *Water Resource Management:* Implement sustainable water use practices and control activities that may lead to water pollution.
- *Conservation of Keystone Species:* Implement conservation measures specific to keystone species to ensure their long-term viability.
- *Invasive Species Management:* Develop and implement strategies to control and manage invasive species that can disrupt natural ecosystem processes.
- *Climate Change Adaptation:* Implement measures that enhance the resilience of the ecosystem to climate-related challenges.

Conservation efforts can effectively protect and restore the ecosystem's structure, functions, and processes within the elephant reserve.

3.3.3.3 Incorporating social dimensions-ecosystem values and resource uses

Incorporating social dimensions, ecosystem values, and resource uses in an elephant reserve is crucial for achieving sustainable conservation and promoting harmonious coexistence between wildlife and local communities.

Integrating social considerations ensures that conservation initiatives are culturally sensitive, economically viable, and contribute to the well-being of both ecosystems and people.

The measures for incorporating social dimensions in an elephant reserve envisages:

- ecosystem services assessment; participatory approach; respect cultural and traditional practices; livelihood diversification; community-based conservation enterprises; resource use agreements; conflict resolution mechanisms; benefit sharing mechanisms; conduct social impact assessments; promote gender-inclusive strategies; empower local communities; & collaboration with indigenous communities.

This approach contributes to the long-term success of conservation initiatives and promotes sustainable coexistence between people and elephants.

3.3.3.4 Integrating biological, socio-economic and governance perspectives

A holistic approach that considers the ecological health, community well-being, and effective governance structures is essential for the success of conservation initiatives.

The strategies to integrate these perspectives include:

- Develop integrated management plans that consider biological, socio-economic, and governance aspects.
- Promote co-management approaches that empower local communities in decision-making processes related to the reserve.
- Establish partnerships among diverse stakeholders and encourage joint initiatives that address both ecological and socio-economic dimensions.
- Implement zoning strategies that consider both biological and socio-economic factors.
- Integrate community-based natural resource management approaches and establish mechanisms for shared benefits and responsibilities in the sustainable use of natural resources.
- Conduct social impact assessments alongside biological assessments to understand the potential effects of conservation actions on local communities.
- Implement programs that promote alternative livelihoods for local communities, reducing dependency on activities that may conflict with conservation goals.
- Promote gender-inclusive and culturally sensitive governance mechanisms that address the needs of all community members.
- Empower local communities through education, training, and capacity-building programs.
- Establish transparent benefit-sharing mechanisms that ensure local communities receive tangible benefits from conservation efforts.

- Develop communication strategies that bridge the gap between biological and socio-economic perspectives.
- Implement ongoing monitoring and evaluation systems that assess the effectiveness of conservation initiatives from biological, socio-economic, & governance perspectives.

By integrating biological, socio-economic, and governance perspectives, conservation efforts in the elephant reserve can achieve a more balanced and sustainable approach. The strategy recognizes the interconnectedness of natural ecosystems and human communities, promoting a collaborative and adaptive approach to conservation and sustainable development.

3.3.3.5 Developing common vision among stakeholders and informed adaptations based on local and scientific knowledge

A shared vision ensures that diverse stakeholders are aligned toward common goals, and informed adaptations leverage both traditional ecological knowledge and scientific expertise for effective conservation. Measures to achieve this integration envisage:

- stakeholder engagement and collaboration; participatory visioning process; local and traditional knowledge integration; scientific research and data sharing; scenario planning; adaptive management framework; cultural and social values assessment; capacity building; consensus building; educational programs; regular communication channels; demonstration projects; economic incentives; and independent monitoring and evaluation.

By integrating local and scientific knowledge, fostering collaboration, and adapting strategies based on a common vision, stakeholders in the elephant reserve can work together towards sustainable conservation outcomes. This approach recognizes the importance of diversity in perspectives and promotes a unified and adaptive approach to address the complex challenges of elephant conservation and ecosystem management.

3.4 ADDRESSING AND MONITORING VARIOUS DISTURBANCE REGIMES IN THE EHR

Addressing and monitoring disturbance regimes in the Elephant-Habitat Relationship (EHR) is essential for effective conservation and management in an elephant reserve. Disturbance regimes can include both natural and human-induced factors that impact the habitat and influence the behaviour of elephants.

Strategies for addressing and monitoring various disturbance regimes in the EHR include:

- *Addressing Disturbance Regimes:* through human-wildlife conflict mitigation; anti-poaching and law enforcement; habitat restoration and protection; land use planning; infrastructure planning and development; tourism management; community engagement and livelihood improvement.
- *Monitoring Disturbance Regimes:* using camera traps and remote sensing; GIS-based monitoring; satellite telemetry and GPS tracking; human-elephant conflict reporting systems; ecological surveys; social surveys and community feedback; behavioural observations; law enforcement monitoring.

By addressing and monitoring disturbance regimes in the Elephant-Habitat Relationship, conservationists and authorities can implement adaptive management strategies to ensure the long-term sustainability of elephant populations and their habitats.

3.4.1. Spread of invasives

The spread of invasive alien species (IAS) in an elephant reserve can have significant negative impacts on the ecosystem, including competition for resources, alteration of habitats, and potential harm to native flora and fauna.

Majority of invasives belong to Asteraceae/ Verbenaceae because of efficient adaptation for survival / distribution on land. It has colonized forest areas in Peninsula, Himalayan foothills & Western Ghats. Critical ones in the elephant reserves include:

- *Lantana camara, Chromolaena odorata, Mikania micrantha, Aegeratum conyzoides, Cassia tora, Cuscuta spp, Prosopis juliflora, Acacia farnesiana, Cytisus scoparius, Imperata cylindrica, Parthenium hysterophorus, Clidemia hirta, Arundo donax, Eupatorium adenophorum, Opuntia dillenii, Eichhornia crassipes, Acacia mearnsii, Senna spectabilis, Mimosa diplotricha etc*

While the impacts of IAS are classified as environmental, economic, and health related, these categories are not mutually exclusive. Costs of biological invasion are measured not just in currency, but also as food & water shortages, environmental degradation, loss of biodiversity, natural disasters etc.

The Elephants require large foraging areas with abundant nutritional forage, therefore protecting such areas from deleterious invasive plants is a conservation priority. Effectively addressing the problem can require field managers to invest substantial resources in management operations and work to restore ecosystems in order to re-produce their goods and services.

Impact of Invasives on ER

- Presence of invasive like lantana alters spatial pattern of herbaceous vegetation, changes microhabitat, light & nutrient availability, self-perpetuation over regeneration of other species.
- Growth of invasive also alters light microhabitat by addition of debris, which is a factor in controlling herb composition. Accumulation of lantana litter could lead to allelopathic suppression, reduction of species diversity & cover.
- Many invasives are fire prone and can burn readily, altering the fire regime to favour its persistence. The heat from burning of invasives may also cause seed and seedling mortality in the area. Both, lantana and mikania are also known to cause fire hazards in the production systems.
- Direct relationship exists between canopy opening due to disturbance and density of species; fodder availability for large herbivores reduces due to lantana, hence wildlife conflict increases.
- Amongst the introduced tree species, invasiveness is observed in case of Wattle, Prosopis and Subabul. Mikania has also contributed to the degradation of forests. Certain shrub plants like Eupatorium, Cytisus, Ulex, Lantana and Parthenium are still extensive and have become weeds.

Thus, invasives may create demographic instability in tree species and reduce diversity, potentially changing the structure of forest in future.

Controlling and mitigating the spread of invasives is crucial for maintaining the ecological integrity of the reserve. Strategies to address the spread of invasives in an elephant reserve includes:

Prevention and Control Strategies:

- Establish monitoring programs for early detection of invasive species and implementation of rapid response mechanisms to control and eradicate invasive species.
- Introduce quarantine measures to prevent the introduction of invasives including inspection and control of the movement of plants, animals, and equipment to reduce the risk of spread.
- Implement biosecurity protocols at entry points to the reserve, such as checkpoints and gates and develop and enforce guidelines to reduce the risk of invasive species introduction.

Monitoring and Research:

- Conduct regular surveys and inventories to monitor the presence and spread of invasive species including documentation of changes in vegetation and biodiversity.
- Utilize GIS mapping to track the distribution of invasive species within the reserve and develop spatial models to predict potential areas at risk of invasion.
- Conduct research on the biology and ecology of invasive species to better understand their spread and potential control methods to develop management strategies.

Control and Management Strategies:

- Implement mechanical control methods, such as manual removal or cutting, to manage invasives and utilize machinery, where needed, for large-scale removal.
- Use herbicides judiciously and ensure that chemical control methods are environmentally safe and do not harm non-target species.
- Introduce biological control agents, such as natural predators or pathogens, to manage invasives after conducting thorough risk assessments before implementing control measures.

- Implement habitat restoration activities to promote the recovery of native vegetation and enhance the resilience of ecosystems to resist invasive species establishment.
- Involve local communities in control efforts by establishing community-based monitoring and control programs to address invasive species spread.
- Adopt an integrated approach to pest management that combines biological, chemical, and cultural control methods and develop IPM plans specific to the invasive species present in the elephant reserve.

Restoration and Adaptive Management:

- Implement adaptive management strategies that allow for flexibility in response to changing conditions including regular review and updation of invasive species based on monitoring data.
- Areas affected by wildfires, are more susceptible to invasive species colonization and therefore needs implementation of post-fire management strategies to prevent their establishment.
- Collaborate with governmental agencies, NGOs, research institutions, and local communities and establish partnerships to share resources, expertise, and support for invasive species management.

Mapping Invasives by Remote Sensing

- Remote sensing has been successful in aquatic, wetland, grassland or desert area, due to unobstructed view. Multi-date satellite data facilitates monitoring phenological changes & integration of other attributes can be useful in predicting spread. Hyperspectral data have been used by researchers for detection and mapping of invasive species. There is potential of LISS-IV and Cartosat-1 data in detection and mapping of invasive species such as Lantana.
- The improved ability of the object-based approach to delineate structurally distinct objects with characteristic spectral & spatial characteristics of their own, as well as with reference to their surroundings, allows for much flexibility in identifying invasive understorey shrubs among the complex vegetation of the tropical forest than that provided by the parametric classifier.

Example- Lantana Control Operation:

- *Traditional methods of control:* envisage slashing/ chopping; burning; manual removal; and through mechanical, chemical and biological approaches.
- *Innovative management strategy:* envisages its removal by 'cut-rootstock method' on the basis of biological & ecological attributes. The advantages of this management strategy are: its cost effectiveness; simple and easy to adopt; and ensures successful control without using chemicals and exotic biological control agents, and with minimum disturbance of soil.
- For eradication of Lantana the standard strategy involves its removal by cut rootstock method; weeding of saplings from beneath the trees used for perching by generalist birds that disperse the seeds; and ecological restoration of eradicated areas by planting grasses and bamboos to prevent reinvasion of the same species.
- There are other species on which survey are lacking and they too have to be eradicated as the rate of their spread may be increasing. The list of priority plants should be developed region wise, for the various species invading grasslands and forests.

By combining prevention, monitoring, and control strategies, it is possible to address and mitigate the spread of invasive species in an elephant reserve. A proactive and collaborative approach is essential to preserve the ecological balance and biodiversity of the reserve.

3.4.2. Biotic pressures and Overgrazing

Biotic pressures in an elephant reserve refer to the various biological factors that can affect the health and well-being of the ecosystem and its inhabitants, particularly elephants. Some critical biotic pressures in an elephant reserve are overgrazing, deforestation, and land-use changes that can lead to habitat degradation, affecting the availability of food and water.

Overgrazing by cattle inside an elephant reserve can have detrimental effects on the ecosystem, leading to habitat degradation and impacting both plant and animal species.

Key considerations and potential management strategies for addressing overgrazing by cattle in such reserves include:

- *Impact on Vegetation:* Cattle overgrazing can result in the depletion of preferred plant species, affecting biodiversity and altering the composition of the plant community and continuous grazing may hinder the regeneration of trees and shrubs, leading to changes in the structure and function of the ecosystem.
- *Habitat Degradation:* Overgrazing contributes to soil compaction, erosion, and reduced ground cover, leading to habitat degradation and changes in vegetation structure can impact other wildlife species dependent on the same habitat.
- *Competition for Resources:* Overgrazing can intensify competition for limited resources such as water and food among wildlife species. This can lead to increased stress, reduced reproductive success, and decreased overall health in wildlife populations.
- *Impact on Wildlife Health:* Overgrazing can weaken wildlife populations, making them more susceptible to diseases. Stress from competition for resources, reduced food availability, and habitat degradation can compromise the immune systems of wildlife, making them more vulnerable to pathogens.
- *Monitoring and Assessment:* Regular monitoring of vegetation health and composition helps detect signs of overgrazing by cattle. Assessments of vegetation cover, browse lines, and the presence of invasive species can provide insights into the intensity of grazing pressure.
- *Carrying Capacity Studies:* Determine the carrying capacity of the reserve, considering both elephants and cattle, to establish the maximum number of animals that the ecosystem can sustain without causing overgrazing.
- *Grazing Management:* Implement controlled grazing regimes to prevent continuous and unrestricted access to sensitive areas and rotate grazing areas periodically to allow for vegetation recovery and to distribute grazing pressure more evenly.
- *Fencing Strategies:* Establish strategic fencing (including cattle proof trench) to control the movement of cattle and prevent them from accessing vulnerable or recovering vegetation. Collaborate with local communities to design and implement effective fencing strategies.
- *Community Involvement:* Involve local communities in sustainable land-use practices and educate them about the importance of maintaining a balanced ecosystem and educate communities to develop alternative livestock management practices that reduce negative impacts on the reserve.
- *Livestock Management Plans:* Develop and implement comprehensive livestock management plans that address the specific needs of the reserve and encourage sustainable grazing practices, such as rotational grazing and proper rest periods for grazing areas.
- *Regulatory Measures:* Enforce and strengthen regulations related to grazing within the reserve, including the establishment of no-grazing zones and penalties for non-compliance and collaborate with JFM/EDC/VFC committees to ensure the effective implementation of regulations.
- *Research and Adaptive Management:* Conduct research on the interactions between cattle and the reserve's ecosystem to inform adaptive management strategies and regularly assess the impact of cattle grazing and adjust management plans based on monitoring results and changing ecological conditions.

Effective management of overgrazing by cattle requires a multi-faceted approach, involving collaboration among forest officials, local communities, and relevant authorities.

3.4.3. Forest fire management and monitoring

Elephant Reserves are large diverse landscapes with a spectrum of vegetation types, terrain and climatic conditions that are prone to fire. In tropical deciduous forests, fire is a natural phenomenon due to higher levels of water stress during summer but the same is caused by various anthropogenic reasons.

Forest fire management has to be based on a robust data management system to plan for fire prevention, detection, suppression and post-fire management.

- The creation of a common classification scheme for the causes of fire, standard reporting protocols, and standard methods for assessing burnt areas would facilitate the creation of a robust database which must have information on fire lines, watch towers, firefighting assets (and their locations), and communications infrastructure.
- The inadequate resources and lack of staff hampers the fire management operations and therefore, the availability of sufficient number of required equipment like fire beaters, fire burners, backpack water sprayers and blowers are necessary in every range. Besides, the staff have to be trained on the use of equipment and ground strategy to prevent fires.
- The Standard Operating Procedure (SOP) based on the 'Strengthening Forest Fire Management Report' of MoEF&CC, including a range of silvicultural and management practices and controlled burning to reduce fuel loads, needs to be developed. The SOP should safeguard against any under reporting of fires, the causes, extent of area burnt, and economic damages etc.

Forest fire management and monitoring are crucial aspects of conservation, especially in elephant reserves, where forest fires can have significant impacts on both elephants and their habitats. Strategies for forest fire management and monitoring in elephant reserves, envisage:

Forest Fire Management:

- *Prevention Strategies:* Conduct awareness campaigns to educate local communities and visitors about the risks of forest fires and establish and maintain fire lines / firebreaks to create barriers that control the spread of wildfires.
- *Early Detection Systems:* Install elevated surveillance towers in strategic locations to enhance early detection capabilities and utilize remote sensing technology to detect wildfires in real-time.
- *Developing Fire Likelihood Model:* Develop Forest fire likelihood model in spatial domain using causative and anti-causative factors as a variable with habitat flammability as another variable and plan mitigation strategy accordingly.
- *Firebreaks and Controlled Burns:* Create and maintain mechanical firebreaks by clearing vegetation in specific areas to prevent the spread of fires and conduct controlled / prescribed burns before onset of fire season to reduce fuel loads and minimize the risk of uncontrolled wildfires.
- *Firefighting Infrastructure:* Equip the reserve with firefighting tools, such as fire trucks, water tankers, and handheld firefighting equipment and also explore the possibilities for helicopter support to transport water and deploy fire suppressants in remote areas.
- *Community Engagement:* Provide training programs for local communities on fire prevention and firefighting techniques and also establish community-based fire brigades to respond rapidly to fire incidents.
- *Weather Monitoring:* Install meteorological stations to monitor weather conditions, including temperature, humidity, and wind speed and use the weather data to establish fire danger ratings, in helping determine the level of fire risk on any given day.
- *Collaboration and Coordination:* Collaborate with local fire departments and relevant government agencies to create coordinated responses to wildfires and foster partnerships with local communities, NGOs, and research institutions to enhance fire management efforts.
- *Legal Measures:* Enforce regulations related to fire prevention and control within the reserve as per the forest and wildlife laws and levy penalties for activities that may lead to unauthorized fires.

Forest Fire Monitoring:

- *Remote Sensing and GIS:* Utilize remote sensing and GIS technology for monitoring the extent and spread of wildfires and develop fire vulnerability maps based on historical data and real-time monitoring.
- *Sensor Networks:* Install sensor networks in critical areas to detect signs of fire or unusual activity and connect sensors to monitoring systems for rapid response.
- *Patrols and Aerial Surveillance:* Conduct regular ground patrols with field personnel to monitor signs of wildfires and use aerial surveillance, such as drones for enhanced monitoring coverage.

- *Community Reporting Systems:* Establish community reporting systems for communities to report potential fire hazards and implement hotlines and mobile applications for reporting fire incidents.
- *Fire Severity Assessments:* Assess the severity of wildfires after they occur to understand their impact on vegetation, wildlife, and ecosystems and conduct post-fire ecological assessments to guide rehabilitation efforts.
- *Data Analysis and Trend Monitoring:* Analyse historical fire data to identify trends and patterns and monitor changes in fire frequency and intensity over time.
- *Early Warning Systems:* Develop and implement early warning systems to alert authorities and communities about potential fire threats and utilize sirens, mobile alerts, and other communication channels for timely warnings. The Forest Survey of India (FSI) uses remote sensing technologies for issuing fire alerts but ground-based detection is also essential.
- *Research and Innovation:* Support research initiatives focused on understanding fire behaviour and its ecological impact and explore innovative technologies for improved fire monitoring, detection, and management.

Effective forest fire management and monitoring in elephant reserves require a combination of proactive prevention measures, rapid detection capabilities, and coordinated response efforts. Continuous monitoring, community involvement, and adaptive management strategies are essential components of a comprehensive approach to mitigate the impact of wildfires on elephant habitats and biodiversity.

3.4.4. Catchment capability and water scarcity including wetlands

The Elephant Reserve landscape has numerous rivers, streams and water bodies. The catchment areas are the forested habitats whose quality is to be maintained for continuous flow of water. The catchment capability is about integrated catchment management which requires a scientific understanding of the interaction between the catchment flows (both surface water and groundwater) and the human systems, that depend on it; including the water-dependent ecosystems such as wetlands and swamps. Also in a large landscape, the presence of large dams, reservoirs and check dams change the hydrological regime with a gain in one location in the catchment would mean a loss for a downstream location.

The catchment capability for watersheds in an elephant reserve refers to the capacity of the watershed to efficiently capture, store, and release water. This capability is essential for maintaining the health of ecosystems, supporting biodiversity, and ensuring the availability of water resources for both wildlife and human communities.

Proper management of water resources is vital for the well-being of elephants and other wildlife. Considerations related to catchment capability, water scarcity, and wetlands in elephant reserves are:

Catchment Capability:

- Assess the topography and hydrology of the catchment area to comprehend water flow patterns, seasonal variations, and the formation of water sources.
- Evaluate soil characteristics to determine water infiltration rates and the potential for groundwater recharge including assessment of runoff patterns to identify areas prone to erosion and sedimentation.
- Consider the forest health in the catchment area, as healthy forests contribute to water retention, reduced runoff, and improved water quality.
- Evaluate land use practices in the catchment area, such as agriculture and infrastructure development, to better understand their impact on water availability.

Water Scarcity:

- Analyse climate data, including rainfall patterns and trends, to assess the availability of water throughout the year and consider the potential impact of climate change on precipitation and water availability.
- Estimate the water demand from various sources, including wildlife, vegetation, and human communities within or near the elephant reserve including assessment of the sustainability of current water use practices.

- Recognize the potential for human-elephant conflict related to water scarcity, as elephants may venture into human settlements in search of water during pinch periods.
- Develop drought preparedness plans that include water management strategies and emergency interventions during extended dry periods.

Wetlands:

- Map seasonal and permanent wetlands including water holes within the elephant reserve, and consider the ecological importance of wetlands for water storage, biodiversity, and habitat maintenance.
- Recognize the hydrological connectivity between wetlands and other water bodies, ensuring that wetlands receive sufficient water inflow.
- Implement conservation measures to protect wetlands from degradation, pollution, and encroachment and establish buffer zones around wetlands to minimize anthropogenic disturbances.
- Regularly monitor the water quality of wetlands to ensure that they remain suitable for wildlife, including elephants and address pollution sources and mitigate the impact of human activities on wetland ecosystems.
- Develop wetland restoration programs to rehabilitate degraded wetland areas and enhance the natural functions of wetlands to support water availability and biodiversity.
- Engage local communities in water conservation education programs and promote sustainable water use practices to reduce pressure on water resources.
- Establish community-based water management initiatives that involve local communities in monitoring and maintaining water sources and encourage the adoption of water-efficient technologies and practices.
- Explore alternative livelihood options for water-resources dependent communities by reducing the impact of resource extraction on the ecosystem.

Integrated Water Resource Management:

- Collaborate with relevant government agencies, NGOs, and local authorities to implement integrated water resource management plans and coordinate efforts to address water-related challenges collectively.
- Envisage development of conjunctive basin management by judicious use of the surface and ground water with the help of Department of Water Resources / Ground Water Board, and ensure recharging as well as availability of the ground water during the pinch period.
- Implement adaptive management strategies to respond to changing hydrological conditions, climate patterns, and human activities and periodically review and update water resource management plans based on monitoring data and feedback.

The integrated management of catchment areas, addressing water scarcity, and preserving wetlands are integral components of sustainable conservation practices in elephant reserves. By understanding the dynamics of water resources and implementing effective management strategies, we can contribute to the well-being of both elephant and local communities while ensuring the long-term ecological health of the reserve.

3.4.5. Habitat restoration and monitoring

The Elephant Reserve landscape has large tract of forests, managed under various silvicultural systems and practices. The anthropogenic pressures continue to degrade and fragment forest land especially the narrow corridors, threatened due to intense human activity and have to be ecologically restored.

There are large-scale monoculture plantations with low forage nutrition which are not conducive to wildlife habitat including for the elephants. These have to be replaced and planted with indigenous species after proper assessment.

Habitat restoration and monitoring are essential components of effective conservation efforts in elephant reserves and also aims to enhance and maintain suitable habitats for elephants and other wildlife, promoting biodiversity and ecological balance.

The strategies for habitat restoration and monitoring in elephant reserves envisages:

Habitat Restoration:

- *Vegetation Management:* Implement measures to manage and control invasives that may threaten native vegetation and conduct habitat reforestation programs to restore areas affected by deforestation, or other disturbances including agro-pastoral and silvicultural practices to improve availability of fodder species.
- *Soil Conservation:* Implement erosion control measures, such as the use of cover crops, contour ploughing, and check dams, to reduce soil erosion and use measures to enhance fertility and support plant growth in degraded areas.
- *Water Source Enhancement:* Maintain and create water holes to ensure a reliable water supply for elephants and other wildlife during pinch period and implement restoration projects to improve water flow and quality in rivers and streams.
- *Habitat Connectivity:* Establish and maintain wildlife corridors to facilitate the movement of elephants between different habitats and envisage measures to reduce habitat fragmentation, such as the creation of canopy bridges or underpasses.
- *Bamboo and Grassland Management:* Plant bamboo, in areas where it has been depleted and implement initiatives to restore and manage grasslands, ensuring a diverse range of grass species for herbivores.
- *Habitat Diversity Enhancement:* Create snags (standing dead trees) and den structures to provide shelter for various wildlife species and encourage a diverse range of vegetation types, including grasslands, woodlands, and wetlands, to support varied wildlife.

Habitat Monitoring:

- *Remote Sensing and Spatial Mapping:* Use remote sensing and satellite imagery to monitor changes in vegetation cover and distribution. Develop GIS-based systems to map and monitor changes in habitat conditions, land cover, and land use and integrate data from various sources, such as climate, topography, and vegetation, to create comprehensive habitat maps.
- *Habitat Quality Assessment:* Assess the health of vegetation through field surveys to determine the quality of forage available for elephants and regularly monitor the quality of water sources to ensure that the requirements of wildlife are met.
- *Ecological Surveys:* Conduct ecological surveys to assess the diversity of plant and animal species within the reserve and also evaluate soil quality and composition to understand its impact on vegetation and habitat health.
- *Human-Wildlife Interaction Monitoring:* Monitor and document human-wildlife conflict incidents, especially those related to habitat use and resource competition along with the feedback from the local communities regarding wildlife interactions and habitat conditions.
- *Climate Change Adaptation Monitoring:* Assess the potential impacts of climate change on habitat conditions for adjusting management strategies and monitor weather patterns and trends to understand the effects of climate on vegetation and water availability.
- *Adaptive Management and Capacity Building:* Conduct training programs for reserve staff, local communities, and volunteers on habitat monitoring techniques and ecological principles and build local capacity for habitat restoration and monitoring; encouraging citizen science initiatives and community involvement for incorporating traditional eco-knowledge in monitoring.

Habitat restoration and monitoring are ongoing processes that require collaboration, adaptive management, and a holistic understanding of ecological systems. By implementing these strategies, elephant reserves can contribute to the long-term conservation of elephant populations and the overall health of their habitats.

3.4.6. NTFP and other leases

The Elephant Reserve has large tracts of forest with NTFP, however prolonged unsustainable NTFP collection have led to its rapid decline. The common species occur mostly in the dry and moist deciduous forests, where both regeneration and recruitment have suffered. There is no information on the trends in the population of the NTFP species or the status of regeneration. Most NTFP species wherever exploited are likely to be locally extirpated though the status in the PAs is satisfactory.

- The Plan has to consider the inventory of major NTFP, its distribution and past yields, revenue generated and evaluate adverse impacts of NTFP collection activities on plant and animal species, sites, habitats and non-target species. Also, to be considered are the potential and opportunities for NTFP collection outside the PA, the methods of collection and what kind of field controls are to be prescribed.

- Wherever leases have been granted outside PAs for NTFP we need to look into the nature and type of lease, area, procedure of operation, terms and conditions, the out-turn, revenue and the consequences for forest diversity, including local, ecological and economic impacts.

Non-Timber Forest Products (NTFPs) and other leases in an elephant reserve involve the sustainable utilization of forest resources for economic and community development while ensuring the conservation of biodiversity and habitat integrity.

Proper management practices are essential to strike a balance between the requirements of the local communities and the objectives of the elephant reserve management. For managing NTFPs and leases in elephant reserves, following considerations are envisaged:

Non-Timber Forest Products (NTFPs):

- Identify NTFPs within the ER to understand their distribution and abundance and implement sustainable harvesting practices to prevent over-exploitation.
- Map areas with NTFPs to guide sustainable harvesting practices and monitor changes in resource availability and adjust harvesting quotas based on ecological assessments.
- Involve local communities in decision-making processes related to NTFP utilization and establish community-based systems to ensure equitable distribution of benefits.
- Develop and enforce guidelines for the sustainable harvesting of NTFPs, considering factors such as seasonality, regeneration rates, and ecological impacts and provide training on sustainable harvesting techniques.
- Support value addition to NTFPs to enhance their market value and assist local communities in developing market linkages, promoting sustainable livelihoods.
- Implement regulations for NTFP harvesting to prevent unsustainable practices and establish mechanisms to track harvest volumes, compliance with regulations, and ecological impacts.
- Conduct research on NTFPs to understand their ecological roles, potential uses, and sustainable management practices and promote the cultivation of certain species to reduce pressure on wild populations.

Leases and Other Land Use:

- Develop land use plans that consider the ecological needs of elephants and other wildlife in addition to the socio-economic needs of local communities and identify zones for different land uses, including agriculture, settlements, and conservation areas.
- Facilitate community-based forest management initiatives that grant communities legal rights to manage and utilize forest resources sustainably and provide training on sustainable land use practices and community-led conservation efforts.
- Establish guidelines for leasing forest land for various purposes, ensuring compatibility with conservation objectives and ensure that leases include clauses for sustainable resource use, reforestation, and conservation practices.
- Explore eco-tourism opportunities that can generate revenue for the reserve while minimizing negative impacts on wildlife and develop guidelines for responsible tourism practices to prevent habitat disturbance.
- Recognize the cultural and traditional uses of the land by local communities and integrate cultural values into land use planning and leasing decisions.
- Use EIAs to informed decision-making in proposed activities, such as mining or infrastructure development, to assess potential environmental impacts and implement mitigation measures wherever necessary.
- Establish a robust monitoring system for leased areas to track compliance with agreements and regulations and periodically assess the ecological health of leased areas and intercede if adverse impacts are observed.

- Implement revenue-sharing mechanisms that ensure part of the income generated from leases goes to the local communities and establish transparent and equitable system for revenue distribution.
- Ensure that leasing and land use activities are in accordance with existing conservation laws and enforce penalties for any illegal activities that may harm the reserve.
- Foster collaboration between government agencies, local communities, NGOs, and private enterprises and facilitate multi-stakeholder dialogues to address conflicts and find solutions that balance conservation and development goals.

Effective management of NTFPs and leases in an elephant reserve requires a collaborative and adaptive approach that prioritizes both ecological sustainability and the well-being of local communities. Engaging stakeholders in decision-making processes and continuously monitoring and adjusting management practices are key elements of successful conservation efforts in such landscapes.

3.4.7. Linear and other development projects

The Elephant reserves have a substantial number of linear infrastructures, mainly transmission lines, and roads apart from railway lines and canals etc. The Linear infrastructure fragments habitat reduces and isolates habitat area and impacts wildlife movement and traditional migration paths. Moreover, the railway, road and power transmission lines cause mortality of animals due to road kills and electrocution. Linear infrastructure can change soil characteristics, hydrologic cycles, and other ecosystem processes and functioning, and facilitate the dispersal of invasive and pathogens into natural habitats.

- The Wildlife Institute of India has developed "Ecofriendly measures to mitigate the impact of linear infrastructure on wildlife" a comprehensive guideline for forest managers and other sectors.

Balancing the needs of development with the conservation of elephants and their habitats requires careful planning, mitigation measures, and adherence to sustainable practices. Considerations for managing linear and other development projects in elephant reserves envisages:

Linear Development Projects (e.g., Roads, Railways):

- Recognize the potential threat of the linear infrastructure, such as roads and railways, to habitat fragmentation and implement measures to mitigate habitat fragmentation, including wildlife corridors and underpasses.
- Design and construct wildlife crossings, including overpasses and underpasses, to facilitate the movement of elephants and other wildlife across linear infrastructure and ensure that crossings are strategically located based on wildlife movement patterns and migration paths.
- Establish and enforce speed limits in areas with high wildlife movement to reduce the risk of vehicle collisions with elephants and install warning signs to alert drivers about the presence of wildlife crossings.
- Integrate linear development plans into comprehensive landscape level planning for the entire elephant reserve and minimize new linear infrastructure within core areas and critical habitats and prioritize alternative routes.
- Conduct detailed EIAs for proposed linear development projects to assess potential impacts on the elephant population and its habitats including biodiversity and implement mitigation measures to minimize adverse effects.
- Establish monitoring programs to assess the impact of linear infrastructure on elephant behaviour, movement patterns, and habitat use and use such data to adaptively manage infrastructure projects and implement changes to reduce negative impacts.

Other Development Projects (e.g., Agriculture, Human Settlements):

- Designate buffer zones (human coexistence zone) around core elephant habitats to minimize the impact of development projects on critical areas and regulate and monitor activities in buffer zones to maintain ecological connectivity.
- Promote sustainable land use practices, especially in areas adjacent to elephant habitats and encourage agricultural and animal husbandry practices that minimize conflicts, such as raising non-palatable crops and controlled-rotational livestock grazing etc.

- Engage local communities in the planning and implementation of development projects and address community concerns by incorporating traditional knowledge in decision-making processes.
- Explore the possibility of establishing conservation easements within or adjacent to development zones and designate such areas, where certain development activities are restricted to protect critical wildlife habitats.
- Encourage the adoption of wildlife-friendly infrastructure design principles in development projects and incorporate wildlife crossings, green corridors, and habitat restoration features into project development plans.
- Establish zoning regulations that consider the needs of both human communities and wildlife and restrict certain types of development in areas with high elephant movement.
- Establish conflict resolution mechanisms to address human-wildlife conflicts arising from development projects and provide compensation or alternative livelihood options for communities affected by wildlife-related issues.
- Adopt landscape-scale planning approaches that consider the cumulative impacts of various development projects on the entire ecosystem and envisage multi-criteria analysis including collaboration with multi-stakeholders to develop integrated plans that balance conservation and development goals.
- Ensure that all development projects comply with relevant environmental and conservation laws, and regulations and enforce penalties for non-compliance to deter activities that could harm elephant habitats.
- Conduct public awareness campaigns to educate local communities, developers, and decision-makers about the importance of conservation and potential impacts of development projects.

Managing linear and other development projects in elephant reserves requires a holistic approach that involves collaboration among government agencies, local communities, conservation organizations, and developers. By integrating conservation principles, it is possible to reduce negative impacts on elephant habitats and promote sustainable coexistence between humans and elephants.

3.4.8 Other site-specific disturbances and natural disasters

The Elephant Reserves landscape has a diversity of vegetation, climatic conditions and physiography with large catchments draining water into rivers, streams and lakes. Such landscapes are prone to disturbances which are an integral part of forest ecology, allowing rejuvenation, nutrient cycling, and maintaining biodiversity. The forest ecosystems have co-evolved with a given disturbance regime that they adapted to. The forest disturbances can be classified into abiotic (storms, wildfires, cyclones, droughts, floods etc), biotic (forest diseases caused by fungi, viruses, insects and invasive exotic plants etc), and man-made (illicit felling, land conversion, pollution, and anthropogenic climate changes etc).

Elephant reserves, like any other ecosystems, are susceptible to various site-specific disturbances and natural disasters that can have significant impacts on wildlife, habitats, and local communities. Managing these disturbances is crucial for the conservation of elephants and the overall ecological balance.

- Strategies that promote the recourse to nature-based solutions that address all aspects of vulnerability and risk reduction, are important.

Following considerations are envisaged for addressing site-specific disturbances and natural disasters in elephant reserves:

Site-Specific Disturbances:

- Implement strict regulations for mining and quarrying activities within or near elephant reserves and enforce restoration plans for areas affected by mining and ensuring the recovery of habitat.
- Promote sustainable timber extraction practices, including selective logging and reforestation efforts and designate certain areas within the reserve as logging-free zones to protect critical habitats.
- Develop land use plans that balance agricultural needs with conservation objectives and promote agroecological practices that minimize HEC and habitat destruction.
- Conduct ions for infrastructure development projects to assess potential impacts on elephant habitats and implement mitigation measures to reduce the ecological footprint of development.

- Determine the carrying capacity for tourism activities to prevent habitat degradation and disturbance to wildlife and take measures for ecotourism development including ecotourism related aspects within the reserve.

Natural Disasters:

- Implement measures to prevent and control fires, such as creating firebreaks/ fire lines, conducting controlled burning and developing early warning systems to detect and respond to potential forest fires.
- Plan infrastructure in flood-prone areas to minimize the risk of damage during floods and develop emergency response plans for floods and cyclones including cyclone related aspects to ensure the safety of both humans and wildlife including evacuation measures.
- Implement water management strategies during droughts, including creation of water sources and conservation of existing ones and provide water supplies for wildlife including elephants during prolonged droughts and pinch period by pumping from solar-powered borewells etc.
- Design infrastructure with earthquake resilience in mind to minimize the risk of damage and develop evacuation plans for human communities and wildlife in the event of a significant earthquake to safer places as part of disaster management plan.
- Promote the conservation of vegetation cover to reduce the risk of landslides and monitor areas prone to landslides and implement vegetative stabilizing measures.
- Implement ecosystem-based adaptation measures, (such as mangrove restoration), to mitigate the impact of storm surges and establish coastal zoning regulations to guide development and protect sensitive areas.

Addressing site-specific disturbances and natural disasters in elephant reserves requires a multi-faceted approach that combines proactive planning, community involvement, and adaptive management.

3.4.9 Climate change and disaster risk reduction

Forests and climate mitigation are linked since forests are a source of carbon sequestration. Forest conversion and degradation are a source of carbon emissions that contribute to GHG emissions causing climate change. Thus, conserving forests or preventing their conversion to other land uses, besides sustainable management of forests, both constitute mitigation and adaptation measures. Sustainable forest management can increase the resilience of landscape and provide economic, social and environmental services such as food, wood, energy, shelter, fodder, fibre, and livelihood opportunities.

- Sound forestry practices can reduce risk as it will provide buffering of extreme temperatures and precipitation, flood risk reduction, storm risk reduction etc.

Climate change and disaster risk reduction are critical considerations in the management of elephant reserves. The impacts of climate change, such as altered precipitation patterns, increased frequency and intensity of extreme weather events, and rising temperatures, can exacerbate existing challenges in elephant conservation. Implementing strategies for disaster risk reduction is essential to enhance the resilience of elephant habitats and local communities.

Following measures are envisaged for addressing climate change and disaster risk reduction in ER:

Climate Change Adaptation:

- Conduct a thorough assessment of climate vulnerabilities specific to the elephant reserve, including potential impacts on vegetation, water sources, and elephant populations and identify key climate change drivers and their implications for elephants and their habitats.
- Integrate climate-resilient habitat management practices into planning and consider the potential shifts in vegetation zones and migration patterns of elephants due to climate change.
- Implement adaptive water resource management strategies to ensure an adequate and reliable water supply for elephants and other wildlife during changing climate conditions and also explore conjunctive basin management and sustainable water harvesting techniques.
- Develop land use plans that account for climate change impacts on vegetation, habitat connectivity, and human-elephant interactions and identify climate-smart zones for sustainable development.

- Protect and enhance migration paths and corridors that elephants use in response to changing climatic conditions and develop measures to secure and manage key habitats along migration routes.
- Engage local communities in climate change adaptation strategies and provide training and support for adapting to climate-resilient agricultural practices and sustainable livelihoods.
- Implement monitoring programs to track climate-related changes in vegetation, water availability, and elephant behaviour and undertake research initiatives to better understand the specific impacts of climate change on elephants and their ecosystems.

Disaster Risk Reduction:

- Establish early warning systems to detect and communicate potential disaster events such as floods, droughts, and cyclones and conduct regular trainings and awareness programs to ensure effective community response.
- Design and retrofit infrastructure, such as roads and bridges, to be resilient to climate-related disasters and consider the impact of infrastructure projects on natural drainage systems and water flow.
- Develop and regularly update emergency preparedness and response plans that address the specific risks and vulnerabilities of the elephant reserve and collaborate with local authorities, emergency services, and community organizations.
- Provide training to local communities on disaster preparedness, response, and recovery and build local capacity to handle emergencies, including elephant-related happenings.
- Emphasize biodiversity conservation as a means of enhancing ecosystem resilience and protect and restore natural buffers (e.g. mangroves and wetlands) that can mitigate the disaster impacts.
- Develop and implement spatial-based fire management strategies as well as community-based fire management strategies to reduce the risk of forest fires.
- Strengthen buffer zones around core elephant habitats to serve as natural barriers against disasters and enhance the protection of designated protected areas and tiger reserves within elephant reserve.
- Conduct public awareness to educate local communities and visitors about disaster risks and the importance of conservation practices and provide educational materials on disaster preparedness and climate change adaptation.
- Promote climate-resilient agricultural practices that reduce vulnerability to extreme weather events and contribute to sustainable land use.
- Collaborate with government agencies, NGOs, local communities, and researchers to implement integrated disaster risk reduction strategies and establish coordination for effective communication and response during emergencies.
- Support research initiatives focused on understanding the specific disaster risks in the region and developing innovative solutions and foster the use of technology and data-driven approaches for disaster risk reduction.

Addressing climate change and disaster risk reduction in elephant reserves requires a holistic and adaptive approach. By incorporating climate resilience and risk reduction strategies into planning, elephant reserves can contribute to the long-term sustainability of both ecosystems and communities.

3.5 CORRIDORS: DESCRIPTION, PROTECTION AND MANAGING DISPERSING POPULATIONS

Elephant corridors are crucial components of elephant reserves and conservation efforts aimed at maintaining connectivity between fragmented habitats. These corridors serve as pathways that allow elephants to move between different areas, facilitating natural behaviours such as migration, foraging, and breeding.

Description of Elephant Corridor:

The description of elephant corridors within an elephant reserve may include:

- *Definition and Purpose:* Elephant corridors are defined as specific routes or passages that elephants use to move between different habitats within an elephant reserve or between reserves with the primary purpose of free movement of elephant populations, maintaining genetic diversity and promoting healthy ecological dynamics.
- *Connectivity:* Elephant reserves are often fragmented by human settlements, roads, agriculture, and other infrastructure and the corridors serve as links between these fragmented areas, allowing elephants to traverse the landscape without encountering significant barriers.
- *Natural Migration Routes:* Elephant corridors typically follow traditional migration routes that elephants have used for generations and these routes are influenced by factors such as availability of food, water, and seasonal changes.
- *Habitat Preservation:* Elephant corridors contribute to the preservation of natural habitats by allowing elephants to access different areas for feeding, breeding, and social interactions which in turn, supports the overall biodiversity of the ecosystem.
- *Mapping and Planning:* Identifying and mapping elephant corridors involve careful study of elephant movement patterns, behaviour, and historical migration routes and this information could be used to plan and manage the landscape and also to support the needs of elephant populations.
- *Corridor Conservation Measures:* Conservation efforts in and around elephant corridors may include land-use planning, implementation of wildlife-friendly infrastructure (such as wildlife underpasses or overpasses across roads), and community engagement to promote corridor conservation.
- *Monitoring Protocols:* Regular monitoring of elephant movement through corridors is essential for understanding their effectiveness and identifying potential threats.

The creation and preservation of elephant corridors are vital components of broader conservation strategies, contributing to the sustainable coexistence of elephants and human communities while safeguarding the ecological integrity of the elephant reserve.

Protecting corridors, migration routes and managing dispersing populations in elephant reserves are crucial aspects of wildlife conservation, especially for large and wide-ranging species like elephants. Certain strategies that can be implemented include:

Corridor and Migration Path Protection:

- Conduct thorough surveys and research to identify existing elephant corridors/ migration paths and use GIS technology to map and monitor these corridors and paths.
- Implement measures to conserve and restore natural habitats within the corridors/ migration paths and work with communities to reduce human activities that encroach upon these habitats.
- Establish buffer zones around the corridors to minimize conflict and implement land-use planning regulations to restrict activities that can disrupt the corridors and migration paths.
- Install effective fencing along critical sections of the corridor and migration path to prevent human encroachment and use eco-friendly and wildlife-friendly fencing methods to avoid harm to both humans and elephants.
- Involve local communities in corridor protection initiatives and create awareness about the importance of corridors for elephants and the overall ecosystem.

Managing Dispersing Populations:

- Develop and implement early warning systems to alert local communities about approaching elephant herds and use technology such as sensors, or drones to detect elephant movement.
- Provide training to local communities on how to respond to elephant presence without causing harm and educate them on the importance of coexisting with the elephants.
- Introduce and promote elephant-friendly crop protection measures, such as using chilli / beehive fences, or deterrents and compensate farmers for crop losses to reduce negative attitudes towards elephants.

- Construct safe passages like underpasses or overpasses along highways to prevent road accidents involving elephants and ensure that infrastructure development considers elephant movement patterns.
- Conduct research on dispersal patterns and behaviours of elephant populations and monitor dispersing individuals through tracking and satellite collars to understand their movements.
- Consider translocating elephants only as a last resort when conflicts cannot be resolved in any other way by ensuring proper assessments as per the wildlife act, before initiating any translocation.

By implementing a combination of these strategies, it is possible to protect elephant corridors and manage dispersing populations in a way that ensures the long-term survival of both elephants and the ecosystems they inhabit.

3.5.1 Local Overpopulation, Splinter Groups and related management options

The overpopulation or overabundance of elephants may be due to the increased birth rates, reduced predation and migration of population. The animals in an overpopulated area may then be forced to stray into adjoining agricultural landscapes attracted by the crops grown in those areas, exacerbating conflict.

- The ER landscape has been witnessing an increase in the population of elephants over the last few decades and this local overpopulation or overabundance may or may not be regarded as a major conservation or management challenge in the absence of any carrying capacity studies specifying unique density of elephants that can serve to qualify as threshold of carrying capacity.
- The relationship between elephant density and the ecological impact of elephants is complex and variable, and our understanding of these processes is still developing.

Local overpopulation of elephants can lead to various challenges, including habitat degradation, human-wildlife conflict, and increased competition for resources. Effective management strategies are essential to address these issues. Some options for managing local overpopulation of elephants include:

- Implement contraception methods to control elephant population growth by use of immuno-contraceptives or hormonal contraceptives under the guidance of veterinarians. Artificial control measures using immuno-contraceptive reproductive control has not been standardized so far, in the absence of any studies on the threshold of carrying capacity.
- Translocate the elephant population, in phased manner, to areas with lower elephant densities or suitable habitats and ensure careful planning, monitoring, and ethical considerations to minimize stress in the translocated individuals.
- Improve and expand existing habitats to accommodate the local elephant population and implement habitat restoration programs to enhance food availability and quality.
- Install robust fencing to protect agricultural areas and human settlements from elephant encroachment and implement deterrent methods (noise devices, flashing lights, or chili-infused barriers etc) to prevent elephants from entering specific zones.
- Engage local communities in conservation efforts, making them stakeholders in elephant management and implement community-based programs that provide benefits from coexisting with elephants, such as community-based ecotourism.
- Conduct educational programs to raise awareness about the importance of elephants and the need for their conservation and foster positive attitudes toward coexistence.
- Develop and implement strategies to reduce HEC by strategies such as early warning systems, rapid response teams, and community training and also provide compensation for crop damage and loss of livestock to assuage negative sentiments toward elephants.
- Conduct ongoing research to monitor the local elephant population, their behaviours, and their impact on the ecosystem and use scientific data to inform management decisions and adjust strategies as needed.

A holistic and collaborative approach that involves various stakeholders is key to finding sustainable solutions to local overpopulation issues while ensuring the conservation of elephants and their habitats.

Besides, elephants may stray from their typical habitats or ranges for various reasons, and these include both natural and human-induced factors. Some common reasons for the straying of elephants include:

- They may stray from their usual habitat in search of food, especially during periods of food scarcity or when their preferred food sources become depleted.
- During dry seasons or droughts, elephants may travel long distances in search of water sources, leading them into areas where they wouldn't typically be found.
- Habitat fragmentation can create barriers to elephant movement, forcing them to stray into unfamiliar areas in search of suitable habitat and resources.
- Conflict with humans, particularly in areas where human populations encroach upon elephant habitats, can cause elephants to stray into human settlements or agricultural areas.
- Disruptions to social structures, such as the loss of a matriarch or conflicts within a herd, may cause individual elephants or entire groups to wander into new areas.
- Natural disasters such as floods, wildfires, or storms can disrupt elephant habitats and force elephants to move into new areas in search of safety or resources.
- Human interventions such as translocations, habitat restoration projects, or wildlife management activities can also cause elephants to stray into new areas.
- Elephants have excellent memory and navigational abilities, but they can sometimes make errors in judgment or become disoriented, especially in unfamiliar terrain or when faced with novel obstacles such as fences or roads. This can lead them to stray into unexpected areas.

Addressing the straying of elephants requires a multi-faceted approach that considers habitat conservation, land-use planning, human-elephant conflict mitigation, and efforts to reduce anthropogenic pressures on elephant populations and their habitats.

3.5.2 Addressing Spatial activities of Resident human populations that lead to conflict

The spatial activities of resident human populations that contribute to human-elephant conflict in an elephant reserve involves implementing a combination of mitigation strategies, community engagement, and spatial planning.

The key approaches to address these challenges envisages:

- land-use planning and zoning; mapping and spatial analysis; community engagement and education; crop protection measures; early warning systems; wildlife corridors and habitat connectivity; community-based conflict resolution; livelihood diversification; conservation incentives; infrastructure planning; research and monitoring; and enforcement measures

Addressing the spatial activities of resident human populations in an elephant reserve requires a holistic, collaborative, and adaptive approach, involving government agencies, local communities, NGOs, and conservation organizations. Sustainable coexistence is achievable through proactive planning, community engagement, and the implementation of effective mitigation measures.

3.6 LIVELIHOOD DEPENDENCE & BIOTIC PRESSURES IN THE ELEPHANT HABITAT

The Elephant Reserve Forest landscape has numerous hamlets and settlements within forest and in forest fringes, the communities depend on the forest resource for their socio-cultural and livelihood needs. The impact of the livelihood dependency on forests and unsustainable exploitation has resulted in the degradation of the forest, and affected the native biodiversity.

Forests are not only a source of subsistence income for the poor but forestry operations employ most of the fringe community members for sustainable management of forests and ensuring livelihood to the communities through Joint Forest Management.

Reducing livelihood dependence and biotic pressures and sustainable resource utilization by communities in elephant habitats is crucial for promoting harmonious coexistence between humans and elephants. Some strategies to achieve this, are:

- There is need to consider the number of forest fringe villages, their dependence on the forest, socio-economic requirements and design strategies that would create alternative livelihood opportunities or income generation schemes.
- Introduce and promote alternative livelihood options for communities residing in or near elephant habitats and develop vocational training and skill development to enhance skills for

alternative income-generating activities such as ecotourism, handicrafts, or sustainable agriculture.

- Encourage and educate farmers about eco-friendly and sustainable agricultural practices and implement methods such as agroforestry, organic farming, and permaculture to reduce the negative impact on elephant habitats.
- Implement effective livestock management practices to minimize conflicts between elephants and livestock and encourage secure enclosures for livestock during vulnerable periods, and provide veterinary support to prevent diseases that may affect both elephants and livestock.
- Substitute the use of fuel wood from forests by promoting alternative energy sources like biogas, solar energy, and improved cook stoves and expand the provisions for cleaner cooking fuels such as LPG in rural areas to reduce pressure on forests.
- Develop alternative livelihood opportunities through poverty alleviation programs including inter-sectoral linkage for generating employment for the rural poor (e.g. MNREGA).
- Enable the forest-dependent populations to diversify their livelihood options through welfare schemes like support for improved seeds, agricultural implements and other natural resource-based activities like sericulture, and apiculture.
- Enhance households' income by marketing and value addition of range of marketable NTFPs like fruits, flowers, berries, tubers, resins, honey, leaves, creepers etc. that have great nutritional, medicinal, and other use values.
- Develop and maintain effective fencing systems to protect crops from elephant raids and promote the use of crop protection methods such as chilli fences, beehive fences, or natural deterrents.
- Engage local communities as partners in conservation efforts and establish community-based management programs to provide communities with a sense of ownership and benefit-sharing.
- Provide support in the forest fire control, poaching, and HEC mitigation through participatory forest management and community-driven management practices.
- Conduct awareness programs to educate local communities about the importance of elephant habitats and the need for conservation and promote a better understanding of elephant behaviour and ecology to reduce fear and negative perceptions.
- Implement early warning systems and community-based conflict resolution mechanisms to reduce HEC and provide compensation and insurance schemes for crop and property damage caused by elephants.
- Implement effective land-use planning to minimize encroachments into elephant habitats and enforce zoning regulations that restrict certain types of development in critical elephant areas.
- Explore sustainable tourism initiatives that can generate revenue for local communities while promoting the conservation of elephant habitats and ensure that tourism activities are well-managed to minimize negative impacts on the environment.

It is crucial to tailor these strategies to the specific needs and contexts of each region, considering the socio-economic and cultural factors of the local communities involved.

3.6.1 Safeguarding threatened biodiversity values

The conservation plan has already identified the values and the species that are threatened and for which special efforts are required for protection and conservation.

Safeguarding threatened biodiversity values in elephant reserves requires a comprehensive approach that addresses the conservation needs of various species and ecosystems. Strategies to ensure the protection of biodiversity in elephant reserves envisage:

- Develop inventory of threatened and vulnerable species, including distribution and mapping, before concerted efforts to address the causes for the decline and species recovery programs are implemented. The database may be validated by field surveys, BSI and ZSI reports.
- Identify and protect critical habitats within the reserve, especially those of threatened species and implement habitat restoration programs to enhance the quality and connectivity of ecosystems.

- Regulate working in the forest divisions, where rare and threatened species are present unlike the PAs, which are repositories of many rare and threatened. Ecological restoration in the landscape also provides additional habitat for threatened species
- Preserve and maintain wildlife corridors that facilitate the movement of species, promoting genetic diversity and ecosystem health and mitigate threats to corridors.
- Implement conservation programs for threatened and endemic species within the reserve and conduct research to understand the specific requirements and develop plans accordingly.
- Control and manage invasives that threaten the native biodiversity and implement programs to eradicate or control invasive species that outcompete or harm native flora and fauna.
- Engage local communities in conservation efforts through education and capacity-building programs and establish community-based conservation initiatives that provide incentives for protecting biodiversity.
- Conduct regular biodiversity assessments and monitoring programs to track the health and status of ecosystems and species and use scientific data to develop conservation strategies and adapt management plans as required.
- Develop climate change adaptation strategies to mitigate the impacts on biodiversity and enhance the resilience of ecosystems to climate change through habitat restoration and sustainable land management.
- Collaborate with governmental agencies, research institutions, and local communities to pool resources and expertise and develop partnerships to implement joint conservation projects involving traditional knowledge.
- Conduct educational programs to raise awareness about the importance of biodiversity in the elephant reserve and engage schools, local communities, and the media to promote a conservation ethos.
- Collaborate with neighbouring countries or regions to implement transboundary or regional conservation initiatives and share information and resources for the protection of migratory species and ecosystems that span multiple jurisdictions.

By adopting a holistic and adaptive approach that considers the interconnectedness of species and ecosystems, it is possible to safeguard threatened biodiversity values in elephant reserves and contribute to the overall health of the environment.

3.7. ELEPHANT PROTECTION

The major threat to elephants despite stringent protection is from elephant poaching, fragmentation, loss and destruction of habitat, fragile wildlife corridors and human-elephant conflict. The elephant reserves are management units encompassing tiger reserves, protected areas and forest divisions. Approximately, one-fourth of the elephant reserves are part of the PA network and core area of the tiger reserve, which is well protected; half under forest and forest-buffer zone; while another one-fourth are beyond the control of the forest administration, posing management and governance challenges.

Protecting elephants is a critical component of conservation efforts to ensure its well-being. Strategies for elephant protection include:

- Strengthen anti-poaching efforts through increased patrolling, surveillance, and the use of technology such as drones and thermal imaging cameras and implement strict law enforcement towards poaching and illegal wildlife trade.
- Engage local communities in elephant conservation, emphasizing the economic and ecological benefits of preserving, and establish community-based monitoring and protection programs.
- Develop and implement strategies to reduce human-elephant conflicts, such as early warning systems, crop protection methods, and community education and provide timely compensation for crop and property damage caused by elephants.
- Protect and preserve elephant habitats, including critical migratory corridors and implement measures to reduce habitat fragmentation and human encroachment.
- Install effective fencing, to protect agricultural areas and human settlements from elephant raids and explore the use of technological solutions like sensor-based fences.

- Consider translocating elephants in emergency situations where HEC is severe or when elephants are at risk and ensure comprehensive assessments before translocating elephants.
- Establish rapid response teams to address emergencies, such as injured or distressed elephants and collaborate with local authorities, veterinarians, and wildlife rescue organizations.

3.7.1 Vulnerable Areas and Species susceptible for poaching

Identifying vulnerable areas and species susceptible to poaching in an elephant reserve is crucial for effective conservation and protection efforts. A security vulnerability map helps in a better understanding of the likely areas where poaching can occur and would enable more effective law enforcement and possibly prevent poaching. Besides this information on the fringe village communities' crime history data, their associates and intelligence inputs have to be incorporated into vulnerability analysis.

Some considerations and strategies to address this issue include:

Identifying Vulnerable Areas:

- Conduct a thorough analysis of the reserve's habitat characteristics, focusing on areas with high biodiversity and those crucial for elephant.
- Identify areas with frequent human-elephant conflicts, as these areas may attract poachers attempting to mitigate perceived threats.
- Assess remote or inaccessible areas within the reserve that may lack regular monitoring and are potentially attractive to poachers.
- Inspect and keep vigil in the border areas of the reserve, where illegal activities may be easier to carry out due to proximity to external influences.
- Review historical data on poaching incidents to identify patterns and areas with a higher incidence of illegal activities.
- Identify areas with a lack of law enforcement or monitoring presence, making them more susceptible to poaching.
- Prepare vulnerability map and update the spatial and temporal information on all poaching events so that potential poaching patterns are established.

Species Susceptible to Poaching:

- Wildlife species like elephants, rhinos, big cats (tigers, leopards) and other rare species are susceptible to poaching.
- Identify species in high demand in illegal wildlife trade markets and prioritize their protection.

Strategies for Protection:

- Increase the frequency and intensity of patrols in vulnerable areas, especially those identified as potential poaching hotspots.
- Employ technological innovations such as camera traps, drones, etc to enhance surveillance and gather intelligence on poaching activities.
- Engage local communities as partners in elephant protection efforts, seeking their support in reporting suspicious activities.
- Train and equip law enforcement personnel and field staff to effectively combat poaching activities including increased penalties for poaching offences to dissuade criminals.
- Establish intelligence networks to gather information on potential poaching threats and collaborate with local communities, informants, and other stakeholders to gather intelligence.
- Establish specialized units or task forces dedicated to investigating and combating crimes related to elephant and ensure effective prosecution of offenders.
- Carry awareness campaigns to educate communities about the elephant poaching impact and the importance of elephant conservation.
- Collaborate with conservation organizations, law enforcement agencies, and neighbouring regions to address regional / transboundary elephant crime issues.

- Build the capacity of local law enforcement agencies, forest officials, and community members to actively participate in anti-poaching efforts.

By identifying vulnerable areas, understanding the species at risk, and implementing protection strategies, it is possible to enhance the resilience of the elephant reserve against poaching threats.

3.7.2 Traditional migratory routes

Elephants are social and intelligent animals with well-developed cognitive abilities to adapt and respond to the changing environment, which makes them less vulnerable. They mostly migrate long distances in search of new foraging areas with abundant water. Elephants migrate over long distances across landscapes, which enables them to search for new foraging habitats strengthening gene flow among the populations and altering the forest ecosystem.

The elephants rigidly follow their traditional migratory path and would range over to new habitats to fulfil their requirements, and such large home ranges and dispersal facilitate them to avoid inbreeding and maintaining gene flow among populations. The elephants would take the same migratory path in the reverse direction following a cyclic spatio-temporal movement. This traditional migration is influenced by the availability of high-quality forage and water sources on a year-round basis.

Climatic factors have now altered the movement pattern and behaviour, with elephants moving beyond their defined historical ranges, and the wide-ranging elephants acclimatizing to new landscapes and environments, breaking the traditional cycle. The disruption in the movement in the traditional migratory paths due to linear intrusions and developments in the pathway and the appearance of corridors with fragile viability has to be considered.

Understanding and preserving traditional migratory routes is crucial for the conservation of elephants in reserves. Steps to identify and protect traditional migratory routes in an elephant reserve envisage:

- Conduct field surveys and use tracking technologies (GPS collars, satellite tracking) to monitor elephant movements and document the migration paths regularly used by elephants throughout the year in different seasons.
- Collaborate with local communities, especially those having traditional knowledge about elephant movements and gather information on historical migratory routes in the region, passed down through generations.
- Analyse historical records, including maps, research studies, and reports, to identify past migratory routes and also consider factors such as changes in land use pattern, human settlements, and infrastructure that could have impacted these routes.
- Consider the availability of vegetation and water along the routes, as these are crucial factors influencing elephant movement including key feeding and watering areas that elephants rely on during migration.
- Use GIS technology to map out the identified migratory routes and analyse the landscape parameters to determine the ecological connectivity of these routes.
- Conduct habitat connectivity assessments to evaluate the impact of human developments on migratory pathways and identify critical areas where habitat fragmentation may disrupt traditional routes.
- Implement measures to protect and enhance existing elephant corridors and collaborate with local communities and enforcement agencies to prevent encroachment on these corridors.
- Collaborate with neighbouring regions or countries to ensure the protection of migratory routes that extend beyond reserve boundaries and coordinate conservation efforts on a broader scale beyond the reserve.

Preserving traditional migratory routes is not only essential for the well-being of elephants but also contributes to the overall health of ecosystems.

3.7.2.1 Historic data and information on large mammal movements

The movement of large animals has been affected due to loss of landscape connectivity, occurrence of human- dominated and fragmented landscapes. The data on several species on the ecology, movement, occurrence, and behaviour is lacking, and therefore, there is an urgent need for an understanding of multi-species landscape permeability to movement to rationalize land-use planning and decision-making.

- Two types of movement in the ER landscape:
    - movement within an established home range for foraging, breeding, and/ or shelter --- where landscape permeability influences individual survival and reproduction; and
    - long-distance dispersal out of the natal home range to establish new home ranges --- where landscape permeability influences gene flow between populations.
- The adaptability of the animal to seek few alternative movement paths for easy passage, and any impediment due to landscape features offering high resistance to movement due to linear infrastructure and land-use and land-cover features, is to be considered.
- Accessing historic data and information on large mammal (elephant) movements in an elephant reserve is critical for understanding behaviour, planning conservation strategies, and mitigating human-elephant conflicts. The sources, to gather such information include:
    - research institutions and wildlife organizations; government agencies and their databases; academic journals and publications; GIS and remote sensing data; wildlife conservation NGOs; local communities and indigenous knowledge; wildlife tracking studies; collaborate with researchers; international conservation databases (like IUCN); conservation reports and plans; and wildlife biologists and experts.

Gathering historic data on large mammal movements may involve a combination of these strategies, and it is essential to approach multiple sources to ensure a comprehensive understanding. Once obtained, this information can contribute significantly to conservation efforts and help in the sustainable management of the elephant reserve.

3.7.2.2 Monitor migratory and seasonal movements and demarcation of corridors

Migration is the periodic movement of animals from one forest spatial unit to another, with a return journey. These regular movements of animals to breeding shelters and grounds in search of food and water occur in response to the spatial and temporal variability of rainfall and forage availability in terms of quality and quantity. Large herbivores like elephants migrate in response to seasonal variability of available resources as a means to enhancing access to high quality food.

Animals may move daily (local resident movement) or change habitat seasonally (migration and dispersal) due to the patchiness of resource distribution in their home ranges. Elephants and many other species in the vast ER landscapes have become isolated herds and some have been separated, as most of their habitats have been degraded, fragmented, or lost to human activities. Thus, dispersal areas and migratory routes or corridors are essential in connecting such habitats and sustaining populations.

Elephants show considerable movements, while other species congregate in large concentrations seasonally. For the continued survival of species, it is necessary to maintain existing dispersal areas and migration routes/corridors and to restore degraded corridors. There is a need to evaluate the design of elephant corridors including an understanding, of the ecological requirements and movement patterns of elephants using the corridor; which also determines that what form a particular corridor would take, in terms of habitat cover, and length and breadth, among other considerations.

Steps to effectively monitor elephant migrations and establish corridors envisages:

- *Collaboration and Planning:* Collaborate with wildlife experts, researchers, government agencies, and local communities for planning and executing corridor demarcation initiatives and develop a comprehensive strategy that considers ecological, social, and economic factors in monitoring and development of corridors.
- *Identify Key Migratory Routes:* Use historical data, satellite imagery, and on-the-ground observations to identify key migratory routes used by elephants and consider input from local communities and indigenous knowledge about traditional migration patterns.
- *Implement Tracking Technologies:* Use advanced tracking technologies such as GPS collars or satellite tags to monitor individual elephants and track their movements and regularly analyse tracking data to identify seasonal variations and annual changes in migration patterns.
- *Camera Traps and Remote Sensing:* Install camera traps along potential migratory routes to capture images of elephants and other wildlife and utilize remote sensing technologies to monitor changes in vegetation and habitat use.
- *GIS Mapping and Spatial Analysis:* Create detailed GIS maps that illustrate elephant movements and potential migration corridors and conduct spatial analysis to identify areas of habitat fragmentation and assess the connectivity of potential corridors.

- *Modelling potential corridor:* A habitat suitability model using major landscape attributes and 'Least Cost Path' analysis is required. This model formulates the shortest route from sink point to source points through the highest suitable areas. The movement of elephants and their habitat functions track the path of least resistance across a landscape.
- *Community Involvement and Citizen Science:* Involve local communities in monitoring efforts, encouraging them to report elephant sightings and movements and establish citizen science initiatives to collect data on elephant migrations.
- *Ecological Assessments:* Conduct ecological assessments to determine the suitability of potential corridors and assess vegetation quality, water availability, and other ecological factors that influence migratory movements.
- *Demarcation and Habitat Restoration:* Physically demarcate identified elephant corridors using signs, fencing, or other markers and implement habitat restoration works to enhance the quality and connectivity of these corridors.
- *Buffer Zones and Land-Use Planning:* Establish buffer zones around migratory corridors to minimize human-elephant conflict and work with local authorities to integrate corridor protection into land-use planning.
- *Community Education and Awareness:* Conduct educational programs to raise awareness among local communities about the importance of elephant corridors and promote a sense of responsibility and cooperation in corridor protection.
- *Regular Monitoring and Data Analysis:* Implement a routine monitoring program to track changes in migratory movements and corridor usage and analyse data trends to adapt conservation strategies based on the observed behaviour of elephants.
- *Research and Scientific Studies:* Conduct scientific studies on elephant behaviour, ecology, and the effectiveness of existing corridors and share research findings to contribute to the broader understanding of elephant migrations.
- *Transboundary Collaboration:* Collaborate with neighbouring regions or countries if migratory routes extend beyond reserve boundaries and share requisite information and data and coordinate conservation efforts across borders.

By combining technological advancements, community engagement, and ecological assessments, it is possible to monitor migratory movements effectively and establish corridors that contribute to the long-term conservation of elephants and the biodiversity of the reserve.

3.7.3 Anti-poaching measures

Poaching is the biggest threat to wildlife especially elephants, in the elephant reserves, as any population decline, shifts or reduces the distributional range of many species. Poaching affects the population status and demographic structures of wild flora and fauna including the entire ecosystem functions.

The security in the tiger reserves and PAs is better organized than the territorial forest divisions and the lack of resources and basic training in many forest divisions, hinders protection measures.

The enforcement mechanism is focused on pre-emptive measures to prevent poaching by detecting snares and traps, surveillance of boundaries to detect live wires for the protection of crops, and gathering intelligence to apprehend poachers by conducting raids in suspected places.

Implementing effective **anti-poaching measures** is crucial for the protection of elephants in reserves. Poaching poses a significant threat to elephants, particularly due to the demand for ivory and other illegal wildlife products. Key anti-poaching measures for elephant reserve envisages:

- *Frontline Staff Training and Capacity Building:* Provide comprehensive training for rangers and frontline staff on anti-poaching techniques, law enforcement, and conflict resolution and equip them with necessary tools, communication devices, and skills to carry out their duties effectively.
- *Increased Patrols and Surveillance:* Intensify regular patrols in critical areas within the reserve, including known elephant habitats and migration routes and employ technology such as drones, camera traps, and remote sensing to enhance surveillance capabilities.

- *Anti-Poaching Units:* Establish specialized anti-poaching units equipped with modern technology and trained personnel, manned by anti-poaching watchers and forest staff including deployment of rapid response teams to address immediate threats and incidents.
- *Intelligence Gathering:* Develop intelligence networks to gather information on potential poaching activities and encourage collaboration with local communities, informants, and law enforcement agencies including establishment of crime control bureau.
- *Community Engagement:* Involve local communities in the conservation efforts by nurturing a sense of ownership and responsibility and establish community-based wildlife protection programs, and provide incentives for reporting illegal activities.
- *Technology Integration:* Utilize technology like GPS tracking, radio collaring, and sensor networks to monitor elephant movements and detect unusual behaviour and implement digital technologies for real-time monitoring and analysis.
- *Super Sniffer (K9) Dogs:* Deploy specially trained super sniffer dogs (trained by WWF-Traffic India) to detect wildlife products, firearms, and other illegal items during patrols and inspections. The following breeds are popular choices to be trained as Super Sniffer dogs: Belgian Malinois. German Shepherd Dogs. Labradors
- *Strategic Fencing:* Install strategic fencing in key areas to prevent illegal entry and deter poachers and use solar-based electric fences or sensor-based fences for additional security.
- *Undercover Operations:* Conduct undercover operations to infiltrate and gather intelligence on poaching networks and engage with enforcement agencies to coordinate undercover operations.
- *International and Regional Collaboration:* Collaborate with international organizations, law enforcement agencies, and neighbouring countries/ regions to address transboundary/ regional poaching networks and exchange intelligence and coordinate efforts to combat wildlife trafficking.
- *Education and Awareness:* Conduct educational programs by involving NGOs to raise awareness about the consequences of poaching on elephant populations and ecosystems and educate the public about the illegal trade in wildlife especially ivory and the importance of conservation.
- *Technology-Enabled Reporting:* Implement mobile apps or hotlines that allow the public to report poaching incidents or illegal activities anonymously and enable prompt reporting and response. Use of SMART applications like M-STrIPES could be considered.
- *Incentivize Conservation:* Develop incentive programs for local communities to engage in conservation efforts by ensuring that communities benefit from wildlife protection through ecotourism, employment, or revenue-sharing initiatives.
- *Regular Audits and Evaluation:* Conduct regular audits of anti-poaching measures, elephant death audit and evaluate their effectiveness. Besides, adapt strategies based on lessons learned and emerging threats.
- *Prosecution Support:* Provide support for the prosecution of poachers and traffickers and collaborate with enforcement authorities to ensure the successful conviction of wildlife crimes.

Implementing a combination of these measures, customized to the specific context of the elephant reserve, can significantly enhance the protection of elephants against poaching.

3.7.3.1 Anti-poaching camps and facilities

Anti-poaching camps (APCs) are constructed in remote parts of forests and lack basic facilities like power source or water connection. Establishing anti-poaching camps in elephant reserves are crucial measures to protect wildlife including elephants and maintain the ecological balance of their habitats.

Key aspects to consider when establishing camps are:

- Identify high-risk zones within the elephant reserve where poaching is more likely to occur and establish well-equipped and strategically located anti-poaching camps in these areas to dissuade poachers and provide a rapid response to potential threats.
- Recruit the anti-poaching staff from the local villages, and help them work better, and efficiently by providing them with the field kits containing camouflaged uniform, caps, water bottles, backpacks, mosquito nets and repellents, binoculars, shoes and socks, first aid medical kit etc.

- Construct eco-friendly, sustainable and renewable energy-based anti-poaching camps using green building concepts, and reducing carbon footprint; the camp can be built with local materials and pre-fabricated hollow cement blocks which also provide thermal comfort.
- Provide accommodation facility and kitchen on the ground floor and observation room for round-the-clock vigil with the aid of high-resolution binoculars and a drone operating station on the first floor in the camp.
- Construct an elephant-proof trench with an additional power fence around the anti-poaching camp for the protection against wild elephants and other animals.
- Instal rainwater harvesting system with the water storage facility to meet the water demand.
- Instal solar power energy panels with LED bulbs for power supply and charging mobile phones. Fuel-efficient biomass cook stoves may be provided to conserve wood and create a smoke-free environment.
- Prohibit plastic usage in the camps and sustainable waste disposal to be encouraged.
- Equip the anti-poaching squads with appropriate gear, communication devices (wireless), night-vision equipment, and non-lethal deterrents.
- Develop skill of the anti-poaching squads with a curriculum including practical exercises and interactive sessions in wildlife tracking, surveillance, weapon operation, ambush, fire control methods, data collection and reporting, field investigation and law enforcement etc.
- Conduct regular training sessions for anti-poaching squads to ensure their skills are up-to-date and evaluate the effectiveness of the implemented strategies and make adjustments based on lessons learned.

3.7.3.2 Developing Intelligence network and linkages

Wildlife crime and intelligence analysis with respect to elephants, is a complex and highly specialized field that deals with the profile of offenders, illicit poaching patterns, markets, smuggling routes and consumers. The intelligence network involves gathering, collation, analysis and dissemination, and exchange of intelligence among relevant authorities aimed at curtailing wildlife (elephant) crime.

There is a need to examine the strategic intelligence to determine the levels and patterns of wildlife (elephant) crime at local, national and sometimes international levels. Further, there is also a need to develop a tactical intelligence framework for managers and frontline staff and plan activities and deploy resources to achieve operational effectiveness including operational management.

Developing an intelligence network and establishing linkages in an elephant reserve is crucial for effective conservation and protection. Key steps to consider when developing such a network include:

- Identify and engage with key stakeholders, including local communities, law enforcement agencies, NGOs, researchers, and international organizations (in transboundary areas) and establish partnerships to create a comprehensive network.
- Work closely with local communities living around the reserve, involving them in conservation efforts and empowering the members to act as informants, reporting any illegal activities.
- Establish local intelligence units composed of trained individuals from the community and provide with the necessary training in wildlife monitoring, data collection, and communication skills.
- Implement technological solutions such as camera traps, sensors, and GPS tracking devices to collect data on elephant movements and potential threats including identifying poachers.
- Analyse mobile telephones, social media analysis, websites, online communications and covert conversations with cooperation and assistance from forensic institutions and police resources.
- Coordinate with the Wildlife Crime Control Bureau (WCCB) for any covert surveillance, informants and undercover investigation. The WCCB has developed a crime analysis protocol that may be adhered to in crime investigation.

- Develop clear protocols for sharing information, ensuring that data is accurate, timely, and secure and establish a centralized database in the reserve to store and analyse information related to elephant movements, poaching activities, and potential threats.
- Build a robust communication infrastructure, including radio networks, mobile apps, and online platforms, to facilitate real-time communication among members and also ensure that communication channels are encrypted and secure to protect sensitive information.
- Conduct regular training sessions for members of the intelligence network to enhance their skills in data collection, analysis, and reporting and provide ongoing support and resources to strengthen the capacity of local communities and organizations.
- Coordinate joint patrols involving local intelligence units, law enforcement, and forest authorities and utilize aerial surveillance, drones, etc for efficient monitoring of the elephant reserve.
- Evaluate the performance of the intelligence network and adjust strategies based on feedback and keep abreast about the latest developments in technology and conservation practices for effectiveness of the network.

By building a strong intelligence network and fostering collaboration among various stakeholders, it becomes possible to gather and disseminate information efficiently, respond promptly to threats, and enhance the overall conservation efforts in the elephant reserve.

3.7.3.3 Creation of Enforcement Cell

The responsibility of law enforcement in Elephant Reserves is with the administrative units and their efforts are complemented by the WCCB - a premier wildlife enforcement agency. The creation of an enforcement cell and collaboration with other enforcement agencies are vital components of a comprehensive strategy to protect elephant reserves.

Establishing and coordinating an enforcement cell in an elephant reserve envisages:

- Establish a dedicated enforcement cell within the elephant reserve and deploy experienced and well-trained personnel to lead the enforcement cell, including rangers, and support staff. The Enforcement Cell may be established by the Elephant Reserve Management Coordination committee (ERMCC), which may coordinate with the WCCB for collating intelligence related to organized elephant crime, so as to apprehend the criminals and also to establish a data bank.
- Clearly define the mandate and responsibilities of the enforcement cell, including anti-poaching efforts, wildlife crime investigation, and coordination with other agencies and ensure that the cell is equipped to handle enforcement challenges in the reserve.
- Provide specialized training for enforcement cell members, focusing on wildlife law enforcement, anti-poaching tactics, intelligence gathering, community engagement and collaborate with recognized training institutions or experts in crime prevention.
- Equip the enforcement cell with necessary resources, including vehicles, communication devices, surveillance equipment, and arms and ammunition and ensure regular maintenance and upgradation to enhance effectiveness.
- Utilize technology, such as GPS tracking, camera traps, and drones, to enhance surveillance and monitoring capabilities and integrate the same into the enforcement cell's operations for data collection, analysis, and communication.
- Establish a community-based reporting system to encourage locals to share information about illegal activities and involve community members as volunteers or informants, creating a sense of shared responsibility for elephant protection.
- Establish formal collaborations with other relevant enforcement agencies, such as the police, DRI, customs, and border patrol and share intelligence, coordinate joint patrols, and conduct joint training exercises to enhance overall effectiveness.
- Collaborate with legal authorities to ensure rapid and effective prosecution of offenders in the wildlife crime.
- Organize regular coordination meetings involving the enforcement cell, other agencies, and local stakeholders and discuss emerging threats, share intelligence, and strategize joint efforts.
- Implement a system to monitor and evaluate the performance of the enforcement cell regularly and use key performance indicators (KPIs) to measure the success of anti-poaching efforts and overall elephant protection.

- Stay informed about evolving threats and adjust enforcement strategies accordingly and encourage a culture of continuous improvement, incorporating feedback and lessons learned into future operations.

By establishing a well-equipped enforcement cell and fostering collaboration with other enforcement agencies, we can enhance the protection of elephant reserves, deter illegal activities, and contribute to the long-term conservation of elephants

3.7.3.4 Coordination & involvement of other enforcement agencies

Protecting and managing an elephant reserve involves coordination and involvement of various enforcement agencies to ensure the conservation and well-being of elephants and their habitats. Wildlife (elephant) crime detection and prosecution requires expertise in different areas like forensics, analysis of mobile telephones, computers and data storage devices etc.

Inter-agency task forces and joint initiatives can enhance the overall effectiveness of conservation efforts and offers unique areas of expertise, intelligence and resources; and reduces misunderstandings and miscommunications. Joint efforts between agencies include: collecting and analysing intelligence; conducting investigations; and developing forward and backward linkages.

- There is a need for coordination with the agencies like Wildlife Crime Control Bureau (WCCB), Customs, Revenue intelligence, State Police, State Forensic units, Wildlife Institute of India (WII), Laboratory for Conservation of Endangered Species (LaCONES), Centre for Cellular and Microbiology (CCMB), Indo Tibetan Border Police (ITBP), Shashastra Seema Bal (SSB), Border Security Force (BSF), Central Reserve Protection Force (CRPF), Railway Protection Force (RPF) etc for interagency collaboration and information sharing between departments.
- Inter-agency collaboration can be strengthened by entering into a multilateral MoU with a clear understanding of the level of cooperation and coordination.

Effective coordination and collaboration among these agencies are essential to address the multi-faceted challenges of elephant reserve management, including poaching, and human-elephant conflict.

3.7.3.5 Sustaining Anti-poaching operations

Anti-poaching operations are a continuous process of maintaining vigil and pursuing leads and tip-offs to their logical conclusion. The anti-poaching operations have to be continuous regular operation as per the security plan with regular patrols in vulnerable areas and responding to any intelligence inputs. Sustaining anti-poaching operations in an elephant reserve requires a well-planned and ongoing effort involving various stakeholders.

Key strategies to ensure the continued effectiveness of anti-poaching initiatives envisage:

- *Long-Term Funding and Resource Allocation:* Secure sustainable funding for anti-poaching operations through government allocations, grants, donations, and partnerships with conservation organizations and develop a budget covering salaries, equipment maintenance, training programs, and community engagement initiatives.
- *Public-Private Partnerships:* Collaborate with private organizations, and philanthropists to complement government funding and establish partnerships that include financial support, technology provision, and expertise sharing.
- *Community Involvement and Support:* Maintain strong relationships with local communities by involving them in conservation efforts and establish community-based programs that provide alternative livelihoods and benefits, fostering a sense of ownership and supporting anti-poaching operations.
- *Capacity Building and Training:* Invest in the training and capacity building of anti-poaching personnel and keep updated on the latest techniques, technologies, and strategies in elephant conservation for incorporating into training programs.
- *Technology Integration and Innovation:* Adopt technological advancements and innovations to enhance the efficiency of anti-poaching operations and regularly assess and upgrade surveillance technology, communication systems, and data analytics tools to stay ahead.
- *Intelligence Gathering and Analysis:* Strengthen intelligence networks and consistently gather, analyse, and act upon information related to poaching activities and also envisage predictive modelling and data-driven approaches to anticipate and prevent potential threats.

- *Regular Patrols and Monitoring:* Conduct regular and well-coordinated patrols in vulnerable areas of the elephant reserve and utilize modern monitoring techniques, including drones and camera traps, to enhance surveillance and gather valuable data on animal movements.
- *Adaptive Strategies:* Develop a flexible and adaptive anti-poaching strategy that can respond to changing poaching trends and tactics and periodically review and update protocols based on feedback and emerging threats.
- *International Collaboration:* Foster collaboration with international conservation organizations, research institutions, and enforcement agencies and share information and best practices, and seek assistance when necessary to address transnational poaching threats.
- *Legal Measures:* Contribute to the enforcement of conservation laws and collaborate with legal authorities to ensure effective prosecution of poachers and traffickers.
- *Public Awareness and Education:* Continue public awareness campaigns to educate the public about the importance of elephant conservation and the negative impacts of poaching and garner support to build an effective network against elephant crime.
- *Monitoring and Evaluation:* Establish a robust system for monitoring and evaluating the effectiveness of anti-poaching operations by using performance metrics to measure success and identify areas for improvement.

By sustained efforts and building a holistic and adaptive approach, it is possible to effectively combat poaching and protect elephants in the reserve over the long term.

3.7.3.6 Maintenance of Village level Crime Dossiers

Crime dossiers are a collection of all documents or information researched, collected, analysed, and systematically compiled for a specific purpose, such as a legal case or investigation. It may include various types of evidence, such as witness statements, photographs, and other relevant materials. Dossiers are often used in criminal investigations and legal proceedings to present information to a senior case supervising forest officer, prosecutor, court, or other judicial decision-making body. The information is kept separately for each village.

- The following documents are kept in the case file: (1) Personal file (dossier) of the offender; 2) Photograph; 3) Name, Father's name and address; 4) Aliases; 5) Personal descriptions, date of birth/ age, place of birth, sex, hair, colour of eyes, complexion, height, weight, built, citizenship, language spoken, identification marks; 6) Important personal information, telephone/ mobile phone number, e-mail address, passport number, bank account details, Aadhaar No./identity card; 7) Current/previous occupations and list of properties owned; 8) Associates/relatives and their occupations; 9) Crime history and brief cases of the wildlife, case(s) against him; 10) Crime modus operandi; 11) Area of his activities; 12) Victim and witness statement; 13) Medical and forensic reports; 14) Legal and investigative document; 15) Previous acquittals/convictions; 16) If declared proclaimed offender, details; 17) Any other remarks.

The Investigating officer has to undertake dossier analysis which includes, reviewing, evaluating, and interpreting the information and evidence contained in a dossier. The purpose of dossier analysis is to extract the most relevant and important information from the large amount of data that is collected and to use it to support the investigation or legal proceedings, especially inside the court.

A guide on how to establish and maintain such dossiers envisages:

- Create a structured and easily accessible reporting system for villagers to report any illegal activities related to the reserve and develop various reporting channels, including dedicated hotlines, community meetings, and online platforms.
- Appoint community liaison officers who may act as a bridge between the local communities and forest authorities and train them to communicate effectively, build trust, and collect detailed information on reported incidents.
- Develop a standardized protocol for documenting each reported incident, including the date, time, location, nature of the incident, and any evidence available and create incident report forms to have comprehensive documentation.
- Encourage the collection of photographic or video evidence wherever possible and provide training on basic documentation techniques and on preserving evidence.

- Utilize Geographic Information System (GIS) mapping to accurately record the location of each reported incident and map out hotspots to aid in resource allocation and strategic planning.
- Establish a secure database for storing crime dossiers, ensuring that sensitive information is protected and ensure strict confidentiality measures to protect the identity of those reporting incidents.
- Periodically analyse the collected data to identify patterns, trends, and emerging threats and use data insights to informed decision-making, resource allocation, and targeted interventions.
- Share relevant information from the crime dossiers with law enforcement agencies responsible for wildlife protection and collaborate closely with local police, and other enforcement agencies to facilitate investigations and legal actions.

By implementing a robust and participatory crime dossier system, we can enhance the early detection of illegal activities in elephant reserves, facilitate timely responses, and contribute to the overall conservation efforts in the region.

3.8 ELEPHANT HEALTH MONITORING, VETERINARY CARE AND CAPTIVE MANAGEMENT

Wildlife health monitoring is a system for continuously creating and analysing information on the health of the animal and associated risk factors, to meet the objectives of disease prevention, early pathogen detection, controlling or potentially eradicating disease in a population.

Wildlife health monitoring in an elephant reserve is essential for the early detection of diseases, identification of potential threats to the population, and the overall conservation of the ecosystem. The challenges of destruction and fragmentation of contiguous habitats may affect the health of elephants by the impacts on availability of food and water to meet nutritional requirements.

For the purpose of planning health monitoring strategies and also programs for their implementation, the population must be divided into free-range and captive elephants (which includes elephant camps, temples, privately owned animals and zoos).

3.8.1 Elephant Health Monitoring

Elephants are susceptible to several infectious diseases and it is necessary to monitor the etiology, mode of transmission and clinical signs and further make provisions for timely prevention and control.

Monitoring the health of elephants is a challenging task, requiring knowledge of biology, behaviour and physiology and needs a comprehensive approach combining physical examinations, behavioural observations, and technological innovations.

Broad objectives for the elephant health monitoring in an elephant reserve may envisage following:

- Establish a dedicated wildlife health unit comprising veterinarians, wildlife biologists, and trained field staff and equip the unit with the essential tools, medical supplies, and equipment for health assessments.
- Implement routine health checks for individual elephants, including physical examinations, blood tests, collect biological samples (blood, faeces, and tissues) and utilize trained veterinarians and experts for disease screening, genetic analysis and comprehensive health assessments.
- Establish disease surveillance programs to monitor and manage potential health threats to elephant populations and collaborate with veterinary authorities to prevent and control the spread of diseases.
- Use GPS collars to monitor the movement patterns and behaviour of elephants and track elephants in real-time to identify potential health issues or abnormal behaviour.
- Adopt technological innovations such as drones and camera traps to monitor elephant health and assess the condition of individuals from a distance and implement advanced imaging techniques for non-intrusive health assessments.
- Encourage public to report any sightings of injured or distressed elephants and create awareness about the importance of elephant health and the role of community in reporting concerns of the species.

- Monitor reproductive health, including the fertility and breeding success of elephant populations by collaborating with scientific/ research institute and implement programs to support the conservation of genetic diversity within elephant herds.
- Conduct behavioural studies to understand normal behaviours and identify signs of stress, trauma, or illness and also use technological innovations to observe elephants without causing disturbance.
- Conduct research on elephant health, including nutritional needs, disease susceptibility and impact of environmental factors and maintain a comprehensive database for monitoring.
- Develop an emergency response plan for health crises, including the availability of veterinary care, medications, and facilities for injured or sick elephants.
- Encourage public to report sightings of injured or distressed elephants and create awareness about the importance of elephant health and the role of the community in reporting concerns.
- Provide training for local communities, officials, and veterinarians on elephant health monitoring and emergency response and build local capacity for basic health assessments and reporting.
- Implement a robust data management system to store and analyse animal health data, systematically and employ data analytics tools to identify patterns, trends, and potential health risks in the elephants.
- Regularly review the effectiveness of the wildlife health monitoring program and adapt strategies based on lessons learned, emerging health threats, and advancements in technologies.
- Collaborate with neighbouring regions and countries for transboundary wildlife health monitoring, especially in the case of migratory elephant populations.

By implementing a comprehensive elephant health monitoring program, we can contribute to the overall well-being of elephants in the reserve, detect and mitigate health threats, and ensure the long-term conservation of the animal.

3.8.2 Veterinary surveillance and disease monitoring

The surveillance and monitoring of disease outbreaks in elephant populations are particularly relevant due to increasing human-elephant interaction. An efficient disease surveillance program requires early detection of diseases, some of which may have serious zoonotic and economic implications.

Diseases, when expressed in free-ranging animals, can have a significant effect on wildlife ecologies. Some diseases have dramatic epizootic outbreaks characterized by high morbidity and mortality. In addition, wild animals can be reservoirs of diseases, as well as other important diseases that infect domestic animals or humans. Consequently, active surveillance for known diseases amongst wildlife especially elephants, protects the habitat and domestic animal population.

Veterinary surveillance and disease monitoring are critical components of wildlife health monitoring, especially in an elephant reserve. Implementing an effective program in this context involves careful planning, collaboration, and utilization of various tools and strategies. Besides measures on wildlife health monitoring, establishing veterinary surveillance and disease monitoring in an ER also includes:

- *Formation of a Veterinary Unit:* Establish a dedicated veterinary unit within the elephant reserve and employ experienced wildlife veterinarians and support staff who are knowledgeable about the health of elephants and other wildlife in the reserve.
- *Disease Database and Reporting System:* Develop a centralized database for recording and managing health-related data, including disease occurrences, treatments, and monitoring results and implement a standardized reporting system for veterinarians to report any health issues.
- *Collection of Data and Samples:* Adequate sampling of both live and dead animal involves the collection of quantitative and qualitative data (biological data) about the animals, behaviour, clinical findings, pathology observations, etc. The collection of blood, as well as frozen and preserved tissues, and appropriately prepared microbiological samples from animals, will assist in the ongoing investigations to confirm the presence or absence of disease-causing agents.
- *Regular Health Checks:* Conduct routine health checks on the elephant population, including physical examinations, blood tests, and other non-invasive monitoring methods and develop a schedule for regular check-ups to monitor overall health status and detect potential issues.

Whenever a report of any disease or illness or deaths of free-ranging elephant population is received, a prompt intervention and investigation is essential.

- *Disease Surveillance and Monitoring:* Implement a comprehensive disease surveillance program to monitor the prevalence of diseases in elephants and use diagnostic tools, such as serological tests, to identify specific diseases and assess the overall health of the population.
- *Active surveillance program*: Collect a certain number of samples from a target population (either live and/or dead animals) to determine the point prevalence of certain pathogens using antigen or specific antibody techniques. Once an infectious pathogen has been identified, serological surveys supported by accurate species-specific tests are the most commonly used means to actively assess the extent of an infection within selected free-ranging populations.

By implementing a comprehensive veterinary surveillance and disease monitoring program, we can proactively address health issues in the elephant reserve, contribute to the conservation of the species, and protect the overall biodiversity of the ecosystem.

3.8.2.1 Veterinary facilities and Equipment

Veterinary facilities and tools are essential for dealing with the elephants in captivity or for ensuring the health and well-being of these animals. Captive elephant facilities typically have veterinary clinics or hospitals on-site or nearby manned by qualified veterinarians and support staff. These facilities are equipped with diagnostic tools, treatment areas, and surgery rooms to provide comprehensive medical care for elephants. Some key components include:

Restraint equipment: Elephant Restraint Device (ERD) restricts the elephant's movements while allowing handlers access for routine husbandry and medical care. Safe methods for immobilizing elephants during medical procedures, such as padded stocks or restraint chutes may be maintained.

Diagnostic Equipment & Services: Veterinary facilities may be equipped with diagnostic equipment such as X-ray machines, ultrasound scanners, blood analyzers, endoscopy equipment and thermography cameras. These tools help veterinarians assess the health status of elephants, diagnose illnesses, and monitor treatment. Diagnostic laboratory services include cytology, microbiology, parasitology, complete blood count, blood chemistry, urinalysis, serology and other appropriate laboratory procedures.

Necropsy and Disposal facility: Establishing a necropsy (post-mortem) and disposal facility is essential for proper management of deceased animals in both wild and captive settings. The necropsy facility entails on a dedicated space or building, equipment, sharp and blunt dissection tools, bone saws, scales, measuring tools, and containers for specimen collection with adequate safety measures, ventilation systems and refrigeration facilities. Depending on local regulations and circumstances, disposal options may include burial, cremation, or composting with due compliance with environmental regulations.

Sedation and Anaesthesia Equipment: Safe and effective sedation and anaesthesia equipment are essential for conducting medical procedures and surgeries. This includes specialized equipment for administering anaesthesia, monitoring vital signs, and ensuring safety of both the elephants and staff.

Surgical facilities: Surgical facilities must have access to appropriate surgical and anaesthetic equipment including injectable anaesthetics, reversal agents, inhalant anaesthetic agents and vaporisers, oxygen, sterilized surgical packs, surgical preparation solutions, intravenous fluids, fluid administration equipment, pulse oximetry, heart monitoring equipment (ECG), and emergency drugs. The facility must have adequate lighting, ventilation, and temperature controls, and can be easily cleaned and disinfected.

Medications and Pharmaceuticals: Veterinary facilities should maintain a supply of medications and pharmaceuticals specifically formulated for elephants. These may include antibiotics, anti-parasitic drugs, pain relievers, and other medications. Besides, pharmaceutical storage for routinely used drugs, such as emergency resuscitative medications, antibiotics, anthelmintics, fluids, anaesthetics, analgesics, and tranquillizers, a safe for narcotics that meets the standards may be maintained.

Weighing Scale: Each elephant facility should acquire a scale to routinely weigh the elephants to attain accurate weights, monitor growth, and provide a precise means of dosing medications.

Transportation Equipment: Captive elephant facilities need specialized transportation equipment for safely moving elephants between enclosures, veterinary clinics, and other locations. This may include transport trailers, crates, or specialized vehicles equipped with hydraulic lifts or ramps.

Specialised Orphan Care facility: Establishing an orphan care facility for elephant calves is crucial for the welfare and survival of orphaned elephants. It may include specially designed enclosure with

appropriate fencing or barriers; facilities for preparing specialized milk formula and feeding stations or bottles for feeding calves at regular intervals along with feeding supplements (hay, grass, or browse); veterinary care; and enrichment items and socialization areas. The facility may also have experienced elephant caregivers providing round-the-clock care, including feeding, cleaning, and monitoring the health and behaviour of the calves besides engaging behavioural specialists for assessing the emotional well-being of the calves and implementing appropriate behavioral management strategies.

Quarantine facility: Establishing a quarantine facility for elephants is essential for managing the health and well-being of newly acquired, sick, or potentially infectious elephants, whether they are in captive settings, or being translocated in conservation efforts. The key components of a quarantine facility include designated quarantine area with sturdy fencing; written quarantine protocols outlining procedures for admitting, monitoring, and caring including health assessments, quarantine duration and biosecurity measures; equipment like shelters or barns providing protection from the elements, secure feeding and watering stations to ensure proper nutrition and hydration, bedding materials or substrates suitable for elephants' comfort and hygiene and facilities for bathing and cleaning elephants as needed; socialization and enrichment through opportunities for social interaction and enrichment activities; and quarantine release criteria based on health assessments and veterinary recommendations.

Foot and Hoof Care Tools: Proper foot and hoof care are essential for elephant health, especially in captive environments where elephants may not have access to natural terrain for wearing down their hooves. Veterinary facilities should have tools for trimming and maintaining elephant hooves, such as hoof knives, rasps, and foot-care products.

Dental Care Equipment: Dental health is critical for elephants, and veterinary facilities should be equipped with tools for routine dental exams, cleaning, and treatment of dental issues. This may include dental picks, mirrors, drills, and specialized instruments for performing dental procedures on elephants.

Emergency Response Equipment: In the event of emergencies such as injuries or medical crises, veterinary facilities may have emergency response equipment on hand. This may include first aid supplies, intravenous fluids, oxygen therapy equipment, and emergency transport units.

Training and Enrichment Tools: Training and enrichment are important for maintaining the physical and mental well-being of captive elephants. Veterinary facilities may have tools for conducting positive reinforcement training sessions, as well as enrichment items such as puzzle feeders, toys, and environmental enrichment structures.

Monitoring and Record-Keeping Systems: Software or systems for managing and documenting elephant health information and monitoring devices in the form of cameras and sensors for tracking vital signs, elephant behaviour, and activity levels may be maintained.

By providing comprehensive veterinary facilities and tools, captive elephant facilities can ensure that elephants receive the medical care, attention, and support they need to thrive in captivity. If the Elephant Reserve does not have an on-site veterinary facility or has only a partially outfitted veterinary facility, then it may have a working relationship with the nearby veterinary laboratories or institutes.

3.8.3 Captive Elephant Management

The elephant has served man in times of war and assisted in economic activities relating to Forestry operations, patrolling, eco-tourism and Zoo exhibits. The elephant has been an integral part of Indian culture, history and religious beliefs since time immemorial and is revered.

Free-ranging wild elephants are found in 17 states while captive elephants are found in 26 states and union territories. The number of captive elephants' number is about 2675, distributed both in non-range states as well as range states; the majority found in the north-eastern (41%) and southern (26%) states. In the northeast, they are found in larger number in the states of Assam (n=905) and Arunachal Pradesh (n=109). In South India, captive elephants are majorly found in Kerala (n=518), Karnataka (n=184) and in Tamil Nadu (n=138). The adult male-to-female ratio of elephants in captivity in India is estimated to be 1:1.2, implying that a greater number of females are present in captivity than males probably due to the reason that the females are comparatively easier to handle in comparison to adult males/tuskers.

A large fraction of captive elephants in India are under temple and private ownership (63%) with lesser numbers under control of forest department (28%). The Wildlife (Protection) Act mandates suitable upkeep and maintenance as a prerequisite for issuing ownership certificates.

The Central Government has issued guidelines for care and management of captive elephants in the country in 2008. These guidelines have laid down norms for transportation, housing, feed, veterinary care and other norms for the care and management of captive elephants in the country. The Gajah

Report published in 2010 has laid down elaborate recommendations for improving the management of captive elephants in India. MoEF&CC has embarked on the creation of a central repository of a genetic database with individual-level genetic data and pictures of the captive elephants. Subsequently, Central Government has also framed new rules regarding transfer and translocation of captive elephants vide Captive Elephant (Transfer or Transport) Rules, 2024 including genetic profiling of the captive elephants.

Proper management is essential to ensure the physical and mental health of the captive elephants. Key considerations for effective captive elephant management envisages:

- *Habitat and Enclosure Design:* Create spacious and enriched enclosures that mimic the elephants' natural habitat as closely as possible and provide a variety of substrates, including sand, soil, and grass, to support natural behaviours (like dust bathing).
- *Diet and Nutrition:* Develop a nutrition plan in consultation with veterinarians to meet the specific dietary requirements of each elephant and ensure access to fresh water, a balanced diet, and opportunities for foraging to encourage natural behaviours.
- *Healthcare and Veterinary Care:* Establish a regular healthcare routine, including routine health checks, vaccinations, and parasite control by engaging a qualified veterinarian on-site or on-call to address any health issues promptly.
- *Enrichment Activities:* Provide a variety of enrichment activities to stimulate physical and mental well-being and envisage items and structures that encourage exercise and problem-solving.
- *Social Structure:* House elephants in social groups that mimic natural family structures and monitor social dynamics and provide opportunities for positive social interactions.
- *Training and Behavioural Management:* Implement positive reinforcement training techniques to facilitate husbandry tasks and medical procedures and encourage mentally stimulating activities to prevent stereotypic behaviours.
- *Environmental Enrichment:* Incorporate elements like pools, mud wallows, and natural features to encourage natural behaviours and interchange and vary environmental features periodically to keep the environment stimulating.
- *Training for Cooperative Care:* Train elephants to participate in their own care, such as presenting body parts for inspection and allowing medical procedures without stress and foster a positive relationship between caregivers and elephants through trust-building exercises.
- *Visitor Education and Interaction:* Develop educational programs for visitors to promote awareness about elephant conservation and welfare and avoid direct interactions between visitors and elephants to ensure the safety of both.
- *Record Keeping:* Maintain detailed records of each elephant's health, behaviour, and interactions and use these records for ongoing assessment, and continuous improvement in management practices.
- *Regulatory Compliance:* Adhere to the relevant regulations and guidelines related to captive elephant management and work closely with relevant authorities and organizations to ensure compliance.
- *Collaboration and Research:* Collaborate with conservation organizations, research institutions, and other captive facilities to share best practices and contribute to scientific understanding and involve in research projects that focus on captive elephant welfare and management.
- *Rescue and Rehabilitation:* Collaborate with organizations involved in the rescue and rehabilitation of elephants from abusive or unsustainable conditions and ensure proper integration and care for rescued elephants.
- *Retirement Planning:* Develop retirement plans for old elephants, considering their age and changing health needs and provide them with a comfortable and peaceful environment.
- *Continuous Improvement:* Regularly review and assess captive elephant management practices and seek feedback from experts, staff, and stakeholders to identify areas for improvement and implement changes accordingly.

Captive elephant management requires a holistic and ethical approach, prioritizing the physical and mental well-being of the animals while promoting conservation and education efforts.

3.8.3.1 Elephants under the control of Govt Department

There are about 2675 captive elephants in the country of which 28% are in the custody of the Forest department housed in elephant camps, rescue and rehabilitation centres and in zoos.

- The welfare of camp elephants is the main priority of the Forest department and this is ensured by the presence of conspecifics, natural physical environments such as river/water-bodies/ forest cover, and veterinary intervention. The department provides housing, upkeep, maintenance and health care as per the Project Elephant guidelines.
- The camp elephants are almost in free-ranging condition; have the opportunity to interact with the other camp elephants, bathe in rivers and streams and breed with both camp and wild elephants; for exercise walk 5-7 km per day, bring fodder from the forest and are provided nutrition as per the diet chart. The elephants are either chained in the night or free range in adjoining forests, forage in the forest and also stall fed with a prescribed diet in the camp.
- The camp elephants are mostly born in captivity or caught/rescued from the wild and very few are seized for offences and kept in camps.
- Nowadays, with forestry logging/ timber operations being restricted, the captive elephants are underutilized having a minimum work load.
- The camp elephants under government control may be used for wildlife conservation activities, such as patrolling vulnerable areas; in elephant rides; monitoring wildlife, participating in anti-poaching efforts; forestry operations, such as timber extraction, habitat restoration, removal of weeds etc; managing human-wildlife conflicts, translocation and rescue operations, participating in koomkie operations; and ecotourism related activities, such as elephant safaris.
- The camp elephants may be provided with necessary training by the Forest department, and training may include commands for handling, transporting, and performing specific tasks.
- The camp elephants are observed for any behavioural symptoms of illness and disease and regularly screened for diseases; the common ailments are related to eye, foot, or leg problems, formation of abscesses, and other medical problems (anaemia, gastric / urinary / respiratory problems, worms and wounds); including welfare, and overall well-being of camp elephants.
- The government has specific rules and guidelines related to the management of captive elephants, known as the "Captive Elephant Management Guidelines 2008 and Captive Elephant (Transfer or Transport) Rules, 2024." These rules address issues such as registration, ownership, care, and transportation of captive elephants.

It's important to note that the management of elephants in government control must adhere to ethical and humane standards, prioritizing the well-being of the elephants.

3.8.3.2 Temple and Private Elephants

Elephants hold significant cultural and religious importance in various regions of India and are often associated with religious ceremonies, festivals, and processions. Temples keep elephants as part of their religious practices and private individuals may own elephants for various reasons. Both temple and privately owned elephants are often used in ceremonial functions, such as religious processions, weddings, and other cultural events. In some cases, private individuals may use elephants for tourism-related activities, however, concerns related to the ethical treatment and welfare have been raised.

Certain key aspects related to temple and private elephants are:

- In few temples, elephants can freely range in the temple forest- the sacred grooves. Generally, female elephants are kept in the temples as males would be uncontrollable during musth and a threat to the security of staff and pilgrims. The reduction and loss of the temple forest reduced space for the exercise of animals and also temples were not able to generate collections/ revenue and started the practice of blessing devotees to collect money and food offered by devotees.
- The welfare of elephants was compromised by keeping them in very small, closed spaces with inadequate light and ventilation. There was laxity in maintaining sanitation and hygiene, adequate nutrition and health care. The cemented floors in the elephant house and long walks on tar or metal roads cause foot problems, that are difficult to heal.
- The drawbacks in the management of captive temple elephants are the lack of proper housing with animals kept in open without shelter and in closed spaces, lack of access to rivers and streams, use of tap/tank water for drinking and bathing, lack of exercise due to non-availability of walking space, stress due to long working hours by standing to greet pilgrims, interaction with conspecifics is lacking, mostly stall fed and inadequate veterinary health care.

- The ownership and management of elephants, whether in temples or privately, are subject to regulations outlined in the Wildlife Protection Act, 1972, under specific provision related to the ownership and the management of captive elephants. Also, the "Captive Elephant Management Guidelines 2008 and Captive Elephant (Transfer or Transport) Rules, 2024" provide guidelines for the registration, ownership, care, and treatment of captive elephants. These rules aim to ensure the welfare and ethical treatment of elephants in captivity.
- The treatment and living conditions of temple and private elephants have been a subject of concern, with issues related to proper care, nutrition, housing, and medical attention being raised by animal welfare activists. Efforts have been made to raise awareness about the conservation and welfare of elephants and conservation organizations and animal welfare groups advocate for responsible practices in the treatment of temple and private elephants.
- In cases where elephants are found to be in distress or subjected to poor conditions, efforts may be made by government authorities and animal welfare organizations to rescue and rehabilitate these elephants. Legal action may be taken against the individuals or institutions found to be violating animal welfare laws which may include confiscation of elephants and legal penalties.

Balancing cultural and religious practices with ethical treatment and welfare considerations is a complex challenge. It requires collaboration between religious institutions, private owners, government authorities, and animal welfare organizations.

3.8.4 One Health Approach

'One Health' is an interdisciplinary approach that recognizes the interconnectedness of human health, animal health, and environmental health.

- It emphasizes collaboration across multiple sectors, including human medicine, veterinary medicine, environmental science, public health, and others, to address complex health challenges that arise at the interface of humans, animals, and their shared environments.
- The One Health approach promotes holistic solutions to prevent and control diseases, protect biodiversity and ecosystems, ensure food safety and security, address environmental degradation, and promote the well-being of both human and animal populations.
- By considering the health of humans, animals, and ecosystems as interconnected and interdependent, One Health seeks to achieve sustainable health outcomes for all.

A 'zoonosis' is an infectious disease that can be transmitted between animals and humans. More than 200 zoonoses range widely across different pathogen classes, including bacteria, viruses, fungi, parasites, and prions and they may be transmitted through direct contact with infected animals, consumption of contaminated food or water, inhalation of airborne particles, or through vectors such as mosquitoes or ticks. Zoonoses can pose significant public health risks, as they have the potential to cause outbreaks or pandemics in human populations.

Understanding/ controlling zoonotic diseases is important for protecting both human and animal health.

- Situations where humans and elephants come in contact include interface areas, tourism, animal care etc and the interaction could be observational, low-level interactive, and/or high-level interactive events with varied emphasis.
- Animal welfare, public health, and safety, as well as species conservation, are the main concerns and are closely linked to both direct and indirect interactions based around elephants.
- Some elephant-to-human zoonoses, including tuberculosis, Anthrax, Leptospirosis, Elephant Pox Virus and other transmissible infectious pathogens, pose a prospective risk to public health.
- Reverse human zoonoses, or infections that can spread from humans-to-elephants, such as tuberculosis can also afflict elephants.
- The infections can have varied degrees of morbidity and mortality, affecting both humans and elephants.
- Elephant abuse and the spread of diseases connected with elephants-to-humans (which might be made worse by stress-induced immunosuppression) can cause psycho-behavioural harm to the animals, which could then have an impact on public health and safety.

- Elephants that get subpar care, may pose greater dangers to public health and safety through a somewhat cyclical web of causes and effects.

These consequences highlight the significance of the one health paradigm, which takes into account the interdependence of people, animals, and the environment. This transitions into the paradigm of 'one welfare' which considers the relationship between animal welfare, human well-being, and the physical and social environment meaning that the health and welfare dynamics of the elephant-human relationship are largely inseparable and may impact both people and the animals and poor health is associated with increased risk of pathogen shedding.

'One health' approach is the inter-sectoral coordinated approach involving all relevant sectors (medical, veterinary and forest department) with 'One health vision' for effective surveillance, prevention and control of existing zoonotic diseases and newly evolving zoonotic threats in human beings. Since several emerging diseases have animals as reservoirs, hence, disease surveillance in animals has the added advantage of protecting humankind through early detection, prevention and control of zoonotic diseases.

3.9 SUSTAINABLE WASTE MANAGEMENT & SAFE SANITATION AROUND ELEPHANT HABITAT

'Garbage' is known to attract elephants, and when garbage dumps are on the periphery or inside a village/town they create potential for accidental encounters between humans and elephants. In several rural/urban areas near forests, garbage is collected by the gram-sabha/municipality, and is placed in open garbage dumps, located near elephant reserves, attracting elephants.

Unmanaged garbage may also habituate elephants to move and forage in human-use areas, and as a consequence, there may be high levels of conflict; vegetable and food waste generated in weekly rural markets and garbage thrown along roads and railway lines passing through forests, attracts elephants.

With a large number of humans moving around on foot or two-wheelers, particularly in the evening, and elephants also moving into the same area in the evening, accidental encounters happen; encounters also happen when humans go into the forest for defecation, especially at dawn/ dusk.

In few instances, elephants feeding on garbage die by ingesting polythene and are also susceptible to food poisoning. The garbage containing food waste is often tightly sealed inside polythene bags, the food is putrefied, the bacteria create toxic substances causing the deaths of garbage-eating elephants.

Sanitation systems in rural India are inadequate; people in rural and semi-rural areas practice open defecation and faecal waste in open areas contaminate the environment. The health risks associated with infected human excreta contains a variety of microbes which include pathogenic viruses and infectious virions, bacterial pathogens, protozoan cysts and helminth eggs. Lack of sanitation facilities (toilets) drives village communities close to forests and are vulnerable to attack by elephants.

Certain strategies for achieving sustainable waste management and safe sanitation in and around elephant habitats are:

- Ensure sustainable and ecologically sound waste- and garbage disposal by town municipalities and village panchayats bordering elephant habitats.
- Undertake periodic inspection of the forest perimeter near villages/towns to ensure that poor disposal of waste and garbage is detected early and brought to the notice of relevant authorities.
- Identify sites and collect evidence on the elephants visiting dump sites and take remedial measures like securing garbage dumps by constructing walls and driving the animals away.
- Aversion conditioning measures may be implemented, in areas where elephants have started foraging inside the boundary of villages and have grown accustomed to feeding on garbage.
- Community awareness including signages etc may be implemented to facilitate effective participation from local communities in garbage management.
- SFDs may also coordinate with municipalities/ panchayats on garbage management and explore the possibility of building toilets under the Swachh Bharat Mission to prevent accidental encounters at HEC hotspots.
- Briefing forest user groups, and workers of tea and coffee plantations before every work season about elephant risk and safety issues.

- Create awareness amongst communities and there is a need to extend awareness programmes for the development agencies, railways, power, irrigation, highways, mining companies, tourism industry, district administration, etc.
- Plan and implement training programs and extension measures with school and college students, engage with women's self-help groups, Village Forest Committees (VFCs), Eco-development Committees (EDCs), Large Area Multipurpose Society (LAMPs), forest user groups, etc.
- Promote waste reduction by encouraging the use of reusable items and minimizing single-use plastics and implement waste segregation at the source. Establish waste collection programs around elephant habitats and encourage establishment of recycling facilities, to process locally.
- Encourage composting of organic waste to reduce the volume of waste going to landfills and provide training and resources for communities to set up and maintain composting systems. Promote the use of biodegradable products to reduce the environmental impact of waste and work with local enterprises to encourage the adoption of eco-friendly packaging and products.
- Ensure the availability of proper waste disposal facilities, including designated landfills and waste treatment plants and monitor and regulate waste disposal practices to prevent illegal dumping.
- Improve sanitation infrastructure by constructing and maintaining clean and accessible public toilets and ensure the proper treatment of sewage to prevent contamination of water sources.
- Introduce incentive programs to encourage communities to actively participate in sustainable waste management practices and recognize and reward individuals or communities that excel in waste reduction and proper disposal.
- Provide training to local communities on waste management techniques, sanitation practices, and the importance of maintaining a clean environment and empower community members to take leadership roles in waste management initiatives.
- Promote responsible tourism practices, including waste reduction and proper waste disposal by visitors to the area and integrate waste management education into tourism programs.

By implementing these strategies, it is possible to create a sustainable waste management system and safe sanitation practices that benefit both the environment and the well-being of elephants.

3.10 INVOLVEMENT OF STAKEHOLDERS, SECTORAL COORDINATION, AWARENESS CREATION AND FORGING PARTNERSHIPS

The key stakeholders in the Elephant reserve landscape are the Forest department; Line departments such as District Administration, Police, Agriculture, Industries, Transport, Electricity etc; other agencies like Railways, NHAI, Fire Services, Disaster Management; along with Panchayats, Village Forest Committees, Self-Help Groups, Farmers, Educational Institutions and Media besides local communities.

The involvement of various stakeholders in the protection of the Elephant Reserve requires the existence of a coordination and collaboration mechanism. There is a need for standing orders and instructions in the form of guidelines for mutual cooperation and assistance, whenever required.

To facilitate effective engagement of local communities and various stakeholders in the protection of Elephant reserves, it is extremely important to plan and implement awareness and sensitization measures, taking a participatory approach.

In the management of elephant reserves, involving various stakeholders, fostering sectoral coordination, and creating awareness are crucial aspects for sustainable conservation efforts. Approach on how to effectively address these issues, envisage:

Involvement of Stakeholders:

- Involve local communities living around the elephant reserve in decision-making processes and foster a sense of responsibility for the conservation of elephants.
- Integrate indigenous knowledge about elephants into conservation strategies and collaborate with local communities to blend traditional practices with modern conservation approaches.
- Partner with NGOs and conservation groups to leverage expertise, resources, and community outreach and collaborate on conservation projects and initiatives.

- Coordinate with relevant government agencies and local authorities for ensuring alignment with national and regional conservation policies and strategies.
- Engage with the private sector, especially businesses operating in or around the reserve and encourage for corporate social responsibility (CSR) initiatives, supporting elephant conservation.
- Collaborate with the tourism industry to promote sustainable tourism practices and educate tour operators, guides, and visitors about the significance of minimizing habitat disturbance.
- Collaborate with research institutions for scientific studies on elephant behaviour, ecology, and habitat dynamics and use research findings in conservation strategies.

Sectoral Coordination:

- Facilitate collaboration among various government agencies, including law enforcement agencies and jointly plan and execute conservation activities. Use of digital communication apps (such as WhatsApp group) may be employed to share information.
- If the elephant reserve spans multiple regions, establish cross-border collaborations and share information and best practices with neighbouring jurisdictions.
- Promote coordination between local communities and industries operating in or near the elephant reserve and develop modalities balancing conservation with sustainable development.
- Establish mechanisms for information sharing among stakeholders and integrate data from various sources to enhance the overall understanding of the reserve.
- Develop coordinated emergency response plans for HEC situations, natural disasters, or disease outbreaks and conduct joint drills and exercises to enhance preparedness.

Awareness Creation:

- Conduct regular awareness programs within local communities about the importance of elephant conservation and emphasize the ecological significance and their role in maintaining biodiversity.
- Integrate wildlife conservation and elephant awareness into the school curriculum and organize nature camps and educational events to connect students with nature.
- Work with media outlets to disseminate information about elephant conservation and highlight success stories, challenges, and ongoing conservation efforts through various media channels.
- Utilize social media platforms to reach a wider audience and share updates, success stories, and elicit calls for community involvement.
- Organize public events, festivals, or celebrations that focus on elephant conservation and use these occasions to create awareness.
- Partner with celebrities who can amplify the message of elephant conservation and leverage their reach to promote awareness and garner support for the reserve.
- Send regular newsletters to stakeholders and include success stories, and upcoming initiatives.
- Organize workshops and seminars that involve communities, experts, and stakeholders and provide a platform for discussions, knowledge sharing, and collaborative problem-solving.

By actively involving stakeholders, fostering sectoral coordination, and creating widespread awareness, elephant reserves can benefit from a collaborative and informed approach to conservation, ensuring the long-term well-being of the reserve.

3.10.1 Convergence of cogent programmes, clouts and skills

The convergence of cogent programs, clouts, and skills in an elephant reserve is essential for effective conservation and sustainable management. By integrating well-designed programs, leveraging influence (clouts), and deploying a range of skills, conservation efforts can address various challenges and promote the coexistence of elephants and other species with local communities.

Certain potential areas where these elements can come together include:

- community engagement and education; spatial planning and land-use management; conservation incentives and livelihood programs; human-elephant conflict mitigation; infrastructure planning and conservation-friendly development; law enforcement and regulation; research and data analysis; and monitoring and adaptive management;

Collaboration among diverse stakeholders and the application of various skills are critical for achieving success in such complex conservation endeavours.

3.10.2 Addressing gaps in understanding linkages between actions and their impacts

Addressing gaps in understanding linkages between actions and their impacts in an elephant reserve is crucial for effective conservation and management. It requires a comprehensive approach that involves research, monitoring, community engagement, and adaptive management.

- The key strategies to address these gaps envisages: research and data collection; monitoring and evaluation; stakeholder engagement; community-based participatory research; social impact assessments; economic analyses; scenario planning; capacity building; feedback mechanism; adaptive management; and communication & outreach.

By integrating these strategies, conservation efforts in the elephant reserve can bridge gaps in understanding, leading to more informed decision-making and improved conservation outcomes.

3.10.3 Seeking coordination through the existing structures

Coordinating conservation efforts in an elephant reserve involves leveraging existing structures, engaging stakeholders, and collaborating among various organizations and communities. Steps to seek coordination through existing structures include:

- Identifying key stakeholders involved in elephant conservation within the reserve which may include government agencies, NGOs, local communities, research institutions etc.
- Creating a coordination forum or committee that brings together different stakeholders, which could serve as a platform for communication, collaboration, and decision-making.
- Review and utilize existing conservation/ management/ working plans for the elephant reserve and align conservation strategies with established plans and policies to ensure coherence and effectiveness.

This collaborative effort is essential for addressing complex challenges and ensuring the long-term well-being of both elephants and the surrounding ecosystem.

3.10.4 Sharing knowledge, technology, awareness and participation

Sharing knowledge, technology, awareness, and encouraging participation are essential components for successful conservation initiatives in an ER. Implementing these elements promotes a collaborative and informed approach that involves various stakeholders, from local communities to governmental bodies.

- Facilitation of these aspects can be achieved by establishing a ‘knowledge hub’ for the purposes of sharing information and knowledge by creating a centralized platform to share relevant research findings, conservation strategies, and best practices.
- Technology transfer can be achieved by utilizing Mobile Apps and GIS technology to monitor and track elephant movements, habitat changes, and human activities.
- Awareness campaigns may be carried out to educate local communities, schools, and the general public about the importance of elephant conservation by use of multiple communication channels and social media.
- Community participation may be elicited by creating community forums or committees where residents can actively participate in decision-making processes related to conservation initiatives.
- Cross-sectoral collaboration may be elicited by engaging with other sectors beyond wildlife conservation, such as agriculture, tourism, and infrastructure, to develop integrated and sustainable land-use practices.

By integrating these strategies, conservation initiatives in the elephant reserve can create a collaborative and inclusive framework.

Chapter-4
Human Elephant Conflict (HEC) and Planning Mitigation Strategy

4.1 SPECIFIC CONDITIONS OF CONFLICT AND OPERATIONAL REQUIREMENTS

Human Elephant Conflict (HEC) refers to the negative interaction between humans and elephant, leading to adverse impacts such as injury or loss of human lives, crop, livestock and other properties, or even their emotional well-being, and equally negative impacts on elephant and or its habitat.

The intensity of HEC is highly flexible ranging from very occasional to chronic and depends on the density of elephant populations; nature of the interface between human areas and elephant habitat; irregular and diffuse boundary with a long perimeter; highly fragmented elephant habitat interspersed with human use areas; dispersing herds; railway tracks passing through forests with large elephant populations etc.

HEC can be effectively addressed by understanding the type of conflict, the site of occurrence, and its overall impact on humans and elephants. HEC can be addressed in three broad zone categories, each of which requires different mitigation methods, with some overlap:

- *Elephant Conservation Zone* (occurring inside the forest): envisages habitat management, minimizing forest use, capacity development etc.
- *Elephant Human Co-existence Zone* (occurring at the interface): envisages early warning system, deployment of RRT / PRT, capacity development, barriers and deterrents etc
- *Elephant Human Management Zone* (occurring deep inside human use areas): envisages capture and translocation, release and rehabilitation, capacity development etc.

4.2 APPROACHES IN CONFLICT IDENTIFICATION

4.2.1 Identification of animal/s in conflict

Identification of individual or group of elephants-in-conflict, to be characterized into casual (opportunistic) or repeated (obligatory) crop foraging individuals/groups, may result from elephants with their natural movement adjoining the periphery of the forest, or elephants which exclusively move within the crop lands due to the attractions, resulting in their localization. The following steps may be taken for identifying the elephant, that causes conflict:

- Movement area of the elephant in conflict may be demarcated or mapped.
- Follow the track marks and other distinct signs to confirm the presence and absence of elephants.
- Examine all conflict-related incidents within the region.
- Deploy a number of cameras at strategic locations depending on their predictable movement.
- Investigate the camera trap database, if available, and identify the individual based on the distinct morphological features.

4.2.2 Identifying conflict hotspots

"HEC hotspots" are areas with actual or predicted repeated occurrence of HEC incidents resulting in crop-loss, livestock death, human death and injury, elephant death and injury over temporal and

spatial scales. It can be static (repeated in the same place or time) or dynamic (shift in space and time over the years). In addition, the magnitude of the incidents is subjected to interpolation or extrapolation techniques to define the hotspots in space and time.

Identifying conflict hotspots that could also provide a direction towards the drivers of conflict, is critical to provide site-specific solutions to mitigate human-elephant conflict. Conflict hotspots of HEC can be mapped through geo-spatial assessments, by using both primary data and secondary data including time-series data. The hotspots can be identified and mapped as follows:

a. *Incident hotspot:* Frequency of occurrence of incidences over past specific years such as previous five or ten years, mapped over the target area. The data include number of incident of injury and death, attack/ killing of domestic animals.

b. *Vulnerability Hotspot:* Cumulative index by overlaying past incidents, vulnerability of local community and potential risk of the area.

As recommended in the National Wildlife Action Plan (2017-31), database needs to be created on frequencies of conflict, quantum of damage to crop and property, human and elephant deaths by involving frontline SFD staff, researchers, research institutions, veterinary professionals and others for the identification and assessment of the hotspot.

- Predictive modelling based on the field data and Geographic Information System (GIS) analysis, may be carried out by trained personnel.

4.3 ESTABLISHING SYNERGISTIC MITIGATION STRATEGY

4.3.1 Early warning and rapid response system at conflict hotspots

Since it is inevitable to prevent the wildlife and humans from using the same space in many situations, early warning systems and rapid response teams are important for timely action to prevent the conflicts and to reduce the impacts due to such incidents.

- A system of “Early Warning and Rapid Response (EWRR)” may be established to enhance the overall efficiency of mitigation efforts in the field.

EWRR is a set of tools, processes and personnel competencies needed for the timely and meaningful generation and dissemination of alert information to individuals, communities and establishments at risk, for optimal preparedness and response and at the appropriate time to reduce the likelihood of injury, death or crop damage.

EWRR would structurally include an HEC Mitigation Hub/ Control Room, and a system of three-tiered response teams, viz, Division-level Rapid Response teams (Division RRT), range-level Rapid Response Teams (Range RRT) and village/ward level Primary Response Teams of community (Community PRT).

EWRR system for addressing HEC can specifically include:

- Significant inputs from local and traditional methods and practices such as, look out machans; and modern technological tools such as trip alarm system, Un-manned Aerial Vehicles (drones), thermal imaging, camera traps, geophones, radio collars etc to receive early warning.
- Public announcements, bulk SMS, WhatsApp group, local radio and tv channels, and LED display messages to disseminate the information.
- Adequate warning to be given out in areas of regular movement of elephants, for avoiding disturbance or encounters or erection of any sort of illegal electric fence leading to electrocution.
- Conventional methods of response such as beating drums, or siren to drive the elephants away by the community- PRTs.

As HEC can cut across multiple divisions at the landscape level covering State / International boundaries, hence it would be useful to establish coordination with the adjoining regions.

4.3.2 Monitoring elephant behaviour and movement at the hotspot

Studying the differences in ranging behaviour and habitat use of elephants that are in conflict / non-conflict, will help to identify drivers and pressures. The following measures are envisaged:

- Studies on the behavioural ecology of elephants must be encouraged to get good baseline data on elephants in better habitat so that comparison can be made to poorer quality habitats.
- Documenting seasonality of elephant movement including elephants present in an area at certain season.
- Monitoring to be done by keeping track of individually identified elephants and by use of technology (radio-collars and camera traps).
- Building identification profiles of conflict elephants and non-conflict elephants for identifying and differentiating, individual or groups which are in conflict and their area of operation.

4.3.3 Evolving integrated mitigation strategy for elephant/s in conflict

Male elephants in particular are prone to higher levels of conflict and some of them become habituated to humans and the different methods they use to protect crop.

The following measures are envisaged:

- Develop a database of identified individual and known herds of elephants, their movement pattern within human-dominated landscapes, and the conflict that is thereby generated; this will help identify aggressive and individual elephants with high potential for conflict.
- Test aversion conditioning to train habituated males who have the ability to breach barriers to avoid human use areas through radio collaring of such males for systematic intervention.
- Necessary capture, translocation (if required) to be carried out as per the Guidelines and OP with related monitoring protocols.

There are three key elements in most conflict situations: the elephant, humans (settlement) and the attractant for the elephant (such a palatable crop). Sometimes removal of one of these elements in the conflict is required to resolve an intractable situation.

A- Dealing with high conflict elephant/s

- Translocation is one of the tools available for addressing high conflict individual or even pocketed populations. Animals which are captured may be rehabilitated in a suitable habitat or to be brought into captivity depending upon the situation.
- When settlements inside the forests face very severe HEC and also have other problems based on the remoteness of their location, they may be willing to be resettled outside the forest in order to avoid HEC and to have access to a better livelihood and living conditions. In such situations, voluntary resettlement, as per the MoEF&CC guidelines may be facilitated.

B- Selection of non-palatable crops

- Identification of non-palatable crops by the farmers / agriculture department with due consideration to their socio-economic-cultural aspects
- The low economic return from non-palatable crop needs to be considered by assured pricing mechanism, value addition and marketing linkages.

4.3.4 Establish anti-depredation squads and patrolling

Anti-depredation squads (ADS) are small groups of local community members also referred to as Primary response teams (PRT) comprising of villagers who voluntarily cooperate and assist the

Forest department in the mitigation of conflict. The ADS are part of a community-based protection system, that can promptly reach the hot spot and site of conflict and assure the community that no harm will come to them till the Rapid response team (RRT) of the Forest department reaches the site of conflict.

The duties of ADS include: monitoring the movement of strayed elephants close to their village and providing information on HEC incidents; driving elephants trying to breach barriers into the forest; prevent elephants from raiding agricultural crops and causing property damage; and prevent retaliatory action against the elephant from agitated community members.

Creating an anti-depredation squad for driving elephants away from human settlements and protecting both elephants and people requires a coordinated effort involving various stakeholders. Following measures could be envisaged:

- Conduct a thorough assessment of the human-elephant conflict in the area and identify specific locations where conflicts occur frequently and establish the reasons behind elephant depredation into human settlements and villages.
- Establish collaboration with local communities, NGOs, and other governmental agencies and involve all stakeholders in the anti-depredation operation.
- Conduct awareness programs to educate local communities about elephant behaviour, and encourage community members to report elephant sightings promptly.
- Train personnel who will be part of the anti-depredation squad. This may include local community members, frontline staff, anti-depredation watchers and enforcement officers. The squad needs to be provided with equipment such as vehicles, communication tools, and non-lethal deterrents.
- Develop curriculum for training with inputs on elephant biology, behaviour and movement in their traditional migratory paths including dispersal. Training on the manner of driving elephants, protecting crops, safety measures, first aid and evacuating injured persons is also to be imparted.
- Implement early warning systems using technology like camera traps, sensor networks, or drone surveillance to detect elephant movement in advance, which allows for timely response.
- Equip the squad with non-lethal deterrents, such as bright lights/ torch, loud sounds/ siren, or specific aromas that discourage elephants from approaching human settlements. These methods also aim to drive elephants away without causing any harm.
- Develop a clear and efficient deployment of the anti-depredation measures for situations where elephants are in close proximity to human settlements. This may involve coordinated efforts with local authorities and experts.
- Establish a system for data collection on elephant movements, behaviours, and the effectiveness of the anti-depredation measures and monitor and evaluate the success of the interventions.
- Ensure that the anti-depredation squad operates within the legal framework, obtaining necessary permissions and adhering to wildlife conservation laws.
- Invest in ongoing research to better understand the local elephant population, their habits, and migration patterns and use the data to adapt and improve anti-depredation strategies.

Successful anti-depredation efforts require a combination of proactive measures, community involvement, and adaptive management strategies.

4.3.5 Managing straying and dispersing elephants outside the habitat

Elephants which have strayed out of the forest and have been driven back to their natural habitat and also elephants which colonize new areas, pose a very significant challenge to the managers. The following measures may be envisaged:

- Monitoring of such elephants based on individual identification/ tracking through radio-telemetry.
- Conducting population-habitat viability analysis for population management and HEC mitigation.
- Evaluation of the outcome of past dispersals to determine the effectiveness of mitigation.
- Regular monitoring and review of the situation in all potential HEC conflict hotspots.

4.3.6 Site-specific barriers and other exclusionary measures

Barriers are primarily used to regulate the movement of elephants. Poorly designed barrier can have adverse impact on conservation. There may be breaches and occasionally some elephant may be able to overcome them and enter human use areas. When planning and establishing barriers, following measures are envisaged:

- Adopting a landscape approach during planning and execution so as not to disrupt natural movement of the elephants in the landscape.
- Creation of site-specific quality barriers using a participatory approach from designing, monitoring and maintenance by engagement of communities.
- Barrier to be used only at the interface between human-use areas and forests.

The principal types of barriers used against elephant include:

- Elephant Proof Trench (EPT)
- Solar powered electric fences
- Rubble walls
- Other types – railway girders / tracks, steel channels / ropes / bars etc

Barriers with sharp spikes having potential to injure elephants, livestock and humans must be avoided.

There could be different strategies to instal barriers as under:

i. Construction of barriers around forest areas to keep elephants inside the forest
ii. Barriers constructed across the landscape between two states / districts / countries
iii. Barriers constructed around the settlement to be protected such as village / enclave

As regards the effectiveness of the barriers-

- Strategy (i) is not advisable around small forest blocks (few sq. kms in size) because such forests cannot provide all the space and food requirements and confines the elephant population; compromising their long-term genetic viability. It may be moderately useful around large forest blocks but extremely difficult to completely encircle forest blocks.
- Strategy (ii) is rather impossible to create effective barriers at landscape level ensuring movement of the elephants across ecological landscapes and not be confined to administrative units.
- Strategy (iii) is most effective for protection of crops but it can be used only in specific situations wherever there is a compact area but not so around large enclaves.

If barriers are to be created, a map must be prepared showing location of elephant groups, seasonal migration patterns of elephants and locations of elephant corridors including location of proposed elephant barriers. Barriers may be created only if the boundary is “hard” (clear and sharp demarcation between forest and human landscape), fairly straight without much convolution and not broken by roads, river or large stream for making them more effective.

Crackers, beating of drums or tin can, kerosene torch (mashal), swinging fireball and shouting are the most common repellent measures, but their effectiveness is low in most situations. The following measures may be envisaged:

- Innovative local repellent techniques like honey-bee boxes, chilly ropes etc may be piloted, and customised to enhance their effectiveness, while ensuring their wildlife-friendliness.
- New repellent methods may also include sound of bees and carnivores, use of drones etc besides deterrents like trip / sensor-based alarm system.

Community-based institutions may be engaged together with wildlife experts / organizations, in motivating, training and hand-holding the community in use of exclusionary measures.

4.3.7 Community based awareness building, cooperation and conflict management

Guarding crops at night from any safe structure is one of the most effective early warning and deterrent method. Crop-guarding involves deterring elephants by chasing and driving them using noise (i.e., shouting, beating drums or tins or using firecrackers/torches). Guarding crops at night is suitable in low-conflict areas. The following measures may be envisaged:

- Developing Community-based-conflict-management (CBCM) especially in North Eastern Region, as a means of empowering the community to share the responsibility of HEC management through JFMC / EDC / Gram Sabha considering their vital stake and for eliciting more rapid response.
- Community PRTs and farmer groups may be engaged to ensure that besides preventive measures, traditional crop-guarding methods are encouraged, with the involvement of the community/ farmers.
- Awareness-building and training may be carried out on the proper usage of firecrackers and fire torches so that they do not harm the elephants, nor become fire hazards; and on various aspects of the crop-guarding techniques.
- Develop early warning bulk SMS alerts along with pulsating warning lights on towers, that warns of elephant presence in the area.
- Developing effective and sustainable crop-guarding practices by various incentive mechanisms and subsidized funding under district-level government schemes such as Mahatma Gandhi National Rural Employment Guarantee Scheme (MGNREGS), for supporting farmers.
- A compendium on good practices on crop guarding techniques may be developed for use by the local community.

4.3.8 Training and capacity building

The following measures may be envisaged for facilitating capacity development of institutions/ experts:

A- Field staff & response teams

- All response team personnel from forest and other line departments and agencies should be brought under a systematic approach to capacity development.
- Arrangement for deployment of personnel and quick action on cognizance of conflict cases to be strengthened in each division.
- Sensitization of all response teams and relevant personnel from forest and other line departments and agencies on 'One health' approach, which can be used for planning and implementing measures on occupational health and safety and humane treatment of animals in conflict.
- Regular trainings on critical operations such as rescue, capture and translocation may be conducted along with other key departments, in the form of mock-drills and simulation trainings.

- Advanced trainings on animal welfare issues may be conducted for all personnel of the rapid response teams.
- Competencies of members of RRTs may be reviewed on a regular basis and curriculum for their training to be fine-tuned and updated regularly.
- Arrangement for deployment of personnel and quick action on cognizance of conflict cases may be strengthened in each division.

B- Mahouts and assistants

- Build the capacity of mahouts incorporating learnings from elephant behavioural studies for guiding 'koonkie' elephants in dealing with conflict mitigation.
- Elephant reserves conducting regular trainings can act as regional hubs for imparting trainings to the other States in training of the mahouts of the koonkie elephants.
- A database of experienced mahouts of koonkie elephants may be developed.
- Steps may be envisaged for improving the service conditions of mahouts.

C- Daily wage workers / anti-poaching watchers

- Provide appropriate support and systematic training, to daily wage workers and anti-poaching watchers, on key HEC operations handled by them.
- Steps may be taken to improve their service conditions.

D- Local population

- Facilitate, encourage and seek help from local NGOs, People's representatives, volunteers, schools etc to implement safety measures, aimed at preventing human-elephant encounters. These measures may include guiding people to watch for signs of elephant presence during crepuscular period (around dawn and dusk), and how to respond when they encounter an elephant. Regular trainings in local schools and colleges, and also possibly during village meetings at HEC hotspots can be organized to train people on such safety measures.

4.4 INSTITUTIONAL CAPACITY DEVELOPMENT

4.4.1 Support structure for conflict management

Managing human-elephant conflict requires a comprehensive approach that includes a combination of strategies aimed at both preventing conflicts and mitigating their impact when they occur. The support structure that can be implemented for human-elephant conflict management, envisages:

- Community engagement and awareness through education programs and holding regular meetings with the local communities.
- Developing early warning systems through technology integration and involving local communities in monitoring and reporting elephant activities.
- Habitat management by identifying and protecting crucial elephant migration corridors and implementing land-use planning aiming for coexistence.
- Crop protection measures by introducing crop deterrents and developing fair and prompt compensation systems.
- Community-based conflict resolution by establishing stakeholders' committee and integrating traditional knowledge and practices of local communities in conflict resolution strategies.
- Elephant conservation initiatives by strengthening anti-poaching efforts, reducing stress on elephants and consider translocating 'problem' elephants.
- Collaboration with NGO and other agencies by policy advocacy that addresses both human and elephant needs, and securing financial support for conflict management initiatives.

- Conduct research and monitoring by data collection and continuously adapt and improve conflict management strategies based on research and monitoring findings.
- Infrastructure development by designing and implementing solutions, such as EPT around human settlements or critical agricultural areas and consider elephant-friendly infrastructure planning (roads and rails) to minimize disruptions to elephant habitats.
- Capacity building by providing training programs for local communities, officials, and other stakeholders on conflict management techniques and conservation practices.

Implementing a holistic support structure that combines these elements can contribute to effective human-elephant conflict management and promote coexistence between humans and elephants.

4.5 EMERGENCY RESPONSE SITUATIONS

'Emergency or Crisis' situations can be defined as situations that are sudden, unexpected, have the potential to be serious/are serious in nature and therefore require immediate intervention in time and space, from concerned stakeholders, to minimize loss of lives and assets.

The response to such emergencies involves prompt handling of situations, ensuring reduced vulnerabilities of humans and elephants.

An indicative list of the potential emergency situations on a priority basis is as follows:

i. A human is killed/injured
ii. Need to rescue an injured elephant/ abandoned calf
iii. Elephant has entered human-use areas (agriculture field/ settlement)
iv. Livestock is injured/ dead
v. Crop damage/ Property damage
vi. Elephant death due to retaliatory action by humans / train collision
vii. Elephant sighting in the vicinity of agricultural land or settlement

Key response procedures may be established, and actions promptly implemented/ undertaken for addressing emergency situations.

Detailed step-by-step guidance may be developed as "Operating Procedures for Addressing Emergency Response Situations".

The key emergency response procedures may include the following:

4.5.1 Pre-emergency situation

A- Establishment of emergency response mechanism

A strong institutional mechanism is required, to respond to emergency situation arising due to HEC. This starts with detection of incident, communication to 'Control room' and information dissemination to the officials and staff in the command-and-control hierarchy, including forest and civil administration, for initiation of appropriate response actions. The divisional forest office coordinates action by rushing RRTs to the incident site. The field support operations are structured around the following key operational stages, for synchronization of activities to meet the emergency:

- *Monitoring and situational awareness:* The Range RRTs/Community PRTs that reach the site first should communicate with the Control Room, with first-hand information on the situation / incident.
- *Mitigation Hubs/Control Room:* Disseminates information for quick responses; activates helplines.
- *Helplines:* Messages are transmitted for information and awareness to the stakeholders.

- *RRT/ PRT personnel, veterinary team, drug and equipment, mobility and communication:* The RRT/PRT with sufficient force, equipment, drugs, medicines, vehicle and communication network, and based on situation, seek additional force of trained personnel. This team(s) move swiftly to the incident site with the veterinary team and equipment, to deal with the conflict/conflicting situation.
- *Anti-depredation Squad (ADS) & Koonkie Elephants for Elephant Drives:* ADS may be formed with the trained staff under supervision of a forest officer and equipped with vehicle, torch, siren, fire crackers, guns and preferably supported by at least two koonkie elephants for carrying out 'elephant drives' with the intention of herding elephants from one administrative area to another or from a human populated zone or from any hazardous situation adopting a humane approach.

B- Intra and inter agency coordination & cooperation

- Procedures may be laid down in each forest division/ district, to ensure timely coordination amongst the various response teams from forest department and other agencies, consisting of District Administration (Magistrate/Collector); Police, Fire Services, Animal Husbandry Department, Health Department, SDRF, NDRF, Paramilitary Forces, etc and local community, especially local Panchayat leaders and village Community PRTs.

C- Preparedness of response teams

- Operating Procedures may be laid down in detail to ensure that the capacities and capabilities of the various response teams (Community PRTs, RRTs) are established and facilitated in their capacity development through trainings including measures like occupational health and safety.
- Operating Procedures may be laid down with specifications to ensure that each response team is sensitized and equipped with appropriate and adequate response equipment and personal protective equipment (PPE kits), in view of effective zoonotic diseases and pandemic prevention, management and control.

4.5.2 During emergency situation

- Operating Procedures may be laid down to receive, channelize and disseminate information at the onset of any emergency, from site of the incident, to related forest officials, mitigation-hub; and further information dissemination to requisition response action at the emergency site.
- Specifications may be detailed for mobilisation, activation and deployment of response teams on ground to respond to the emergency situation.

A- Identification of the animal/s in conflict

Identifying the specific individual elephant/s involved in HEC can be challenging due to the large and mobile nature of elephant populations. However, there are various methods and technologies used, to monitor and identify elephants like -

- Radio collars and GPS tracking; Camera traps; Biometric data; DNA analysis; Community reporting; Citizen science initiatives; Expert observation; Collaboration with local communities.

It's important to note that a combination of these methods, is often used for a more comprehensive understanding of elephant populations and their movements. Additionally, ethical considerations, such as minimizing disturbance to the animals, may be considered when employing identification techniques.

B- Key response actions

- Operating Procedures may be laid for step-wise key actions, for all emergency situations, media engagement, crowd management, addressing health emergencies, and post response operation, for management of animal. This includes ensuring animal's health and

safety during capture, transport, selection of translocation site, and monitoring after safe release of the animal.

4.5.3 Post emergency situation

Addressing a post-emergency human-elephant conflict situation involves a combination of relief measures and strategies as under:

- *Human Safety:* Ensure immediate safety measures for the affected communities and evacuate if necessary and provide medical assistance to those injured during the conflict.
- *Elephant Welfare:* Attend to injured or distressed elephants and collaborate with veterinary experts and organizations to provide necessary care and treatment.
- *Damage Assessment:* Evaluate the extent of human and elephant casualties, property damage, and agricultural losses.
- *Identify Hotspots:* Determine areas prone to recurring conflicts and assess the factors contributing to the conflict.
- *Psycho-Social Support:* Provide counselling and support to individuals affected by the conflict, addressing trauma and stress.
- *Livelihood Assistance:* Implement short-term measures to support affected communities, such as providing food, temporary shelter, and financial assistance.
- *Community Meetings:* Hold community meetings to communicate plans for immediate relief and future strategies and gather community input on potential solutions.
- *Public Awareness Campaigns:* Launch awareness campaigns to educate communities on elephant behaviour, safety measures, and conflict prevention.
- *Temporary Barriers:* Set up temporary barriers or deterrents to prevent elephants from entering conflict-prone areas again, while more permanent solutions are developed.
- *Night Watch Teams:* Deploy night teams to monitor and deter elephants during vulnerable hours.
- *Government Agencies:* Coordinate with relevant government agencies responsible for wildlife conservation, agriculture, and local governance.
- *NGOs and Conservation Organizations:* Collaborate with non-governmental organizations and conservation groups to leverage expertise and resources.

4.6 PLANNING FOR CROWD MANAGEMENT AND MEDIA ENGAGEMENT

Crowd related incidents in HEC situations have been reported regularly from different parts of the country. There are various causes and triggers for the uncontrolled and retaliatory behaviour of the crowd gathered at the conflict site, including element of curiosity and limited understanding of behaviour and ecology of elephants. Crowd behaviour can be unpredictable, varying from curiosity to see large animals, to demonstrating irresponsible behaviours (getting too close to elephants to click pictures or media to cover such incidents) to very aggressive behaviours (frenzied mob trying to lynch the animal in retaliation). Sometimes, crowd is hostile and can even harm forest officials/property and animals, due to panic and stress, especially if there is human death or injury by elephant.

- Negative behaviour of a crowd/mob impacts the effectiveness of HEC mitigation measures. It can disturb/irritate the animal which may result in animal attacking the people in panic resulting in human injury or even death. On the other hand, this may injure the animal or lead to severe stress in the animal. It can hamper rescue operation especially if the elephant is to be tranquilized; as such animal which is under severe stress, may have difficulty to cope up with drugs used to chemically immobilize it. Therefore, situations of uncontrolled or mismanaged crowd may lead to negative reporting by the media highlighting the situation of chaos and poor management.

- Crowd control continues to be a major challenge in HEC mitigation efforts and therefore once the elephant enters human dominated landscape, crowd control becomes the most important aspect to deal with. Prudent local community behaviour can avoid crowding and ensure safety of human beings as well as of animal. Quick and well-coordinated response from law enforcement agencies can address the issue of HEC and crowd control effectively. In the forest fringe areas with high population pressure and conflicting social interests, timely action can avoid any mishaps.

- Effective crowd control and management is critical during HEC mitigation as it will allow the response teams to focus exclusively on their work and carry out the mitigation operation smoothly and efficiently. The immobilization and capture of the animal would be quick and the possibility of stress in the animal would be minimized. Moreover, the media would also be able to cover the mitigation process properly without disturbing the rescue team or the animal.

- Depending upon the situation, crowd behaviour and availability of resources, various measures are being implemented in different states/ locations, some of which have led to successful crowd control initiatives/endeavours. There are some good practices to indicate that sensitization of local community and training have assisted in minimising the impact of the conflict situation on ground. However, effective crowd management in HEC still remains a challenge for most of the situations primarily due to limited coordination between departments, and other stakeholders, limited capacities, and non-existence of a common agreed protocols among key stakeholders.

4.6.1 Threat analysis and risk assessment in crowd management

- Key actions under this step could include:
    - To identify the kind of threats / risks related to crowd control in HEC situation.
    - To identify the geographical areas/zones where the risk/threat of HEC exists.
    - To understand the extent of resources available to deal with such situations
- Hazard Zonation and Mapping:
    - Preparation of standard criteria of risk prone areas related to crowd control in HEC
    - Classification of the risk prone areas based on threat perception (including past incidents)

4.6.2 Preparedness framework and development of crowd management plan

'Prevention measures' refer to set of actions/measures undertaken to eliminate or minimize the probability of occurrence of crowd related incidents in HEC situations whereas 'Preparedness measures' refer to the set of actions /measures deployed/undertaken to be able to effectively control crowd related incidents in HEC situations.

- Advance planning for crowd management related HEC impacts can prevent avoidable losses.
- Develop a common plan across key relevant sectors and stakeholders at division/ district levels, to facilitate role clarity and to facilitate knowledge and experience sharing.
- As there are independent jurisdictions of districts / forest divisions in an ER, it will be efficient to have District-level Coordination Committees (DLCC) as the anchors for implementation.
- It would be essential to formulate a comprehensive plan at the district level for dealing with crowd related incidents in HEC situation.
- The plan may include specific roles and responsibilities of each of the identified stakeholders and key set of actions that need to be implemented, for prompt response and mitigation.

- This will in-turn promote multi-stakeholder driven implementation approach and prompt sharing and deployment of resources available with different stakeholders.
- The plans may be developed with the full co-operation amongst all stakeholders in the division/ district and may be implemented in conjunction with the respective division-level HEC action plan.
- This will involve identifying various stakeholders, enhancing capacities of first responders and the specialist responders for rapid response during crowd management, defining clear roles and responsibilities of each stakeholder in the plan for seamless coordination and synergy.
- 'Incident Response System' may be developed. Trigger point for first responders and escalation matrix to trigger specialist responders may be defined for effective incident management.

4.6.3 Containment measures including control

Communication and Emergency Operation including Surveillance, Barriers, Equipment

- This step involves setting up of early warning and operational communication systems, emergency operation centre / control rooms, GIS based monitoring systems etc.
- Monitoring and surveillance by patrol teams [equipping them with appropriate (PA) systems] at regular intervals would assist in quick tracking and reporting of any crowd related incident.
- The information about movement of animal in conflict and exact timing and venue of the planned capture site may only be shared with the concerned people/staff/officials.
- Enhanced PA systems may be made available for RRT, PRT and village response teams.
- Identification and sanitation of safe passages and alternative routes may be worked out.
- Leveraging local knowledge to track animal movement may be included in preparedness phase.
- Identification of various exit routes and formulation of an exit plan in case of situation of uncontrolled/aggressive crowd may be undertaken.
- Drones could be used as part of the surveillance mechanism
- Natural Barriers (rivers/small water streams; lakes, hills; thick bushes, etc.) may be earmarked
- Wherever necessary, structural barriers (fences; barbs, gates, any type of construction that prohibits or prevents access) may be used.
- It would be better to cordon off the conflict area before carrying out the response operation.
- A checklist may be prepared for the equipment and other resources required for suitable response at the incident site.
- Functionality & accuracy of the critical health monitoring devices may be thoroughly checked to ensure timely management of any health complications of the captured wild animal.

Response / Containment Measures

- Crowd management in the HEC situations may be integrated into the State/ District Disaster Management Plans
- Crowd management coordination may be part of review of stakeholder meetings at the level of Forest Department and District Administration
- At the end of the response operation, a detailed incident response report may be made.
- Forest Department with representation from District Administration, Police and other related emergency services may regularly hold interactions with the Media to foster better understanding.

- Interactions with media may be aimed at shifting from 'sensationalizing to sensitization approach'.
- Efforts may also be made to engage with media through short press releases, social networking (online) like WhatsApp, Twitter, Facebook etc.
- Calls from Media may be responded to during times of crowd related incidents and they may be kept informed of developments so that biased/counterproductive narratives are not disseminated.
- Media workshops may also be organised which provide a useful platform for media professionals, forest officials and other stakeholders to interact on issues of this nature in greater depth.

4.6.4 Role of stakeholders in crowd management

- Management of any emergency is a core responsibility of the local administration; however, is also a collective responsibility of various stakeholders affected by the incident.
- A district-level HEC Coordination Committee (DLCC) may be established to ensure coordinated action by key departments/agencies; to ensure better crowd management, among its other roles.
- Role of various stakeholders may be clearly indicated in the Standard Operating Procedures (SOPs) including roles of community-level Primary Response Teams, range-level Rapid Response teams and division-level Rapid Response teams.
- Specific roles and responsibilities of the first responders, specialized responders and other volunteers etc. may be clearly laid down.
- Police has the primary role of law enforcement in crowd management and sometimes due to their wide communication network, police department is the first responder.
- Fire Brigade have tools and skilled manpower that may be useful in some emergency situations.
- SDRF/NDRF have human resources, equipment and capacity to help in emergency situations.
- In places where Paramilitary forces are stationed, they may assist in maintaining vigil.
- Health Department may support where individuals are critically injured/ require priority attention.
- Services of Veterinary doctors serving at the Animal Husbandry Department would be helpful.
- Engagement of potential resources like NGOs, Religious groups, CSOs, Political, Social, RWAs, PRIs/Village Committee, etc. can be planned for operational engagements.

4.6.5 Identification of challenges in forest-media engagement & cooperation

Media can play a key role in raising awareness about wildlife issues. It can influence and shape the perceptions and opinions of the public. Stories, news, and information about the wildlife especially elephants living in natural and human-dominated landscapes, or even elephants that have adapted to living near urban areas, are widely read in newspapers, and also watched with keen interest when reported by electronic media. The impact of news coverage is magnified to a greater degree in the case of highly sensitive HEC scenarios. As a reaction, the public gets polarized, both in the online world and at community level, over human versus elephant.

- Media houses and media persons may be advised to ensure fact-based reporting to avoid publication of stories that either misrepresent, misinform, or sensationalize the situation.
- When they collect information, they must crosscheck facts, that the information source is credible.

- Media persons may also engage with the forest officials as well as conservationists not only for regular flow of stories, but also to develop media products that takes a holistic approach.
- Electronic media can avoid sensationalism by using balanced text, to ensure that the news does not accentuates the fear of the local public, resulting in heightened risk perceptions eventually leading to antagonism and less tolerance towards elephants.
- The challenge of HEC in each landscape are different, owing to the landscape structure, socio-economic scenario, development scenario, past history of conflict / conservation, and overall threat perceptions of people.

Addressing specific challenges that managers face with media on HEC issues

- Forest officers find that media coverage is usually thin, when the escalation of a conflict situation is successfully averted; but if the same had failed and situation had worsened, it would have hit the headlines. It is important that the officials should engage with the media for true impression.
- When media reports place the entire blame of HEC on elephants, rather than explaining the underlying drivers and pressures, this leads to widespread negative perception. Media may take the opportunity to present the HEC situation in a holistic way for the viewers/ readers/ participants.
- Media can use the opportunity to get existing and successful mitigation measures explained by Forest Department to address the situation in a balanced manner.
- Media organizations can take efforts to use the opportunities to get their reporters/ other media personnel/ editors trained on topics relevant to HEC, so that even a quick information sharing will be received well and will facilitate media personnel in communicating on complex issues.
- Media persons, especially photo-videographers, reporting on HEC situation can work as partners by facilitating the operation and avoiding the location, if advised so by the forest department.

Occupational safety and health, ethical issues, and other considerations

- There is a growing trend of people venturing too close to a wild animal for photographs, even in a conflict situation, which can be a grave danger. Media personnel should avoid engaging in acts like this for their own safety and well-being.
- Media personnel should get themselves well informed and well-prepared for any possibility of zoonotic diseases, when working closely with wild/ captive elephants, and take all necessary precautions such as wearing masks, sanitization etc.
- If a media person shares the picture/video with geo-tagging option on social media, poachers and wildlife traders can access the geo-tag and find the exact location of the animal. Therefore, it's important to switch off geo-tagging options, or not to pin the exact location while sharing.
- Cultural and religious views and customs of local communities should be respected, while reporting/ documenting on HEC issues.

Avoidance of Sensationalism in HEC in Media Reporting

- With social media (Facebook, Twitter, Instagram) and instant messaging apps such as WhatsApp, the spread and frequency of fake news is exponentially increasing and it is important to ensure that the source of information is not fake news and arrest any unwanted damage.
- If a fake story goes viral due to some reason, effort should be taken to report to Press Information Bureau or cyber authorities; press release with the correct(ed) information; contacting the journalist and convincing him to publish a corrected version of news or

publish a rejoinder; filing an online complaint with either the Press Council of India, or the Broadcasting Content Complaints Council (BCCC) if the fake news play on television; or contacting a friendly journalist to publish a counter-narrative that discredits the fake news or doctored news.

- Under the new Information Technology (Intermediary Guidelines and Digital Media Ethics Code) Rules, 2021 (the "IT Rules 2021"), a grievance can be raised in case any patently false or misleading information is published by a user on a social media platform. The post or article can be reported to the website or the application (as the case may be) by filing a grievance with their Resident Grievance Officer (RGO). Further, the social media accounts of the forest department can also be used to discredit the fake news or doctored news, and while at the same time sharing the correct information and narrative of the incidence.
- Media persons may check with responsible spokespersons of relevant authorities what the real news is and try and ascertain where the fake story came from and check every fact in the story by talking to responsible forest officials for their version of the story or the controversy.

4.6.6 Measures to be implemented by both media and forest department

- As media professionals are not wildlife specialists, it will be useful for the managers to constantly engage with them, to ensure that the media reporting is accurate, and both forest and media have the same perspective and news coverage of HEC would not only be sensitive but holistic.
- Disseminating the right information to the media is of utmost importance. To avoid lop-sided reporting, wrong facts, and analysis, it is advised that care should be taken by the forest department in providing correct figures and statistics to the media, to avoid controversy.
- Officials may identify media persons (local / state level) from all the media platforms who report on wildlife and environment for regular interactions. The forest officials could make themselves available for comments, reactions and handing over visuals and other information for a particular news/story. In case of an HEC incident, this would ensure that the reporter would have a balanced perspective on the incident and will report stories based on facts in a sensitive manner.

Field visits help generate authentic reports

- It would be a good idea for the forest department to organize field visits for media on a regular basis. Through this exercise, the media develops a clear understanding of HEC issues. This can be done in addition to special days such as World Environment Day/ International Forest Day/ Wildlife Week /Global Tiger Day /Elephant Day/ World Biodiversity Day etc., when the managers can give out specific information related to the day/week and highlight initiatives that they have taken. Such opportunities help media persons write on the subject and create awareness.
- It is important to identify journalists genuinely interested in natural history and conservation issues and build long-term relations with them. Regular interaction with committed media personnel is a very important exercise, for nuanced and balanced reportage on HEC. Regular interactions and field visits with journalists help them understand even a complicated issue such as HEC and develop a proper perspective on wildlife conservation.

Nodal person from forest department to be identified

- When there is an ongoing operation to capture an animal in a conflict situation, media persons will reach the site and attempt to engage with staff of the forest department. The department may ideally designate a spokesperson to interact with the media ensuring that rumours or incorrect news are not reported. It would be good if the spokesperson has already been prepared with the obvious or expected questions.
- Some news reports may carry all the factual information, but would nevertheless use a sensational headline, calling, an elephant a ‘rogue’. That is why, forest officers must keep

in mind not to use such words while talking to the media, at risk of being quoted as such by the media.

- A Public Relations (PR) wing can help the forest department focus on regular communications with both the media and local community, on HEC and other conservation-related challenges. Properly executed PR can help in building a positive image of the forest department. This can be achieved by collating and documenting human interest, feel-good stories etc and sharing such stories with the media regularly. PR Wing could also sensitize media persons on the varied challenges in elephant conservation, and also the wonders of natural history.

Addressing challenges that media encounters during HEC reporting

- Getting information at the right time is extremely crucial for media persons. It is their job to break stories. Stories are also now told via multiple platforms. In such times, a 'Press Release' may be issued as early as possible, not only to make it easy for media coverage, but also to avoid any wrong information getting into news stories.
- Efforts may be made to release any major information through a public press conference, which gives an opportunity for hosting all media persons equally. Also, if a press conference is not possible, it's best to send a common press release across to the media or make the same public.
- It is a good idea to explain everything in detail to the media. Field managers could take care to avoid using jargon, as it would not be understood or cause confusion. The managers should keep it simple with their explanations and avoid technical detail, especially if it is not necessary.
- *Dynamics of regional media:* Since the local media personnel, including independent reporters and columnists are the first to reach the scene of the HEC, and it is their story, pictures and videos that are later used by the state and national media agencies, forest officials should take special care to provide detailed information in simple language and with all facts.

Key points in communication-message from the managers to the media

- It might be a good idea to develop a media strategy to ensure effective forest-media cooperation in each division, if possible.
- Regularly interacting with media persons might help create a positive image of the forest department. Also, such exercises could prevent rumours or misinformation from becoming news.
- Forest officials too may occasionally suggest story ideas to media persons as the latter are not familiar with what is happening in the HEC mitigation front. Creating such opportunities helps build a good positive rapport between media and forest sector.
- Sharing good natural history images from the forests, including photos and videos of rare wildlife, from time to time, helps get accurate and wider coverage.
- It may be useful to organize trainings for media personnel, to develop a common understanding, agree on the communication channels, and knowledge and experience sharing on HEC issues.

4.6.7 Execution of crowd management plan in emergency situations

Indicative situations where crowd management may be required

- A person is killed outside the forest/ protected area in an HEC incident and while attending the case, forest officials are either attacked or their vehicle is damaged/burnt by unruly mob.
- An elephant is electrocuted/shot dead/killed outside the forest/protected area in an HEC incident and while taking action against the accused, forest officials are attacked by the crowd.

- In forest fringe areas, where there are incidents of human/cattle killings and if there is some delay in capturing the wild animal involved, crowd targets officials/ properties of forest department.
- When an elephant, involved in human killing is captured and is being shifted to rescue centre, crowd tries to harm it.
- When crop raiding elephants are driven by forest officials/ response teams, local crowd swells up and endangers the safety of everyone.
- Due to HEC issues, retributory action of crowd especially in the forest fringe areas on wild animals and forest department

Activation of District Plan in the event of Occurrence of an Incident

- As soon as the first information on the occurrence of crowd related incident is received by designate forest officials, the district plan on crowd management may be activated and response actions should get initiated in accordance with the SOPs.
- Key Actions would include prompt dissemination of information to concerned stakeholders; activation of response teams at various levels, joint stakeholder (forest, police, district administration, etc.) deliberations/meetings to address the issue in the most effective manner; deployment of rescue teams, equipment and other resources for on-site operations and suitable response actions undertaken as per the nature and type of incident leading to effective and prompt crowd control at the site.

Creating Security Cordon at the Incident Site

- Security cordon uses to control the incident site and provides important situation awareness of what is happening at the site.
- There are 4 basic principles, generally known as the "4C" – Confirm, Clear, Cordon & Control. Depending on the incident it may require 'inner and outer cordon' to maintain the level of access.
- Before establishing of the cordon, the purpose should determine the cause for restriction of access; distance of restriction from the incident site; staff needed for controlling the access; location of the command post at the incident site; requirements of barriers and markings, if any.
- The integrity of the cordon may be maintained by rotation of the duties of the staff, passing on the information, providing situational awareness to the control room, updates on the incident and sustaining of the cordon by providing necessary logistical arrangements for the staff.
- The incident site officer/ staff should always have close cooperation with the emergency services such as police, ambulance/ paramedics
- When the incident is resolved and the area is safe to re-enter, the cordon needs to collapse.

Maintenance of Public order & Tranquillity (by the Magistrate)

- During the HEC scenario, it is very essential to maintain public order and tranquillity by crowd management and therefore dispersal of unlawful assemblies and public nuisances including urgent cases of nuisance or apprehended danger is important.
- As per Section 144 of CrPC, a District Magistrate, a Sub-divisional Magistrate or any other Executive Magistrate specially empowered by the State Government may issue order in urgent cases of nuisance or apprehended behaviour.

Dispersal of the Crowd (by the Police)

- If psychological methods of persuasion, warning and advice don't work and the use of force is unavoidable, the police may use the minimum possible force so that damage is least.

- Section 129 authorizes only executive Magistrate, officer-in-charge of a police station or anyone at the rank of sub-inspector or above, to command the dispersal of any unlawful assembly.
- Based on the circumstances, the police can make of use of force to disperse the crowd. However, the following principles need to be adhered to - no force should be used more than necessary.
- During any crowd related incident in an HEC situation, the safety of crowd, concerned officials, response teams, onlookers (local community) and elephant/s is of paramount importance. To control an extremely unruly crowd/mob, at times measures such as use of force and weapons are deployed to bring the situation under control. Use of force and related weapons has to be careful and judicious with the aim of ensuring safety of concerned officials, crowd, local community and elephant.

Other actions

- Transportation and Traffic Management Plan may be developed together with Police, Fire and allied Emergency Services.
- First Aid and medical emergencies plans at the incident site may be planned together with the Health Department/ nearby hospitals.
- Helplines/ Mitigation Hubs - System to ensure that the public information on helplines and other reporting channels, in case of any conflict situation, requiring support of SFD is established.
- Role of Media– before, during and after HEC situations may be discussed, to ensure their effective participation in crowd management

4.6.8 Dealing with Media at the Incident Site

- In a crisis situation, it is advisable to not avoid the media. Do not say something like 'No Comments' as it may be misinterpreted or give the impression that there is something to hide.
- If a media person is asking for a comment at a HEC scene, a forest official trained in dealing with media could engage with the media persons enabling other members deal with the crisis.
- It may be effective to use multiple media outlets – print, TV, Radio/ FM, online, social media to broadcast messages, asking the public not to panic, not to leave the safety of their homes and come out, or attempt to attack the animal concerned during a HEC situation.
- In the absence of a designated spokesperson, media briefings are ideally addressed either by the senior-most member of the department, or by anyone with regular interactions with the media.
- There is always a rush of media persons, photographers, and videographers trying to capture all the action during a HEC incident. This usually leads to chaos, and an altercation ensues. It's best to try and provide opportunities for photographers to get visuals, or in some cases, permit forest staff to shoot images and videos and later share it with media persons.

Public Outreach during Crisis

- Anticipate what the public wants to know. Primarily, they will want to know if any danger to human life persists, what is being done to secure their safety, when and what compensation is going to be paid to those affected, and how the conflict is going to be finally resolved.
- Anticipate the questions that the media will ask. The media will also ask the same questions that the public wants answered, as that is what they want to relay to the readers.
- Team members may be coached to direct all questions and queries from the media to the designated spokesperson, when available.

- It is always a wonderful idea to develop a decision chart on who will do what in a crisis, that includes how the media will be briefed. All the personnel in the forest department should be on the same page and not give out contradicting narratives of the incidence.

Coordination between forest department and media during crisis

- During a HEC situation, the media is bound to be around, to capture the news as it happens. To get to the action, media persons will try and get as close to the epicentre as possible. This could very well hinder the HEC mitigation operations. To ensure that the conflict situation is handled carefully, keeping both humans and animals' safety in mind, it is crucial that the forest department, apart from following the recommended standard OP for conflict mitigation, also follows the media management standard OP during the operations.
- During such crises, the Forest Department may involve and seek help from local press clubs, press associations and similar such bodies to ensure that the media persons do not take undue risks to themselves and should instil trust amongst media persons that they will have access to all relevant information, videos and photographs, and these will be shared in a timely fashion.

5.7 REDUCING THE IMPACT OF HEC ON PEOPLE AFFECTED

Humans living in elephant range areas are familiar with its habits and behaviour and are accustomed to elephant presence in the area. Although they are aware of how to react to the situations, many a times, things go beyond control and marginal farmers face losses due to HEC. Moreover, due to dispersal and colonization of elephants in new areas, people are not familiar with elephants and are less tolerant of the damage caused in conflict.

A major response to HEC has been compensation for losses, but little evidence exists to support the claims that these schemes have an impact on people's attitude or the impact on the conservation of elephants. Moral hazard, optimization and leveraging of compensation schemes are a challenge.

Measures, which may encourage people to work towards harmonious co-existence, include participatory planning, awareness and communication for changing the threat perceptions, integrating HEC mitigation into poverty alleviation programs and community-based natural resource management, and other site-appropriate stakeholder engagement measures, such as

- *Compensation* for economic loss from damage to crops by elephant activities, or personal injury or risk from elephant encounters (meant to increase community tolerance towards elephants)
- *Insurance schemes* require participants to pay a premium, for insurance against economic loss. This premium is determined based on the risk associated with HEC. The challenges of high premiums charged (due to high risk) may be addressed by supplementing premiums with government or non-governmental funding support, community financing (through ecotourism), or better risk evaluation.
- *Performance payments* for community support for conservation may also be explored as an instrument, where the EDCs / VFCs can be provided funds for conservation-linked performance payments, and experiences/ learnings can be shared back, for further refinement of guidelines.
- *Conservation Easement* may be a good instrument for mitigation of conflict, which could be explored by incentivizing conservation to mitigation of conflict and as a good innovative mechanism, farmers can be compensated for keeping these areas fallow for part of the year for wild animals or no/reduced gain from the farming income.
- *Community-based ecotourism* can generate enough resources to offset the cost of HEC.
- *Acquisition of private land* or encouragement of voluntary relocation to alternative site or long-term lease in the migration corridor can be explored.
- *Declaring private lands as conservation/ community reserve* in the migratory corridor is also an option. Land adjoining PAs may be notified as Eco-sensitive Zone for conservation.

Mobile application-based system may be developed (as in states like Odisha and Karnataka) for compensation, survey and verification related to HEC when dealing with the injury and death cases; evaluating the loss of property and compensation paid to the owner; and collecting information and processing of claims of farmers, after crop losses, to ensure efficiency and transparency in the system.

4.7.1 Addressing the situation of loss of human life (ex-gratia)

The dimensions of human death are many folds. It's not simple to fathom the loss of human life to the family of the victim. The primary assumption behind *ex gratia* is that the loss of life of any individual cannot be compensated. Therefore, any amount paid to the family of the victim is mere consolation or a kind of solatium. The following measures may be implemented to effectively address the situation:

Ex-gratia:

Part of the *ex-gratia* payment may be made immediately to the victim's family/heirs and the balance payment may be made at the earliest.

- The payments to the victim's family must be compulsorily made in their bank accounts through Direct Benefit Transfer (DBT).
- In the HEC hotspots, a revolving fund may also be established, at the division-level, to ensure availability of funds for providing immediate relief to the victim/family. Possibility of setting up 'elephant conservation foundation' in the elephant reserve, for extending sustainable support to the victim, can also be explored.
- Life/ accident insurance coverage of local communities, in HEC hotspots, may be encouraged.
- The minimum ex-gratia payment may be kept in conformity with the Gajah (Elephant Task Force) recommendation by various states.

4.7.2 Addressing health and overall well- being of people affected

In case of injury:

- In the case of injury, as a result of encounter with human-elephant conflict, the victim needs to be immediately hospitalized and payment should be made depending on the type of injury or disability caused.

In case of emotional trauma and long-term psychological impact:

- Professional counselling through qualified psychiatrists/ health workers will be useful to check the effects of such traumatic incidents.
- The SFDs and other government agencies/ institutions may organize some counselling sessions for such victims and support them in coming out of this psychological impact.

4.7.3 Addressing the situation of property damage

Compensation for property damage does not generally consider the cost of repairing and the costs of temporary fixes that are needed prior to repairs. The poor are affected more as their houses are of low value and damages do not consider the fact that the main costs is actually labour that the family provides in reconstruction and not the cost of materials themselves.

- Grains in the granaries should be stored in '*pucca'* or underground structures, if necessary, communal granaries should be opted for avoiding property damage.
- Property insurance could be the ultimate goal. Awareness and adoption of options regarding property insurance may be given priority. However, till the system is fully established, present system of payment of compensation to be continued and enhanced by factoring in the hidden

costs and losses. Compensation for damage to property (including buildings) may be in accordance with the state government rules.

- Mobile application-based system may be developed, to evaluate the loss of property and compensation paid to the property owner.
- Brewing of indigenous liquor, which attract wild elephants to village should be completely stopped in the HEC areas.

Elephants may also enter urban and semi-urban areas close to the forest, which may create panic amongst the residents. The following measures may provide relief and assistance to the community:

- Awareness on the ecology and behaviour of elephant, to prevent accidental encounters.
- Early warning system using surveillance devices.
- Facilitating competency-development measures, on a regular basis, for community PRTs to ensure effective first response.
- Deployment of barriers, other deterrents
- Maintaining sanitary conditions (including garbage management)
- SFDs may coordinate with the respective resident welfare associations for *compensation/ ex-gratia* payment in the event of loss of property and human injury.

4.7.4 Addressing the situation of loss of livestock

- Livestock loss or injury, as a result of encounter with elephant, are not common. However, cattle tethered near or in elephant movement paths may be at risk. Forest department may coordinate with animal husbandry department for providing livestock insurance coverage in the HEC hotspots. To reduce conflict and risk of loss of livestock inside the forest areas, it is encouraged to stall feed the livestock in the HEC hotspots.

4.7.5 Addressing the situation of crop damage

The long-term impacts of assessment of crop compensation are complex. Payment of inadequate compensation to farmers may lead to resentment, leading to adverse impact on elephant conversation like retaliatory killings. Payment of compensation is equally challenging as it might also lead to laxity in crop protection by the farmers, and inhibit possible innovations for crop guarding.

- Ministry of Agricultural Cooperation and Farmers Welfare have included the crop loss by activities of wild animals under its flagship scheme *Pradhan Mantri Fasal Bima Yojana* (PMFBY), which can be used as an important HEC mitigation instrument. However, till the system is formally established in forest areas, the existing system of direct payment of compensation to farmers may be continued.
- The process of settling crop or property loss compensation should be transparent and simplified. Mobile apps may be used for collecting the information and processing of claims of farmers, after crop losses, to ensure efficiency and transparency in the system. Experiences and success-story sharing across states can facilitate further improvements in the system.
- Farmers may be encouraged, facilitated through community-based institutions, to explore solutions such as change in cropping pattern, use of non-palatable crops etc.
- Collaborative efforts can be made to promote market-based arrangements for alternate crops, wherever feasible. Community Primary Response Teams (PRTs) may be engaged to facilitate this process in their respective villages/ areas of operations.
- Site-specific studies may be conducted to find out appropriate crops that are non-palatable to elephants, in collaboration with agricultural institutions.
- Ensure sufficient delegation at field-level for deciding and disbursing *ex-gratia / compensation* for its effective use for addressing possible trauma due to HEC

4.7.6 Addressing the situation of lost livelihood opportunities

- HEC may deprive humans of their jobs, or reduce their ability to raise income, and thus diminish their capacity to make a living. *Ex-gratia* and *compensation* are important coping mechanisms, but specific measures may be required to ensure long-term sustainability of livelihoods. Following measures may be planned and implemented, with cross-sector cooperation:
    - Systematic assessments of the extent and scale of lost livelihood opportunities and other indirect impacts, due to HEC, may be conducted
    - Development of skills for alternative non-land/non-farming-based income generation opportunities
    - Provision of soft loans for starting alternative non-land/non-farming-based business enterprises.
    - Creation of self-help groups (SHG) for facilitating small businesses that adopt alternative non-land / non-farming-based livelihoods.

4.7.7 Providing insurance cover for damages due to HEC

Insurance schemes were not able to increase tolerance of a species because the damage suffered by livestock owners was barely covered by payments. Another issue is that initiatives are often implemented with no input from the locals they are intended to help, resulting in mistrust and low opt-in rates. Also, moral hazard, where an individual does not take actions to protect their property, exposing a scheme to a greater loss, as well as fraudulent activity can be problematic for financial sustainability.

There are also lessons to be learned from insurance for agricultural losses from weather-related events as microinsurance becomes more developed in Asian countries. The effectiveness of insurance for HEC is context specific, but there are four challenges to success of such schemes:

1. *Cost-effective insurance administration* includes low-cost premium collection and verification of claims, the costs of which can be reduced by comprehensive data and index-based insurance.
2. *Timely and fair payments* can be supported by accurate data, actuarial analysis and technology with claimants kept updated through mobile SMS.
3. *Linking payments to damage prevention* is needed to address moral hazard, where an insured individual exposes a scheme to a greater risk due to a lack of care.
4. *Financial sustainability of premium payments* is perhaps the biggest challenge and limits the involvement of commercial insurance companies.

Some initiatives have failed to increase the tolerance, yet others have been able to reduce animosity towards wildlife especially elephants.

- Financial sustainability of insurance schemes for HEC depends on the level of administrative costs being charged and penetration of insurance markets as a result of consumer awareness campaigns. It requires partnerships with other sectors and players to make premiums more affordable and co-financing from the beneficiaries of wildlife, such as tourists (e.g. insurance fund financed through ecotourism). It can also be enhanced by making them mandatory or bundling insurance services with other products.
- Community insurance schemes are often the most successful schemes at overcoming the fourfold challenges that insurance markets face for HEC.

4.7.8 Offsetting conflict costs

The perceptions and attitudes of people who inhabit conflict prone areas are crucial to the management of human-elephant conflicts and offsetting economic losses plays a major role in building positive attitudes toward wildlife and fostering tolerance toward elephants.

- The lack of standardized assessment guidelines and compensation approaches creates opportunities for conflict and exploitation. Compensation schemes often target the market

price for victims' crops and livestock losses without recognition of opportunity costs of conflict mitigation and transaction costs of getting compensation, or the hidden costs of declined psychosocial and social well-being.

In elephant range countries, compensatory programs face criticism due to insufficient compensation, logistical challenges, ineffective governance, lack of transparency, reduced local understanding and fraudulent claims.

4.8 REDUCING THE IMPACT OF HEC ON THE ANIMAL HEALTH

Capturing of elephants can be for different purposes, for example capture can be for radio-collaring to be used for research purposes, or for early warning and rapid response treatment of injured elephants or rescuing abandoned calves, or removal of elephant from conflict space for the purpose of translocation or bringing it into captivity.

Operating procedure (OP), providing step-by-step procedure and approach for tracking and capturing Elephant/s as a mitigation measure, to be developed. Separate Operating Procedures for radio-collaring, treatment and transport to be developed to ensure animal health and safety during such operations.

4.8.1 Post capture management of elephant

Post-capture management of elephant includes knowing the position of the captured animal (captured through immobilization), monitoring physiological parameters and transportation of the animal. Currently, most of the capture of elephants is done through immobilization.

- The first & foremost thing after immobilisation of the elephant is to restrain it securely in a comfortable position to maintain airway.
- Following drug induction, the elephant should be approached (from the rear) keeping safety in mind.
- Post capture health examination and monitoring of the immobilized elephant is mandatory.
- The physiological parameters (temperature, respiration, pulse and colour of mucous membrane) need constant monitoring, as these are likely to be compromised during chemical capture.
- Any significant deviation in normal physiological parameters may be dealt with appropriately.

Health Examination post capture & Critical monitoring of the immobilized elephant:

- Once the elephant is properly positioned, the veterinarian should examine its health status and monitor its vital signs (pulse, respiration rate, temperature, blood oxygen level etc). Accordingly, it may be decided whether the radio collaring or capture operation will continue or the animal needs to be revived due to some complication/health emergency, and released.

Transportation post capture:

- The animals may be transported in specially designed vehicles or large containers (for long distance) or on foot (for short distance).
- The vehicle may be designed considering the animal's weight, adequate ventilation options (containers), sound non-slippery floor, provision of drainage to facilitate disposal of waste etc.
- The animal needs to be appropriately secured in the vehicle and necessary transport considerations should be in place during transit.
- Alternatively, the animal can be hoisted on the vehicle using slings/ropes/belts taking due anatomical and physiological considerations strictly under veterinary supervision and using a skilled crane operator.
- Stops *enroute* may be pre-planned and identified well in advance aimed at achieving the shortest journey time possible and ensuring safety and wellbeing of the animal.
- The animal needs to be regularly monitored for signs of discomfort or stress during the entire journey period by veterinary professional, and the elephant maintained in a sedated state.

- Koonkies, if available, may be used in moving / pushing the animal into the vehicle/ container.

Food and water during transportation:

- It is better to avoid provisioning of feed and water during overnight transport and efforts may be made to reach the destination (release site/ elephant camp/ designated facility) as early as possible taking due care of vehicle speed and halting destinations.
- Water should be made available to the animal during transportation especially on hot journeys exceeding 6 hrs and should also be at hand to control possible hyperthermia of recumbent animals.

4.8.2 Release essentials (housing & sanitation)

- Relocated elephants may be fitted with GPS-based collars to monitor their movement with the option of recapturing them in case they again come into conflict.
- The site of release to be at sufficient distance (typically of the order of 200-300 km or greater) such that it is unlikely that the elephant would be familiar with the new site and attempt to go back to the place of capture.
- "Soft release" options can also be experimented with; this would involve keeping the animal in a stockade for some limited time period at the proposed site of release before letting it free.
- The animals may be monitored for any transport injuries or any other health-related issues following release.
- The release sites should have proper off-loading facility and release to be done with the least possible stress on the elephants.
- Following release in native habitats, it is necessary to monitor the behaviour of the animal/s and its interaction with the other herbivores
- The animal should be monitored post-release, for injuries, wounds, ill-health and disease such as nervous, locomotive or digestive disturbance by team of veterinary professionals, biologist and manager during the initial period.
- There is also a need for long-term monitoring of the health of the released individual/ population.
- In some instances, the best option or the only option may be to retain the captured elephant or elephants in captivity, especially if the animal has killed people or the risks of release into the wild are too high. If elephants are retained in captivity, it is essential to consider their proper welfare and utilization.
- In case destined for captivity, the animal should be held in fenced enclosure/ Kraal. This would provide chances for the animal to recover from anaesthetics, in getting acclimatized to its surroundings at new destination and provide opportunities for intensive monitoring and veterinary management.

Housing & Sanitation:

- In case the elephant is required to be kept in captivity, the space provided to the elephant should be as per the guidelines issued by the PE division, MoEF&CC.
- Proper sanitation and hygiene should be maintained to avoid chances of infection.
- Adequate balanced food and water should be made available along with mineral and vitamin supplements as per the health status of the elephant.

Health Screening:

- A general health screening once a week should be done and a thorough health examination to be done at least once in a month. Bi-monthly foot dip, foot care and nail trimming to be carried out to prevent foot problems. In case of suspicion of some serious health condition, samples to

be collected and sent to institutes like Indian Veterinary Research Institute (IVRI) etc. for more advanced investigations.

4.8.3 Rehabilitation of the captured elephant

- In the case of elephants brought into captivity temporarily for treatment, their release post treatment should take into consideration their past record in conflict.
- Elephants that have a record of high conflict cannot be released back as they are more habituated to humans when compared to the elephants not causing serious conflict; and can be released back with adequate monitoring.
- States having wild elephant population may envisage at least one elephant rescue and rehabilitation centre and should follow CZA guidelines for their management.
- Efforts to be envisaged to ensure that Rescue and Rehabilitation Centres for elephants as well as housing facilities for captive elephants are maintained properly to avoid complaints about cruelty/ ill treatment of elephants.

4.8.4 Rescue and raising of orphaned/ strayed elephant in conflict

When a herd is chased by humans, sometimes the calf within the herd is abandoned as it will not be able to catch up with the other members of the herd or it can fall into a pit after being chased. Also, if the mother dies from fatal retaliation, electrocution or falling into a pit, the calf will end up an orphan. If mother and calf are translocated to another landscape and the mother dies from reasons like stress, the calf will end up an orphan.

- The rescued calf should be raised under guidance of a veterinarian by an experienced senior/dedicated mahout. It should be handled only by one mahout with full precautions about hand hygiene and hygiene of the room/enclosure in which the calf is housed.
- For young calves below the age of 1 year, the constant presence (24x7) of the mahout is critical as stress of separation can very adversely affect its survival. If there are adult female elephants in the facility and one of them is tolerant to the calf, then the calf should be raised in its presence as the female will act as a foster mother.
- The calves should not be exposed to humans as they have a weak immunity and may contract the diseases quickly.

4.8.5 Radio collaring or tagging (RFID-microchip) the captured elephant

Radio collars are important for HEC mitigation with the objective of understanding ranging behaviour and other studies.

- Ranging behaviour studies will help to better understand how and why certain elephants come into conflict and help the development of customized conflict mitigation measures including RRT deployment, aversion conditioning, barriers, community awareness about preventive behaviours/actions, etc. These studies will also help to ascertain the effectiveness of mitigation methods and also in understanding how elephants respond to these methods and how these methods impact elephants.
- Radio collaring may also facilitate enhancing the effectiveness and efficiency of the response teams, as using real-time location information from satellite collars can help RRTs to intervene early and stop elephants from coming into conflict.
- It is useful to radio collar an injured elephant to monitor it systematically for medical intervention over an extended period of time.
- RFID microchips may be used for tagging of all captured wild elephants brought to captivity.

4.9 OCCUPATIONAL HEALTH SAFETY MEASURES & ADDRESSING HEALTH EMERGENCIES

The primary goal of an occupational health and safety measures is good coordination and teamwork amongst members, towards a common goal, preventing exposure and reducing the risk of occupational hazards, thereby contributing to the success of the HEC operations.

The following elements are essential components of an effective occupational health and safety program:

4.9.1 Hazard and risk assessment

Understanding potential hazards that are inherent to HEC management such as likely injuries from handling animals, exposure to scheduled wildlife restraint drugs, allergens, or zoonosis and to ascertain the level of risk and determine preventive and control measures required in different HEC situation.

Team members participating in HEC mitigation may be assessed for their fitness based on the following: a) the extent and level of participation in occupational health and safety training programme for dealing with wild animals especially elephants; b) the susceptibility of the personnel; and c) the past history of occupational illness or injury when dealing with conflict.

Personal hygiene

- The team members should follow the personal hygiene protocol by maintaining cleanliness and hygiene; having suitable clothing, gloves, masks, head covers, coats, coveralls, shoe covers, etc. when dealing with the animal; hand-washing and changing clothes where ever necessary; and carrying out procedures so as to minimize risks of splashes, spills, and generation of aerosols

Veterinary facility for treatment of injured animals

- Personnel involved in medical management in veterinary hospital or make shift field hospital must understand the chemical and biological dangers associated with the facility and keep the facility clean and ensure that emergency safety devices are easily accessible and in working order.
- While loading dart gun with chemicals and drugs, avoid spill over and careless handling; wash hands after handling infectious material; decontaminate all contaminated materials before disposal or reuse including surfaces following any spill of bio-hazardous materials.

Personal protection

- Use Personal Protective Equipment (PPE) including clothing, shoes, shoe covers, gloves, arm protectors, masks, face shields, respirators and any other item that may be needed.

Medical evaluation and preventive medicine for personnel

- Comply with medical evaluations for high-risk positions and those with substantial contact with animals and comply with immunizations, and vaccinations for personnel dealing with HEC.

Personnel training

- Personnel must learn general safety rules, safe operating procedures, ergonomic hazards and training for specific protocols and must be aware of their specific role and duties and the hazards associated with those duties (such as zoonosis, chemical/physical hazards and allergies, etc).
- Training must provide personnel with information about levels of risk associated with working with animals and personal health conditions including implementing safety precautions.

Record keeping

- Maintain record on medical history, past accidents, exposure and injuries and pre-existing health conditions of all personnel including reference materials.

4.9.2 OHS measures during pre-capture, capture and handling of animals

In the context of HEC, a hazard is the inherent danger involved in capture, tranquilization and translocation of a wild animal in conflict and risk is a measure of the likelihood of a drastic consequence arising from wild animal restraint/ handling and inherent hazard of such operation.

Potential hazard situations

The management of elephants in conflict with humans occurs in agriculture-horticulture-forest landscape, involving a variety of hazards ranging from diverse natural terrain (dense forest, marshland, aquatic ecosystem, mountains with rugged terrain etc) adverse weather conditions, exposure to disease and deployment of equipment.

The potential hazard associated with HEC mitigation includes physical hazards, chemicals hazards, zoonosis, allergies from wild animals (elephants), ergonomics and infectious agents.

- *Physical Hazards:* The use of variety of equipment in difficult rugged terrain with inclement weather (risks of slipping and falling) requires due care and caution as accidental injuries due to unsafe mechanical conditions of equipment for restraint of elephants, transport and communication may occur. Besides harm from occupational hygiene, (hyperthermia and hypothermia), injuries from handling animals (kicks, scratches, and bites etc) are likely to occur.
- *Chemical Hazards:* Personnel involved in HEC mitigation are exposed to chemical hazards during animal capture and rescue operation. Some of the potential chemical hazards for personnel include the exposure to drugs and chemicals used in field operations (scheduled restraint drugs, disinfectants, pharmaceuticals etc).
- *Biological Hazards:* The biological hazards constituting risks to personnel includes, disease causing pathogens, toxic plants, harmful algal blooms, waterborne exposures and diseases, venomous animals and insects etc.
- *Physiological and Psychological Factors:* The personnel managing conflict are exposed to conditions leading to, fatigue, anxiety, psychosomatic disorders, stress, trauma, allergies and vulnerability to pre-existing conditions (Congenital Heart Defect (CHD), hypertension, locomotor disorders etc). These personnel must not engage in any activity likely to harm them.
- *Zoonotic diseases based on pathogenic organism:* The personnel managing conflict are vulnerable to bacterial infections (Bacterial, Rickettsial and Chlamydial diseases - Anthrax, Brucellosis, Leptospirosis etc), viral infections (Rabies, Nipah virus infection, Influenza type A, Kyasanur forest disease (KFD), Viral hepatitis etc) Fungal diseases (Aspergillosis etc) Parasitic diseases- (Leishmaniasis, Toxoplasmosis, Trypanosomiasis etc). Zoonotic disease can be transmitted from different animal taxa and should take precaution and due care.

Hazard analysis

- The information from hazard analysis, will determine appropriate use of standard precautions, personal protective equipment, and workplace safety and health programme to minimize or mitigate risks. Hazard analysis will provide inputs for preventing and eliminating hazards, reducing injuries and illnesses, reducing high compensation costs, and increasing productivity.

HEC Mitigation Personnel - Vulnerability to Hazard and Risks

The HEC mitigation involves a large number of personnel with pre-assigned tasks, requiring coordination amongst team members supported by adequate training and capacity building to perform tasks. The HEC mitigation team are grouped below according to the specific function and duties and their vulnerability to the hazards and risks:

- *Administration team*: (personnel manning administrative offices and control rooms) who do not have direct/substantial animal contact in their daily task and functions, but who may need to visit field operations in the course of their duty are placed in low-risk category and

should report of any medical condition for which medical examination and treatment are required.

- *Wild animal tracking and surveillance teams:* (frontline HEC mitigation workers) are vulnerable to animal attack (high risk) while tracking and surveillance of animal and the injuries could take the form of bites, sprains, scratches and in extreme case body disfigurement, bone fracture and deep grievous injuries and sometimes death. The infectious agents from animal fluids and faeces can cause exposure to bacteria, fungi, parasites, protozoa, rickettsia, viruses, bloodborne pathogens.
- *Veterinary team*: (veterinarians, paramedics, biologist, animal keeper) who do have direct/ substantial animal contact in their task and functions are vulnerable (high risk) to bites, sprains, scratches from animal handling, burns, skin irritations, inhalation, ingestion from chemical agent's zoonotic diseases acquired from animals, allergies from animal urine, contaminated litter, dander, hair & exposure to bacteria, fungi, parasites, protozoa, rickettsia, viruses, blood borne pathogens.
- *Logistics team*: (handling transport, communication, equipment) are also vulnerable to animal attack (medium risk) and have direct/moderate animal contact in their task and functions relating to capture of animals, placing them in cages/kraal and transport to rescue facility and release location. They are moderately prone to all hazards as given above for veterinary team.

4.9.3 OHS measures for human health & safety during handling and transport

Following measure may be implemented for avoiding, reducing, or eliminating exposure to hazards/risks:

- Avail services of veterinarians with knowledge and competency on capture, tranquilisation and translocation of elephants.
- Animal handling during rescue operation should follow the hygiene protocol; and animal transportation to be done using appropriate vehicle with provision of food and water and maintain slow constant speed to avoid any injury to the animal.
- Ensure all field personnel are in good physical and mental condition with preventive vaccinations and other prophylactic measures; and personnel should be familiar with emergency procedures and co-ordinate with appropriate public health, veterinary, medical, and emergency services.
- Personal protective equipment should be worn to avoid any injury/infection and use equipment well maintained for smooth performance.
- Some zoonotic diseases can be prevented by appropriate immunizations or vaccinations; wearing gloves and protective clothing when handling species with zoonotic disease potential; participate in medical consultations and surveillance; avoid high-risk animals and situations.
- Follow strict protocols for handling and transport of animals; collection and handling of samples; Personal Protection Equipment (PPE); disinfection; decontamination; proper training in use, handling, maintenance and disposal of equipment, firearms, chemicals, and drugs involved in the HEC operations; protocols of vaccination and prophylactic measures.
- Participate in training programme on animal handling, personal hygiene, disinfectants use, basic first aid and cardiopulmonary resuscitation (CPR), bio-hazardous waste management, equipment maintenance and safety devices, emergency procedures, reporting protocol of accidents and exposures to zoonosis and conduct hands on practical and mock drills.

4.9.4 Addressing human health emergencies

Identification of health emergencies

- The frontline staffs of forest department and staff of other departments and institutions can often find themselves in situations where they may be harmed during patrolling, where they may be unexpectedly confronted by an elephant or even during wildlife rescues or other HEC mitigation operations. They may also be attacked by a mob that may be reacting to the death or injury caused to humans by an elephant that may have inadvertently strayed into a habitation. It is also not very uncommon for the frontline staff to be electrocuted by an illegal electric fence.

Addressing health emergencies

- Emergency situations may need to be addressed at different levels, i.e., on site treatment through first aid and then possible transfer to local hospitals and in case of special needs/seriousness of injuries-advanced specialised hospitals. Operating procedures may be laid down in each forest division/district to ensure timely coordination amongst the various response teams.

On-site Support

- Staff members, who are trained in administering first aid, basic life support training and basic emergency support, may be deployed; fully equipped ambulance with oxygen supply and first aid kit with required medicines and other important items may be provided; and ready budget for meeting emergencies/ quick local purchases of medicines/ services including directory of contact numbers of nearby healthcare centres may be maintained.

Special case of addressing medical emergencies during crowd management

- Any crowd-related incident in a typical HEC situation will manifest into two kinds of medical emergencies which includes human mortality and physical trauma injuries. The cause of human deaths and trauma injuries in such situations is mainly attributed to: stampede at or in the vicinity of the incident spot; assault by an unruly crowd on the animal, resulting in the animal attacking the crowd; animal/s initiating an attack/assault on the crowd; use of force to disperse or control crowd; accidental firing of arms; and panic attacks to people who are claustrophobic.
- The designate Medical Response Teams on-site may activate the first aid and medical response plan and initiate primary first aid/treatment procedures for the injured people at the incident site; the designate Crowd Control Response Team (police and emergency services) on-site may escort uninjured people to safer havens/areas; and the designate Veterinary/Response Teams (veterinary and forest) on-site may control the movement of the animal/animals by effective tranquilisation and capture procedures in order to contain further injury to people.
- The triage protocol, especially in a mass casualty situation like a stampede, may be immediately deployed by trained personnel of the Quick Medical Response Teams/ Designated Health/ Medical Teams on-site to facilitate segregation of people with minor and major trauma injuries.
- Depending on the nature of the physical injury, first aid and basic life support, including cardiopulmonary resuscitation (CPR)), may be administered to the injured people by trained and authorized personnel. People with major injuries and life-threatening conditions may be immediately transferred in an ambulance/ support vehicle to the nearest health/hospital facility.

During transportation

- The ideal transportation and evacuation may be carried out within minutes or in the shortest possible time so that the injured person can be treated in the 'Golden Hour'. For this, it would be essential to have identified routes, ambulances and support vehicles with a resource inventory of paramedics, health personnel, quick medical response teams (QRMTs) and drivers.
- An adequate mechanism to prioritise the transport of critically injured persons by designated air ambulances may be developed as well. An inventory may be maintained for all emergency evacuation services, emergency medical personnel and paramedics.

Off-site Support

- Financial responsibility for treatment including medical treatment at hospitals along with tie-ups with local hospitals.
- Tapping NGO schemes, if available, for (a) treatments at super-speciality hospitals for critical situations (disfigurement, plastic surgery, organ transplants etc), (b) for meeting treatment costs at local hospitals and (c) for ex gratia support to nominees in case of death of staff members.
- Counselling and psychological support in case of severe trauma and psychological problems that may arise from strenuous field conditions (remote locations, etc.) and challenging field circumstances (occasional violent/dangerous confrontations with elephant etc.)

4.9.5 Addressing elephant health and veterinary emergencies

Identification of wildlife Health emergencies

- *Self-Inflicted injuries* caused due to panic and stress while trying to escape
- *Accidental Injuries* caused due to difficult terrain, hidden traps, snares, electric fences, pits, etc
- *Human-Inflicted injuries* includes retaliatory attacks, injuries caused due to inappropriate physical or chemical capture methods, internal haemorrhage or organ rupture due to darting, overdosing or underdosing of immobilisation drugs, mishandling of immobilised animals, improper positioning resulting in choking, bloating, lung compression and aspiration of gastric contents.
- *Stress related wildlife health emergencies* includes shock, anxiety, restlessness, capture myopathy, arrhythmia, respiratory distress, cardiac arrest, etc.

Addressing wildlife health emergencies on-site

- Ensure ABC (airway, breathing & circulation); measure the vital parameters like respiration, heart rate, pulse, temperature and blood pressure; stabilise the animal using the available resources; give antidote for any complication due to overdosing or an allergic response to the drug used; check if any excessive bleeding is seen; maintain the airway open; look for any external injuries like cuts, wounds and burns; and infuse fluid/rehydrate if animal is dehydrated and compromised.
- Respiratory stimulants and small oxygen cans may be used in case of respiratory arrest, if available, in your first aid kit by/under the guidance of a qualified veterinarian.
- Place the animal in a comfortable position under minimal required safe physical/chemical restrain to eliminate chances of animal hurting itself or the treating team; prepare the animal for transport to the nearest well equipped veterinary healthcare centre if the condition is critical on-site.

Addressing Veterinary Health Emergencies during transportation

- A qualified trained veterinarian along with his/her assistant may accompany the animal either in an ambulance or in a separate vehicle following the ambulance. The ambulance speed may not be high as to cause stress and injury to the animal. Sudden jerks may be avoided.
- The transportation box may be properly secured in the ambulance, and its size may be such as not to allow turning or involuntary rolling of the animal sidewards or back and forth inside the box, causing further panic and injuries.
- Transport the animal only after providing first aid and stabilising it. The veterinarian may keep monitoring the vitals at regular intervals and continue providing fluids and oxygen if

required. Top up the tranquiliser/sedative drug so as to maintain the animal in a stress-free, calm position.

4.9.6 Zoonosis and One health approach

- One Health is a collaborative, multi-sectoral and trans-disciplinary approach—working at the local, regional, national and global levels—with the goal of achieving optimal health outcomes, recognising the interconnection between people, animals, plants and their shared environment.

Key Stakeholders

- The personnel involved in human–wildlife interactions–such as the Rapid Response Teams, rescue team members, veterinarians, veterinary assistants, patrolling forest staff, mahouts, and wild animal attendants in rescue centres and elephant camps, as well as public health personnel are vulnerable to a variety of zoonotic diseases that can be transmitted from animals to humans, apart from the risk of disease transmission from humans to wildlife.

Key Measures to be implemented to Operationalise the One Health Approach

- The basic approach may be to integrate the concept of One Health, which links human and animal health in a shared environment into all the operations and HEC mitigation measures in the field.
- Veterinary capacities and infrastructure may be upgraded to facilitate disease monitoring in elephant populations, for both wildlife conservation and to prevent the spread of zoonotic diseases to livestock and human populations and vice versa.
- A well-formulated Wildlife Health Management and Disease Surveillance Plan may be developed and One Health guidelines developed by national and international organisations such as WHO, FAO and OIE and existing regulations such as IHR (International Health Regulations) may be followed as per their applicability in different situations.
- An effective disease surveillance and disease reporting system may be developed, including standardised protocols:
  - A disease surveillance programme may be carried out by the forest/wildlife department in collaboration with the medical health and animal husbandry departments.
  - Important zoonotic diseases may be identified and prioritised according to their epidemiological patterns.
  - Approved safety protocols (wearing PPE, prevention of occupational health hazards) may be followed during the collection, handling, conducting of investigations, packing and despatching of biological samples.
  - A coordination mechanism may be developed between forest and wildlife, veterinary and public health agencies, wildlife biologists, environmentalists and scientists/researchers for carrying out field programmes and operations.
- The institutional structures at the district level, viz., District-Level Coordination Committee (DLCC), may be used for facilitating integration of the One Health approach into the landscape and district-/division-level planning.

4.9.7 Competency-Development of Personnel Responsible for Health Emergencies

- A One Health approach may be adopted when planning and implementing training measures to prevent the spread of zoonotic diseases during HEC mitigation operations at sites where increased human–wildlife–domestic animal interactions take place.
- Each forest division may standardise occupational health and safety protocols and integrate them with the operations of selected RRTs, including training programmes and procurement of disposable accessories/basic equipment needed for such training programmes. These RRTs may coordinate with the RRTs under the IDSP of the Ministry of Health, Government of India.

- Community-based institutions, panchayats, farmers and women may be facilitated in strengthening their capacities to reduce the negative impacts of HEC as well as those of zoonotic and other emerging diseases.
- CPR and basic life-support training may be provided to all personnel of the field response teams by forest departments in cooperation with training institutions from the wildlife and veterinary sector, with a focus on occupational health and safety and animal welfare.
- DLCC may facilitate joint training of the raid response teams from the forest department, IDSP, teams from the district administration, and other field teams of relevant departments and agencies, civil defence volunteers and home guards, casualty services personnel, local medical teams and other hospital staff, on regular basis.

4.10 ECONOMICS AND EFFICACY OF HEC MITIGATION MEASURES

The complexity of the problem of human elephant conflict makes it necessary to bring together ecological knowledge and economic data in order to develop an effective multidimensional strategy to reduce the interaction between elephants and human settlements, thereby minimizing the scope for HEC, promoting the conservation of natural areas and improving quality of life for people.

- There is a need to evaluate the relative merits of alternative approaches to HEC, ranging from ameliorative measures, such as ex gratia payments, to measures that reduce conflict; in particular, efficacy of physical barriers, elephant capture, and behaviour-based initiatives to influence the movement of elephants away from human settlements.
- The goal should be to develop a framework to assess and evaluate the ecosystem services delivered by elephants and their habitats at various degrees of degradation including developing ratio of benefits to costs in using physical barriers to reduce HEC and also knowing whether the ratio differs substantially across geographical territories.

4.10.1 Socio-economic impact and calculation of areas affected

Peoples' responses to human-elephant conflict in different regions is not independent of their social processes. The overall responses depend a great deal on not just their fear or love of elephants but also on whether they have the economic and social ability to take steps to avoid that conflict. These differences become quite critical when we consider that the areas under consideration are very different socially and economically.

- The boundaries of areas that are expected to be protected by physical barriers should be arrived at by using evidence of conflict such as ex-gratia payments by the forest department to the farmers affected by crop raid. It is known that the conflict, quite predictably, declines as we move away from the forest boundaries and the intensity and frequency of crop raid incidents is more in farms that are closer to the forest boundaries.
- After demarcating areas expected to be protected by physical barriers, the probability of elephant human conflict occurring in any village on a given day needs to be calculated. Probabilities may be calculated for time periods before and after the construction of the barriers.

4.10.2 Status of physical barriers

The efficacy of barriers has been mixed, as observed from the increase or decrease in the compensation paid by the Forest Department in areas where barriers have been implemented.

- There are several reasons for these barriers being ineffective, such as: poor maintenance of EPTs and solar fences; EPTs not conducive to high rainfall areas, where they routinely get filled up and many a time the sides collapse, creating tracks for elephants to easily cross over; elephants attempt to push the side walls and fill up trenches; and elephants have also figured out how to breach electric fences, by pushing trees and logs over fences, or using tusks and foot pads, which are poor conductors, to push and snap the wires.
- This has led the Forest Department to consider stronger barrier options, such as stone walls with spikes on them and barriers made out of discarded railway tracks or a combination of steel rope fencing and power-fencing etc.

- In regions that witness high intensity human-elephant conflict, it is not uncommon for the management to maintain multiple layers of barriers. Factors such as substrate type, topography, ownership, annual precipitation, local density of elephants, local peoples' dependence on the forest, and other factors, may influence the type of barrier for a locality.
- Breaches and breaks in physical barriers could potentially render them permeable to elephants, thus defeating their very purpose. Breaches in barriers are bound to occur due to a suite of induced and natural reasons. For effective management of HEC, it is crucial to periodically assess the breaches in the barriers and mend them.

4.10.3 Evaluation of costs and benefits of barriers

The conceptualization of conflict tends to centre around two elements: divergence of interests and incompatibility of actions. The strategy to mitigate HEC has typically focused primarily on reducing the scope for incompatible actions. The effort is thus primarily to reduce the scope for interaction between wild elephants and areas with human settlements. This was traditionally achieved by providing both people and elephants their autonomous space. The current emphasis on physical and psychological barriers is a continuation of this approach to mitigating conflict.

- In order to see whether the costs of effective physical barriers are justified by the benefit of reduced human-elephant conflict, we need to estimate both the costs of physical barriers as well as the benefit of avoiding the costs of HEC that have been prevented by the barriers.
- In calculating the costs of physical barriers, we need to first take into account the cost of constructing these barriers. These costs will depend on a variety of factors, such as design (for instance, number of strands in an electric fence) and terrain (nature of soil and rock for excavating a trench), but an important consideration is the length of the barrier. The concern is both existence and effectiveness of the barrier. The effectiveness is not determined by its length alone. Some terrains may require a longer physical barrier to effectively keep elephants out of human habitations, while other terrains may be able to achieve the same result with shorter barriers.
- The effectiveness of the barriers would also depend on whether, and how frequently, they have been breached. The breaches need not be made only by elephants. Local people are often dependent on the forests for a variety of needs, from cattle grazing and firewood collection at one end and the pursuit of spirituality at the other extreme. People thus sometimes have reason to breach the barriers too.
- A meaningful unit for measuring the value of barriers/fences would then be the cost per kilometre of the barrier as well as the cost of protecting a square kilometre of area. In making this calculation, it must be recognized that the level of HEC is not static over time. Other factors, like growth in the elephant population and human encroachments into forests, also play their role.
- The relevant comparison after the barriers, then, is not with the levels of conflict before the barriers were put up, but with the levels of conflict that would have existed if no action was taken. Thus, we need to first extrapolate trends in HEC to the period after the physical barriers were created and then compare those levels of conflict with what actually exists to capture the effectiveness of the barriers. This probability-based estimate of the effectiveness of the barriers can be used through what we call an efficiency variable.
- Based on patterns of conflict, a spatial map of the likelihood of conflict for the region needs to be obtained, thereby generating the probability of conflict. Such probabilities are particularly useful to evaluate the effectiveness of physical barriers, as it takes into account the whole range of possibilities, from the impossibility of conflict to a very high probability.
- The cost side of the benefit-cost equation is the total cost spent on construction of the fixed barriers divided by the area that the fixed barrier is expected to protect. On the benefit side, there is a need to look beyond monetary indicators of the costs of conflict and emphasize the larger economic, social and cultural contexts.

- Thus, the evaluation of these benefits is in terms of a larger set of ecosystem services. This is of importance, as an emphasis is placed on the negative impact of HEC on human well-being. Consequently, the removal or reduction of this conflict will be a positive ecosystem service. The task then is reduced to one of estimating the costs of HEC and treating the reduction of these costs as a positive benefit that can be compared with the costs of creating physical barriers.
- Total Economic Value (TEV) is a method that can be used to provide the economic value of both the material and non-material elements of HEC. As this method takes the economic model beyond the material, it can identify different types of economic values neglected by the market. The advantage of using a valuation of ecosystems approach is that it helps assess overall contribution of ecosystems to social and economic well-being.

4.10.4 Cost-Benefit ratio of barriers as a means of reducing HEC

- In considering the empirical reality of the field where the HEC occurs, the various variables can be modified to reflect the on-ground reality of the conflict. Thus, the factors that can be identified in the empirical reality of HEC are: (i) damage to crops and property; (ii) reduced access to forest produce and forest water; (iii) change in land value; (iv) costs of access to spiritual elements within the forest; (v) costs of moving away from a preferred proximity to the forest; (vi) costs associated with overall health; (vii) fear of elephants (as a net effect of existence, bequest, altruistic values, as well as fear of elephants); (viii) abandonment of farming; (ix) change in soil fertility; (x) tapping of alternate sources of income. The total sum of all these individual variables per square kilometre is the total benefit that is to be obtained from reducing HEC per square kilometre. But this is only the total value if the conflict were reduced to zero. Hence, only the proportion of conflict that has resulted from actual reduction is to be taken into consideration. The real benefit-cost ratio can be obtained through taking these variables into consideration and then multiplying them by the proportion of actual benefits of reduction in HEC.
- The final ratio obtained for the different regions highlights the specific localized nature of the HEC. What emerges from the final ratios is the level to which the whole exercise is sensitive to the extent to which ecosystem services are accounted for. Observing the conflict in terms of material benefits alone does not justify the costs of the physical barriers. Savings on consumptive costs are then very small when compared to the costs per kilometre of effective physical barriers. However, once the ecosystem services are brought in, this gets dramatically reversed. From this, it can be inferred that the benefits from other ecosystem services per square kilometre due to reduction in HEC is greater than the costs associated with construction of physical barriers. Such a conclusion, however, needs to be tempered by a more realistic consideration of which ecosystem services are meaningful in such evaluations, as well as more comprehensive cost analysis of the barriers themselves and their efficacy.

4.11 MONITORING AND EVALUATION

Monitoring and evaluation (M&E) in the context of human-elephant conflict (HEC) is crucial for understanding the dynamics of these conflicts, assessing the effectiveness of mitigation measures, and informing future strategies. HEC occurs when elephants and human activities overlap, leading to conflicts that can result in economic losses, damage to property, and, in some cases, human and elephant fatalities. Monitoring and evaluation protocols can be implemented in the context of HEC as under:

- *Data Collection:* Establish a system for reporting and recording incidents of human-elephant conflict which could include damage to crops, property, injuries, and fatalities; and use spatial data (GIS) to map conflict hotspots, migration routes of elephants, and human settlements.
- *Behavioural Studies:* Study the behaviour of elephants, including their movement patterns, feeding habits, and responses to different stimuli and understand human activities that contribute to conflicts, such as agricultural practices, land-use changes, or settlement patterns.

- *Impact Assessment:* Evaluate the economic losses incurred by local communities due to HEC like damage to crops, property, and the cost of mitigation measures; and assess the social impact on communities, considering factors like stress, displacement, and changes in daily life due to conflict.
- *Mitigation Measures:* Evaluate the effectiveness of existing mitigation measures, such as elephant corridors, fences, early warning systems, and community-based approaches; and continuously adapt and innovate mitigation strategies based on the evaluation results.
- *Community Involvement:* Involve local communities in monitoring and reporting incidents and gather feedback from affected communities to understand their perspectives on the effectiveness of mitigation measures and identify areas for improvement.
- *Policy and Planning:* Assess the effectiveness of existing policies related to wildlife conservation and human-elephant conflict management and develop long-term plans based on M&E results, incorporating sustainable land-use planning and conservation strategies.
- *Education and Awareness:* Implement educational programs to raise awareness about human-elephant conflict and promote coexistence and provide training for local communities on how to respond to conflict situations.
- *Research and Innovation:* Explore and integrate new technologies, such as sensor-based monitoring systems, drones, or early warning technologies, to enhance data collection and response capabilities.

Regular and systematic monitoring and evaluation in the context of human-elephant conflict are essential for developing evidence-based strategies that balance the needs of both humans and elephants while promoting coexistence.

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CHAPTER-5 ECOLOGICAL SUSTAINABLE DEVELOPMENT

5.1 TRIBAL CONSIDERATIONS AND OTHER FOREST DWELLERS IN THE ELEPHANT RESERVE

India is home to a diverse array of tribal communities, each with its own distinct culture, language, and way of life. The situation and status of tribal communities varies widely across different regions of India. Government policies and initiatives, as well as ongoing social and economic changes, continue to shape the lives of these communities.

5.1.1 Background information

Tribal considerations within elephant reserves in India are complex and often involve a delicate balance between conservation goals and the rights and livelihoods of tribal communities. Many protected areas and forests in India are inhabited by indigenous or local tribal communities who have been traditionally dependent on these lands for their livelihoods. Some key considerations include:

- *Traditional Dependence:* Tribal communities often have a deep historical and cultural connection to the land within elephant reserves. These communities often rely on the resources within these areas for their livelihoods, including agriculture, hunting, fishing, and gathering.
- *Conservation vs. Livelihood:* There can be conflicts between conservation goals and the livelihood needs of tribal communities. Advocates argue that traditional tribal practices can be sustainable and contribute to biodiversity conservation.
- *Legal Framework:* The Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights) Act, 2006 (commonly known as FRA), recognizes the rights of tribal communities and other traditional forest dwellers over forest lands.
- *Relocation Issues:* In some cases, efforts to protect biodiversity have led to the displacement of tribal communities from their ancestral lands. The process of resettlement raises concerns about the loss of traditional lifestyles and livelihoods.
- *Participation and Consent:* Meaningful involvement of tribal communities in decision-making processes related to elephant reserves is crucial. Principles like Free, Prior, and Informed Consent (FPIC) are increasingly recognized as essential for any initiatives that affect tribal lands and resources.
- *Cultural Heritage:* Efforts should be made to preserve the cultural heritage of tribal communities living in or around protected areas and elephant reserves. Assessments should consider the cultural impact of conservation policies on tribal communities.
- *Development Initiatives:* Balancing conservation with sustainable development initiatives that benefit both wildlife and local communities is a goal. Exploring and implementing alternative livelihood options for tribal communities to reduce dependence on traditional practices within elephant reserves.
- *Ethnographic Studies:* Understanding the socio-cultural dynamics of tribal communities within the elephant reserves through ethnographic studies and recognizing and documenting traditional knowledge of tribal communities regarding biodiversity and ecosystem management, is crucial.

The issue of tribal considerations within elephant reserves is dynamic and involves a multidimensional approach that seeks to address the rights, needs, and aspirations of tribal communities while ensuring the sustainable conservation of natural resources.

5.1.2 Forest Rights of forest dwelling ST&OFD in the Elephant Reserve

The Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of Rights) Act 2006 (FRA) was enacted with the aim at addressing the “historic injustice” that was meted out to the forest dwellers by recognising forest land, resources, and resource management and conservation rights

of the forest dwelling communities. The implementation of the Act in general and especially in the Protected Areas (PA) and Elephant Reserves (ER) is to be taken up in its earnest spirit.

As regards the status of implementation of FRA in the ERs especially PAs, following issues need to be addressed-

i. Extent to which Individual Forest Rights (IFR), Community Rights (CR) and Community Forest Resources (CFR) etc. have been recognised under Sec. 3(1) of FRA, 2006
ii. Extent to which Strategies have been planned under Sec. 5 of FRA, 2006 & Committee constituted under rule 4(e) of FR Rules 2007 for protection of wildlife, forests & biodiversity
iii. Extent to which rights in Sanctuaries under Sec. 24(2)(c) of WLPA 1972 have been recognised
iv. Extent to which provision of Sec. 38 V (4) (i) & (ii) of WLPA 1972 has been implemented
v. Extent to which provisions of Sec. 38 V (5) (i) to (vi) of WLPA 1972 & Sec. 4 (2) (a) to (f) of FRA 2006 have been implemented in the PAs of the ERs.

Individual Forest Rights: right to hold and live in the forest land under the individual or common occupation for habitation or for self-cultivation for livelihood by a member or members of a forest dwelling Scheduled Tribe or other traditional forest dwellers [Sec. 3 (1) (a)]

Community Forest Rights: community rights such as nistar; right of ownership, access to collect, use, and dispose of minor forest produce; other community rights of uses or entitlements; community tenures of habitat and habitation; rights of settlement and conversion; rights to protect, regenerate or conserve or manage any community forest resource; rights which are recognised under any State law or laws; right of access to biodiversity and community right to intellectual property and traditional knowledge; any other traditional right customarily enjoyed by the forest dwelling Scheduled Tribes or other traditional forest dwellers [Sec. 3 (1) (b), (c), (d), (e), (h), (i), (j), (k) and (l)]

Community Resource Management: means customary common forest land within the traditional or customary boundaries of the village or seasonal use of landscape in the case of pastoral communities, including reserved forests, protected forests and protected areas such as Sanctuaries and National Parks to which the community had traditional access [Sec. 2 (a)]

5.1.3 Delineation of Critical Wildlife Habitat (CWH)

"Critical Wildlife Habitat" (CWH) as per Sec 2 (b) of the FRA means such areas of National Parks and Sanctuaries where it has been specifically and clearly established, case by case, on the basis of scientific and objective criteria, that such areas are required to be kept as inviolate for the purposes of wildlife conservation as may be determined and notified by the Central Government (MoEF&CC) after open process of consultation by an Expert Committee, which includes experts from the locality appointed by that Government wherein a representative of the MoTA shall also be included, in determining such areas according to the procedural requirements arising from Sec 4 (1) and (2); thus implying CWH can be established only after completion of Sec 3 & 6 of FRA.

Criteria and Process for declaring CWH:

Guidelines for the notification of Critical Wildlife Habitats within National Parks and Wildlife Sanctuaries has been provided vide MoEF&CC F. No.1-23/2014WL dated 4-1-2018, and procedure for determining and notifying inviolate areas as required by the FRA 2006 has been detailed.

Recognition, Restoration and Vesting of Rights:

As per Recognition, Restoration and Vesting of Forest Rights and related matters [Sec. 4 (1) & (2)], Central Government recognises and vests forest rights in the forest dwelling Scheduled Tribes and the other traditional forest dwellers as mentioned in section 3.

The forest rights recognised under this Act in critical wildlife habitats of National Parks and Sanctuaries may subsequently be modified or resettled, provided that no forest rights holders shall be resettled or have their rights in any manner affected for the purposes of creating inviolate areas for wildlife conservation except in case all the following conditions are satisfied, namely: -

- the process of recognition and vesting of rights as per Sec 6 is completed;
- holders of forest rights shall cause irreversible damage and threaten the existence of species and their habitat;
- other reasonable option such as co-existence is not available;

- resettlement or alternative package has been prepared and communicated;
- free informed consent of Gram Sabha has been obtained in writing;
- facilities and land allocation at location site is complete as per promised package;

However, forest rights cannot continue in the National Park as per Sec 35(3) read with 24(2)(c) of the WLPA 1972.

Constitution of Expert Committee (EC):

As authorized under Sec 2(b) of the FRA, the Chief Wildlife Warden with the approval of State/UT shall notify an expert committee for identification of CWH in the National Park and Wildlife Sanctuary with the concerned CCF having jurisdiction as Chairperson and representative of MoTA, one social scientist, two experts on life sciences, and concerned Panchayat President/ Sarpanch or representative as members with officer (i/c) of NP/WLS as member secretary.

Identification of CWH:

The criterion and indicators of CWH would vary in context of standalone PA or when part of TR or ER. Unlike Critical Tiger Habitat (CTH) where focus is only on tiger; CWH in respect of Wildlife would also include aquatic & land vegetation, besides animals.

- The Expert Committee shall identify areas within the NP/WLS required to be kept inviolate for the purpose of wildlife conservation and the said Committee may conduct necessary field visits and undertake identification of CWH, based on scientific and objective criteria relevant to the NP/WLS.
- The Expert Committee shall adopt an open process of consultations with, the forest rights holders, in their local precincts, to solicit their views on the proposed notification of CWH.
- The open process of consultation (public notice) needs to be structured based on the scientific & objective assessment; area(s) to be notified; implications on forest right; options on resettlement & rehabilitation; human wildlife conflict issues etc.
- The record of the proceedings of the Committee shall be maintained for submission to the Ministry of Environment Forest and Climate Change along with the proposal for notification of CWH.
- Establishing CWH as 'inviolate' would involve delineating the area considering socio-ecological requirements of animals including its viability and dispersal without distorting the natural prey-predator ecological cycle in the habitat (scientific assessment).
- Consider the activities or impact of forest right holders upon wildlife and its habitat in terms of current pressures and future demands on forest resources as the same may cause irreversible damage and threaten the existence of species and its habitat (objective assessment).
- Consider the activities or impact of forest right holders in terms of present and future levels of human-wildlife conflict to evaluate the long-term viability of residing and earning livelihood within the area of the CWH by the local communities (objective assessment).
- No other option exists for mutual co-existence viz. grazing impact, 'zoonosis', space competition, biomass removal etc & would threat mitigation and incorporation in Community Forest Resources Management Plan be sufficient to exclude areas from CWH (scientific / objective assessment).
- A CWH may extend to the entire area comprising a National Park or Wildlife Sanctuary, or only a part of it, as is scientifically and objectively determined by the Expert Committee.
- The CWH has to be determined on case-to-case basis u/s 2(b) of FRA and therefore should be limited to forest right holders' area.

Challenges and Way Forward:

- CWH can only be established after completion of Sec 3 & 6 of FRA and Gram Sabha constitutes Committee under Rule 4 (1) (e) & prepares a conservation and management plan under Rule 4 (1) (f) to regulate community forest resources as per Sec 5 (a) & (d) of FRA.
- As per NTCA order dt 28-3-17 no rights in Core or CTH under Sec 38V (4) (i) in the absence of guidelines for CWH. For Buffer or Peripheral area under Sec 38V (4) (ii), co-

existence to be determined as per scientific and objective criteria in consultation with Gram Sabha and EC.

- Procedure for declaration of Core/ CTH & Buffer of Tiger Reserve in the ER needs to be followed as per 38-V (4) of WLPA and 4 (1) & (2) of FRA including voluntary relocation.
- CWH would vary in context of standalone PAs or when part of Tiger Reserve in the ER.

As a Way Forward, it is essential to strike a balance between conservation objectives and the rights of forest-dwelling communities when declaring inviolate areas.

5.1.4 Voluntary Relocation of Tribal settlements

The voluntary relocation of tribal settlements is a complex and sensitive issue that often involves considerations related to development, conservation, and the rights and well-being of indigenous or tribal communities.

- Save as for voluntary relocation on mutually agreed terms and conditions, provided that such terms and conditions satisfy the requirements laid down in Sec 38-V (5) of the WLPA and Sec 4 (2) of the FRA, no Scheduled Tribes or other forest dwellers shall be resettled or have their rights adversely affected for the purpose of creating inviolate areas unless-
  - the process of recognition and determination of rights and acquisition of land or forest rights of the Scheduled Tribes and such other forest dwelling persons is complete;
  - establishes with the consent of the ST&OFD, that the activities or the impact of their presence upon wild animals is sufficient to cause irreversible damage and shall threaten wildlife and their habitat;
  - the State Government, after obtaining the consent of the ST&OFD inhabiting the area, has come to a conclusion that other reasonable options of co-existence, are not available;
  - resettlement or alternative package has been prepared providing for livelihood for the affected individuals as per National Relief & Rehabilitation Policy including fair compensation;
  - the informed consent of the Gram Sabha concerned, and free, prior and informed consent (FPIC) of the persons affected, to the resettlement programme has been obtained; and
  - the facilities and land allocation at the resettlement location are provided under the said programme, otherwise their existing rights shall not be interfered with.
- Efforts should be made to assess and mitigate the potential impact of relocation on the cultural practices, traditions, and identity of the affected communities.
- Rehabilitation measures should be in place to ensure that relocated communities have access to essential services, education, healthcare, housing and livelihood opportunities.
- Thorough social & environmental impact assessments should be conducted before any relocation to understand the potential consequences on both the affected community and the environment.
- Involvement of experts and NGOs specializing in human rights, indigenous rights, and environmental issues can contribute to a more comprehensive and equitable relocation process.
- The post-relocation phase should be monitored to ensure that the rights and well-being of relocated communities are safeguarded.

5.1.5 Synergy between Forest Rights and Joint Forest Management

Sec 3 (1) (i) of the FRA provides for the rights to protect, regenerate or conserve or manage any community forest resource on all forest lands which the Scheduled Tribes and other traditional forest dwellers have been traditionally protecting and conserving for sustainable use.

As per Sec 5 of the FRA, the holders of any forest right/ Gram Sabha are empowered to protect the wild life, forest and biodiversity; ensure that adjoining catchments area, water sources and other ecological sensitive areas are adequately protected; ensure that the habitat of ST&OFD is preserved from any form of destructive practices affecting their cultural and natural heritage; and ensure that the decisions taken in the Gram Sabha to regulate access to community forest

resources and stop any activity which adversely affects the wild animals, forest and the biodiversity are complied with.

Under Rule 12 (1) (g) of the FRA, the Forest Rights Committee shall, after due intimation to the concerned claimant and the Forest Department prepare a community forest resource map with recognizable land marks. The delineation of community forest resource may include existing legal boundaries such as reserve forest, protected forest, National Parks and Sanctuaries and such delineation shall formalize and recognize the powers of the community in access, conservation and sustainable use of such community forest resources.

The Forest Rights Act (FRA) and Joint Forest Management (JFM) can potentially complement each other, leading to a synergistic approach in forest governance.

- Both FRA and JFM emphasize the involvement of local communities in forest management.
- By integrating the principles of FRA with the collaborative efforts of JFM, there can be a more holistic approach to forest management that balances the needs of local communities with ecological conservation.
- Together, these approaches can contribute to the socio-economic development of forest-dependent communities while ensuring the sustainable use of forest resources.
- Involving local communities in decision-making, can help prevent conflicts between the forest department and communities by fostering collaboration and mutual understanding.
- Recognizing and protecting the rights of communities, can provide an additional layer of protection for biodiversity, as local communities are often the best stewards of their natural environment.

While there is potential for synergy, successful integration requires careful planning, and coordination to the principles of both FRA & JFM. Collaboration between government agencies, local communities, and other stakeholders is crucial for achieving a balanced and sustainable approach to forest governance.

5.1.6 Identify departments, agencies, institutions, NGOs to create a support system

Creating a support system for the effective implementation of the Forest Rights Act in an elephant reserve involves collaboration among various departments, agencies, institutions, and non-governmental organizations (NGOs).

The key entities that can contribute to the support system, include:

1. *Ministry of Tribal Affairs:* Responsible for the overall implementation and monitoring of tribal welfare and development, including the Forest Rights Act.
2. *State Tribal Welfare Departments:* Implementing and coordinating the Forest Rights Act at the state level, ensuring effective outreach and implementation of community forest rights.
3. *Ministry of Environment, Forest, and Climate Change:* Collaborating to ensure that forest conservation efforts align with the Forest Rights Act and the rights of forest-dwelling communities are recognized.
4. *State Forest Departments:* Collaborating with tribal welfare departments to implement the FRA while ensuring that forest conservation goals are not compromised.
5. *National Commission for Scheduled Tribes (NCST):* Monitoring the implementation of the Forest Rights Act to ensure the protection of the rights of Scheduled Tribes.
6. *National Human Rights Commission (NHRC):* Overseeing human rights issues related to the implementation of the FRA and ensuring that the rights of forest-dwelling communities are upheld.
7. *Forest Rights Committees (FRCs):* Local committees formed under the FRA at the village and community levels to facilitate the recognition of forest rights and these committees play a crucial role in the implementation process.
8. *Community-Based Organizations (CBOs) and NGOs:* Organizations working at the grassroots level to raise awareness, build capacity, and facilitate the filing of claims under the Forest Rights Act and NGOs can also provide legal support and advocacy for forest-dwelling communities.

9. *National Institute of Rural Development and Panchayati Raj (NIRDPR):* Offering training programs and capacity-building initiatives for local communities and stakeholders involved in the implementation of the FRA.
10. *Academic Institutions and Research Organizations:* Conducting research on the socio-economic aspects of forest-dwelling communities and providing evidence-based recommendations for effective policy implementation.
11. *Land Revenue Departments:* Collaborating to address land tenure issues and ensure that land rights are duly recognized and integrated with the Forest Rights Act.
12. *State Rural Development Departments:* Coordinating with tribal welfare departments to implement community development programs that align with the Forest Rights Act.
13. *National Tiger Conservation Authority (NTCA) and State Wildlife Boards:* Collaborating to ensure that the Forest Rights Act is implemented without compromising wildlife conservation goals in tiger reserves or other protected areas within the elephant reserve.
14. *Media and Communication Agencies:* Disseminating information about the Forest Rights Act to raise awareness among forest-dwelling communities and the general public.

A collaborative and multi-stakeholder approach involving these entities can contribute to the effective implementation of the Forest Rights Act in the context of elephant reserves, ensuring the recognition and protection of the rights of forest-dwelling communities while considering conservation goals.

5.1.7 Review and monitor programmes

Reviewing and monitoring programs related to the FRA in an elephant reserve is essential to ensure the effective implementation of the Act, protection of the rights of forest-dwelling communities, and the sustainable coexistence of communities and wildlife. The key considerations for reviewing and monitoring FRA programs in the context of an elephant reserve include:

- Set up a robust monitoring framework involving relevant government departments, NGOs, local communities, and independent bodies and define clear indicators and benchmarks for assessing the progress and impact of FRA programs.
- Collect comprehensive data on the implementation of FRA programs, including the number of claims filed, approved, and rejected and document success stories, challenges faced, and lessons learned in the process.
- Ensure the active participation of forest-dwelling communities in the monitoring process and establish mechanisms for feedback and consultation to incorporate their perspectives.
- Verify that the implementation of FRA programs is in compliance with the provisions of the Forest Rights Act and associated guidelines and address any legal or procedural issues that may hinder the effective implementation of the Act.
- Regularly review the status of individual and community forest rights claims and ensure that the processing of claims is timely, transparent, and adheres to the legal requirements of the FRA.
- Monitor and address conflicts arising from the implementation of FRA programs, especially those related to overlapping land use and potential impacts on wildlife conservation.
- Evaluate how FRA programs align with wildlife conservation goals, especially in the context of an elephant reserve and identify measures to balance the recognition of forest rights with the protection of critical wildlife habitats.
- Assess the impact of FRA programs on local biodiversity and ecosystems and consider conducting biodiversity impact assessments to understand the ecological implications of community forest rights.
- Establish a reporting system to provide regular updates on the progress of FRA implementation and share reports with relevant stakeholders, government agencies, and the public.
- Embrace an adaptive management approach by incorporating lessons learned from monitoring into the ongoing implementation of FRA programs and modify strategies based on evolving needs and changing circumstances.

- Assess the availability and effectiveness of legal support services provided to forest-dwelling communities during the FRA process and address any barriers to accessing legal assistance.
- Ensure gender-sensitive monitoring to assess the impact of FRA programs on women and marginalized groups and promote gender equity in the recognition of forest rights.
- Coordinate FRA monitoring efforts with programs focused on elephant conservation in the reserve and foster collaboration to address shared challenges and goals.
- Identify successful models and practices within FRA programs and explore opportunities to scale them up for broader impact and share best practices with other regions or reserves.

By consistently reviewing and monitoring FRA programs in the elephant reserve, it is possible to identify areas for improvement, address challenges, and ensure that the Forest Rights Act contributes positively to the well-being of forest-dwelling communities while maintaining ecological balance within the reserve.

5.2. ECOTOURISM, INTERPRETATION AND CONSERVATION EDUCATION

Ecotourism is defined as "responsible travel to natural areas that conserves the environment, sustains the well-being of the local people, and involves interpretation and education" (The International Ecotourism Society 2015).

The Ecotourism planning is essential as it will provide the broad framework for promotion and development of ecotourism in the Elephant Reserve in a planned and scientific manner. The plan envisages visit to natural areas with minimal impact, enriching the visitors' experience and provide livelihood opportunities to the local communities wherever feasible.

5.2.1 General Principles of Ecotourism

- Ecotourism must respect the intrinsic value of natural resources and should not result in the degradation of the environment by overuse, rather should contribute to the conservation.
- Visitors should be offered first-hand educational experiences about the local environment and cultural life of the communities; encourage environmentally friendly behaviour of tourists and the host communities; and ensuring visitors' expectations within sustainable norms.
- All stakeholders (host community, government, non-governmental organizations, industry, and tourists) must be involved and encouraged to develop partnerships including responsible marketing and promotion.
- The plan should ensure short-term and long-term benefits – in terms of nature conservation and well-being of local communities including support to the local economy and livelihood.

5.2.2 Goal of Ecotourism

To create ecotourism opportunities for strengthening the conservation of the rich natural and cultural heritage in the Elephant Reserve and enhancing sustainable livelihoods of the dependent communities.

5.2.3 Objectives of Ecotourism

- To identify, promote and develop natural areas as ecotourism destinations
- To develop ecotourism on each site based on the carrying capacity and to regulate the influx of visitors within the threshold level to preserve the sanctity of site
- To promote ecofriendly infrastructure in conformity with the guiding principles
- To facilitate partnerships between all stakeholders to develop, promote and maintain ecotourism sites
- To create livelihood opportunities and share benefits with the local communities for their support to conservation

- To build capacity of all stakeholders in interpreting the natural and cultural attributes of the sites, develop hospitality ethics and to provide quality visitors' experience
- To evolve site specific code of conduct for visitor behaviour and sustainable tourism
- To promote nature conservation through education, creating awareness and enhance visitor learning experience for conservation
- To develop monitoring and evaluation protocols for periodical assessment of the impact of ecotourism on forests, wildlife, communities and to gain insight on visitors' satisfaction

5.2.4 Key Aspects of Ecotourism

- *Biodiversity conservation:* The host community actively collaborates with the forest department and other agencies, and shares the responsibility to protect the forest and other natural resources.
- *Learning prospects:* Visitors not only appreciate the nature but get an opportunity to learn about the importance of nature and biodiversity.
- *Clean environment:* Tourists always expect clean and pollution free environment, in majority cases the tourists never like to revisit the polluted or degraded destinations.
- *Livelihood diversification:* Creates opportunities to improve and diversify the livelihoods of the local communities through creating new jobs related to ecotourism services.
- *Local culture and traditional knowledge:* Facilitates learning about the local cultural practices and knowledge, instils pride in the host communities, results in the revival of some cultural practices.
- *Responsible behaviour:* Emphasizes responsible behaviours/ action in terms of conservation on the part of the visiting tourists and also the hosting local communities.
- *Group-based enterprises:* Supports small groups by small scale village-based business to produce handicrafts, organic products, traditional food shops etc.
- *Low-cost tourism promotion:* Encourages to use local products, ensures the lowest possible consumption of non-renewable resources, less expenses to meet, boarding, lodging etc.
- *Community participation:* Insists community participation, ownership, employ local people, business opportunities, equity in sharing the benefits and no leakage of economic benefits etc.
- *Gender mainstreaming:* Insists the active participation of women members and youths from the communities.

5.2.5 Ecotourism Resources

- *Natural attractions:* sites of unique landscapes, particular scenic spots, game viewing, bird watching, coastal environments, wetlands, backwaters, coral reefs, fishing and snorkelling, mountain climbing and trekking tours, camping in the forests, on the mountain, unique flora, fauna, and trail routes in the forests.
- *Cultural attractions:* Cultural landscapes (e.g. rice terraces, multi-layered millet farms, organic agriculture), architecture that reflect the traditional life style, typical huts. Traditional performing arts such as storytelling, folk songs, folk dances, folk theatre and games etc. Traditional recipes, processing methods, herbal medicines, and village festivals. Visit to see the production of handicrafts items. Participating in the ceremonies, visit to the sacred grooves, other sacred sites, and gathering forest products.
- *Eco-destination characteristics:*
    - Natural features conserved within a protected landscape. Evidence that tourism is not harming natural systems such as waterways, coastal areas, wetlands and wildlife areas.
    - Low density development, where natural areas are abundant and the built landscape does not dominate.
    - Small, thriving community businesses, including food stands and other types of craft enterprises owned by local people.

- Plenty of designated outdoor recreation zones that are designed to protect fragile resources, including bike paths, trails or boardwalks that are shared by locals and visitors alike.
- Thriving, locally owned lodges, restaurants and businesses that provide genuine hospitality with friendly, motivated staff.
- A variety of local festivals and events that demonstrate an on-going sense of pride in the local community's natural environment and cultural heritage.
- Clean and basic public facilities for tourists and locals to share, such as toilets.
- Friendly interaction between local people and visitors in natural meeting places, such as local shops and markets, or benches along river banks.

5.2.6 Ecological Concerns and Carrying Capacity

Ecological concerns: While ecotourism has the potential to contribute to conservation efforts and sustainable development, it also raises several ecological concerns that need careful consideration. Some of the key ecological concerns associated with ecotourism development include:

- *Habitat Disturbance:* Increased human activity in ecotourism areas can lead to habitat disturbance and degradation. Trampling, pollution, and infrastructure development can disrupt local ecosystems, affecting plant and animal species and their habitats.
- *Wildlife Disturbance:* Unregulated tourism can lead to disturbance of wildlife. Direct contact with humans can alter animal behaviour, cause stress, and impact breeding and feeding patterns. This disturbance can be particularly detrimental to species that are sensitive to human presence.
- *Overcrowding:* High visitor numbers in popular ecotourism destinations can result in overcrowding leading to increased stress on local ecosystems and wildlife, and impacting visitor experience.
- *Resource Consumption:* Ecotourism infrastructure, such as hotels, resorts, and transportation, can place a strain on local resources such as water, energy etc. Improper waste disposal and resource extraction can have long-term negative effects on the environment.
- *Invasive Species:* Tourists may inadvertently introduce invasive species to ecotourism destinations, either through their clothing, equipment, or unintentional transport leading to ecosystem imbalances.
- *Climate Change Impact:* Ecotourism destinations are often vulnerable to climate change and extreme weather events, changing temperatures, and sea-level rise can directly impact local ecosystems, as well as the infrastructure and communities that support ecotourism.
- *Trails and Infrastructure Development:* The construction of trails, roads, and other infrastructure to support ecotourism can lead to habitat fragmentation and alteration and this can also isolate populations of wildlife, disrupt migration routes, and contribute to biodiversity loss.

To address these concerns, it is crucial to implement and enforce sustainable tourism practices, conduct thorough environmental impact assessments, involve local communities in decision-making processes, and promote responsible tourism behaviour among visitors.

Carrying capacity: in the context of ecotourism refers to the maximum number of visitors that a natural area can sustain over the long term without causing significant negative impacts on the environment. Determining and managing carrying capacity is crucial for ensuring that ecotourism remains sustainable, preserves biodiversity, and minimizes adverse effects on ecosystems.

- *Environmental Impact Assessment:* Before establishing an ecotourism destination, it is essential to conduct a comprehensive environmental impact assessment (EIA) which should evaluate the potential impacts of tourism activities on the local ecosystem, wildlife, and natural resources.
- *Visitor Limits:* Carrying capacity is often expressed as a limit on the number of visitors allowed in a specific area during a given time period and this limit is based on the ecological, social, and infrastructural capacity of the destination. Setting and enforcing visitor limits help prevent overuse and degradation of the natural environment.

- *Infrastructure Planning:* Sustainable ecotourism development involves careful planning of infrastructure to support visitor activities which includes designing and maintaining trails, campsites, and other facilities to minimize ecological impact. Adequate waste management and sanitation facilities are also critical to prevent pollution.
- *Seasonal Adjustments:* Carrying capacity may vary depending on the season. Some areas might be more sensitive to visitor impact during specific times, such as breeding seasons for wildlife or periods of extreme weather. Adjusting visitor limits seasonally can help protect the ecosystem during vulnerable times.
- *Community Involvement:* Engaging local communities in ecotourism planning and management is crucial as often they have valuable knowledge about the environment and can contribute to decisions regarding carrying capacity. Involving communities also helps ensure that tourism benefits are shared, leading to improved livelihoods and a partnership in conservation.
- *Educational Programs:* Implementing educational programs for visitors can foster a sense of responsibility and encourage sustainable behaviour. Educated visitors are more likely to follow guidelines, minimize their impact, and appreciate the importance of preserving environment.
- *Adaptive Management:* Carrying capacity is not a fixed value and may need adjustment over time. Implementing adaptive management strategies allows for ongoing assessment / modification of tourism practices based on changing conditions, information and evolving ecological dynamics.

By carefully managing carrying capacity, ecotourism can strike a balance between promoting economic development, preserving natural ecosystems, and providing meaningful and low-impact experiences.

Already, we have norms for calculation of the carrying capacity of visitors and vehicles as well as residential facilities in respect of the tiger reserves and similar norms may be framed for the protected areas and forest divisions as per site-specific conditions within the elephant reserve.

5.2.7 Guiding principles

All ecotourism activities shall be in conformity with the laws of the land including the Van Sanrakshan Evam Samvardhan Adhiniyam, 1980, Indian Forest Act, 1927, Environment (Protection) Act, 1986 and Wildlife (Protection) Act, 1972 including the guidelines issued by National Tiger Conservation Authority, and MoEF&CC.

The following guiding principles shall be the basis for development of ecotourism in the ER:

5.2.7.1 Planning for Conservation of Natural and Cultural Diversity

- Ecotourism sites will be identified by assessing the potential of sites based on criteria including the site's unique significance, resource availability, vulnerability, logistics. This assessment shall be the essential prerequisite for development of sites and formulation of Plan.
- There are certain divisions in the ER with low ecotourism potential and require special attention to identify ecotourism activities and will be done with the help of local communities to promote ecotourism. The activities for each ecotourism site shall be identified based on the natural resource potential and its impact.
- Ecotourism activities will be open for all sections of visitors without compromising on the conservation of natural/cultural resources of the area and respect for local customs and traditions. The safety norms for the visitors to the site are to be in conformity with the standard protocol.
- Ecotourism sites can be used as important means to conserve the unique cultural traditions associated with the biodiversity of the area. The local resources, traditional knowledge, folk history, culture & architecture would thus be preserved for posterity. The large number of visitors to temples/ cultural sites during the festival season would be regulated as per the existing laws.

5.2.7.2 Developing Sustainable / Community-based Ecotourism

- The emphasis of ecotourism plan shall be on the active involvement of the local communities for their empowerment and socio-economic upliftment. The economic

benefits of ecotourism shall be an incentive to the participating communities to conserve the natural heritage of ER.

- Community based Ecotourism (CBET) refers more specifically to tourism activities or enterprises that involve local communities, occur on their lands, and are based on their cultural and natural assets and attractions, therefore CBET focuses on travel to areas with natural attractions, and which contributes to environmental conservation and local livelihoods.
- Communities must develop awareness and capacity to participate and manage ecotourism projects. They need develop essential skill on management, hosting the visitors, guiding them, and also communication skills to interact and serve the visitors. This could be achieved through organizing workshops, training sessions and exposure visits to the best performing sites.
- It will be crucially important for all ecotourism initiatives to be developed under the auspices of community institutions, usually EDCs or VFCs supplemented with SHGs. For this purpose, the communities living in villages located in sites falling in and around sanctuaries will be constituted into EDCs and those in the forest divisions as VFCs. These institutions will be registered under the Societies Registration Act. Those managing facilities or leading activities should be employed by the community corpus, so that profits accrue to the benefit of the community.

5.2.7.3 Community Participation

- CBET aims to ensure active participation of the local communities and advocates for the high degree of control over the activities, management system and the revenue generated. One of the key principles for successful ecotourism is active role played by the local community in the preparation of action plan, implementation process, and decision-making.
- Formation of village-based groups is an important aspect in the proposed participatory management approach. Village level groups like Eco tourism management committee (ETMC) and self-help groups may be formed to manage tourist services introduced or to produce the handicraft items etc. The management structure, expected roles of the members of the groups, operational methods etc may be decided through participatory methods.
- Local community may be allowed to generate revenue through collecting taxes to visit the site of attraction. Earn money through managing the infrastructures developed for the visiting tourists.
- The local community benefits from small trade like managing eco lodges, promotion of local enterprises like food shops, providing transportation facilities, shops/households to sell handicraft items and accompany the visitors as local guides. Profits made through ecotourism should be retained by the local communities not exported from the local site.
- Ensure equity principle in sharing of benefits received through ecotourism project particularly with women and the poor. It is crucial to promote and sustain local enthusiasm and achieve cooperation from the entire community.
- Community-based ecotourism encourages active women's participation. This can be done through mobilizing women, providing representation, creating new employment opportunities to the women members, developing them as entrepreneurs to manage small scale eco business.
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5.2.7.4 Building Infrastructural Support

The concept of sustainable tourism shall be the guiding principle for development of infrastructure and promotion of any activity. Creation and development of institutional and infrastructural support at ecotourism destinations with least impact on natural resources and local culture shall be the priority.

- The existing infrastructure and facilities should merge with the landscape. Locally available material should be used without extensive concrete structures. The development of additional ecotourism infrastructure should primarily be located outside the forest, however semi-permanent and eco-friendly infrastructures may be set up within the ecotourism site.

Ecotourism should promote energy efficient and ecologically sustainable infrastructure as well as practices to minimize the carbon foot print. The waste should be disposed in an appropriate manner and recycling would be adopted to minimize environmental pollution.

- **Criteria for Eco-hut facilities / Eco-lodges**
  - It conserves the surrounding environment, both natural and cultural.
  - It has minimal impact on the natural surroundings during construction. Use local architecture and building materials (bamboo, rattan, wood, locally made bricks or stone).
  - It fits into its specific physical and cultural contexts through careful attention to form, landscape and colour, as well as the use of localised architecture.
  - It uses alternative, sustainable means of water acquisition and reduces water consumption.
  - It provides careful handling and disposal of solid waste and sewage.
  - It meets its energy needs through passive design and combines these with their modern counterparts for greater sustainability. Install solar energy to meet some power needs.
  - It endeavours to work together with the local community through employment, use of locally produced items etc.
  - It offers interpretative programmes to educate both its employees and tourists about the surrounding natural and cultural environments.

5.2.7.5 Partnership and Multi-Stakeholders approach

Ecotourism has to be managed and promoted through partnership and co-operation between all stakeholders, viz., Local communities, NGOs, tour operators, tour agents, home stay operators, hospitality industry and the government organizations. Multi stakeholder partnership is envisaged to develop ecotourism infrastructure and products in partnership with local community and private enterprises, wherever feasible, in order to ensure long-term sustainability of ecotourism.

- Organizing a stakeholders' meeting at the beginning helps the stakeholders to know about the objectives, get a clear picture about their respective roles in the project and their interests. It is important to strengthen links between private operators and local communities; local tour operators play a paramount role, in promotion, product development, quality and needs of the visitors. Continuous dialogue between stakeholders could help eliminate the communication gap.
- **List of the local stakeholders:** Local communities, elected Panchayats, local tour operators, banks supporting local enterprises, SHG leaders, team of performing artists, local NGOs etc.
- **List of regional stakeholders:** Government departments like Forests, Tourism, Public Works, Tribal, Hindu Religious & Charitable Endowments etc, private tour operators, travel agents etc.

The coordination and networking between the local and regional stakeholders for management, promotion and marketing of ecotourism destination and products is necessary for sustainable ecotourism.

5.2.7.6 Creating Awareness & Capacity Building

Ecotourism can act as tool for education and awareness as well as to generate public support for conservation. Each site needs to be developed in such a way, as to maximize the potential for raising awareness amongst large sections of the local people and those visiting the site.

Also, the capacity of the local communities and the forest staff involved in ecotourism activities has to be strengthened on a continuous basis to ensure responsible and sustainable tourism. Similarly, various outreach and awareness programmes should also be continuously undertaken for other stakeholders.

- Organizing consultative meetings with the community at the initial stages of the project, helps to raise awareness about the objectives of ecotourism and get support/ cooperation from the members of the communities.

- To promote long term conservation, emphasis has to be given on raising awareness amongst school children and youth.
- Ecotourism is a new concept to the local communities; therefore, they need awareness, develop local leadership to manage, entrepreneurial skills, and required organization structure to manage the activities. Lack of man power could result in the failure of the CBET project, hence creating awareness and building the required capacity is important to promote successful ecotourism.
- Good local guides, who are good in their knowledge, know their subject, need training on how to present it. Learning through good practices can facilitate sustainable ecotourism on areas such as: village-based accommodation and home stay programmes; use of local produce and traditional dishes; and handicraft production and sales.
- NGO partners in the project play crucial role in the capacity building process. A training plan prepared based on the training need analysis could help to systematically develop the required skills and capacities with the support of the experienced trainers and resource persons.

5.2.7.7 Building Framework of Standards and Norms

Criteria and Indicators serve as important tools to plan and manage ecotourism sites in a responsible and sustainable manner. Criteria define the essential elements against which sustainability of Ecotourism at a site is to be assessed, with due consideration paid to natural and cultural diversity.

- Monitoring and evaluation frameworks shall be based on the criteria & indicators approach and when applied to assess an ecotourism site, it will determine the sustainability level of site and the remedial measures that needs to be adopted.
- Criteria & indicators for each site are to be developed separately before the commencement of activities. The assessments of ecotourism sites will indicate the viability of site as a sustainable unit and it would be prudent to discontinue sites which are economically and/or ecologically unviable.

5.2.8 The Strategies

The strategy may be in conformity with the guiding principles and is a means to achieve the objectives.

5.2.8.1 Identification of Ecotourism Zone and Zonation

Zonation, a management entity, allows a science-based and pragmatic approach to landscape level planning for conservation. Identifying an ecotourism zone involves a systematic assessment of natural, cultural, and recreational attributes to determine if an area has the potential for sustainable tourism development. The key aspects in the identification process include:

- *Biodiversity Assessment:* Evaluate the area's biodiversity, including plant and animal species, ecosystems, and unique natural features which can indicate ecotourism potential.
- *Landscape Features:* Assess the scenic beauty, geological formations, and other natural features that could attract visitors interested in nature-based experiences.
- *Cultural Heritage Assessment:* Sites with archaeological importance, traditional knowledge, or cultural practices may add value to the ecotourism experience.
- *Local Communities:* Assess the relationship between the area and local communities, including their traditions, lifestyles, and willingness to participate in ecotourism initiatives.
- *Accessibility:* Evaluate the ease of access to the area, considering transportation options and existing infrastructure. Accessible locations are more likely to attract visitors and support tourism.
- *Existing Infrastructure:* Examine the availability of infrastructure such as trails, accommodation, and visitor centres. Adequate infrastructure is essential for managing visitor flow.
- *Market Demand:* Analyse the market demand for ecotourism experiences in the region. Assess whether there is a potential market interested in nature-based, sustainable tourism activities.

- *Local Interest:* Examine the interest and support for ecotourism among local communities, businesses, and government authorities.
- *Land Use Planning:* Review existing land use, zoning regulations and identify areas with conservation value and potential for low-impact recreational activities/ ecotourism development.
- *EIA:* Conduct a thorough EIA to understand the potential effects of tourism on the ecosystem and identification of sensitive areas and development of sustainable management practices.
- *Community Consultation:* Engage with local communities, and other stakeholders to gather insights, address concerns, and ensure that the identification process is inclusive.
- *Economic Viability:* Assess the economic feasibility of ecotourism development and consider potential economic benefits, job creation, and revenue generation for local communities.

By carefully considering above factors, stakeholders can identify ecotourism zones inside elephant reserve that have the potential to provide meaningful experiences for visitors while promoting conservation, community development, and sustainability.

Zonation in ecotourism is a dynamic process that requires ongoing evaluation and adaptation. It helps strike a balance between conserving the natural environment, providing meaningful experiences for visitors, and supporting the well-being of local communities.

The development of Ecotourism in an Elephant reserve falling in different administrative and functional units, envisages:

- *Core Zone:* is dedicated primarily to the conservation, where limited or low-impact tourism is allowed till the development of ecotourism facilities and infrastructure in the buffer zone (10% of the area as per NTCA guidelines). This zone lies in the Elephant Conservation Zone and aims to preserve the natural habitat, protect endangered species, and maintain ecological processes without disturbance.
- *Buffer Zone:* acts as a protective barrier to minimize human impact on the core area where controlled and limited activities, such as ecotourism and environmental education, may be permitted. Infrastructure and visitor facilities are generally located in this zone. This zone lies in the Elephant Human Co-existence Zone.

The Ecotourism sub-zones envisaged in the Elephant Human Co-existence Zone are:

- *Recreation Zone:* is designated for low-impact recreational activities to provide visitors with opportunities for enjoyment like hiking, bird watching, and other nature-based activities. Care is taken to minimize the environmental impact, and trails and viewing platforms may be established.
- *Cultural Zone:* focuses on the preservation and promotion of cultural heritage associated with the area where cultural and educational activities, interpretive centres, and community engagement programs may be conducted to showcase the cultural significance of the region.
- *Visitor Services Zone:* houses necessary infrastructure and services to support visitors and accommodations, information centres, and other visitor services are located. It is designed to meet the needs of tourists while minimizing their impact on sensitive areas.
- *Community Development Zone:* supports the local community by providing opportunities for sustainable development community-based tourism initiatives, handicrafts, and other economic activities that benefit local residents may be encouraged in this zone.

5.2.8.2 Constitution of Ecotourism Management Societies/ Committees

- At the Division level, Ecotourism Management Societies (ETMS) may be established to promote, manage and regulate ecotourism sites through constitution of Ecotourism Management Committees (ETMC). The revenue generated from the ecotourism site in the Division may be ploughed back for development of the site and surplus may be used for the development of other sites and conservation related activities.
- The existing ETMCs may be integrated into the ecotourism federation at Elephant Reserve (ER) level. The federation may facilitate the development of ecotourism by implementation

of the ecotourism guidelines and ecotourism plan, coordinate with other stakeholders and monitor the allocation of funds and revenue generation.

5.2.8.3 Development of Ecotourism Management Plan in Elephant Reserve

A management plan may be developed for Ecotourism site / destination in the Elephant Reserve, with detailed SWOT analysis, maintaining a fine balance between conservation and tourism. Besides, the Ecotourism Plan may be made an integral part of the Management Plan of respective Protected Areas. In case of any conflict, the conservation of Protected Areas, Forests and Wildlife shall take precedence over ecotourism. For sites outside Protected Areas all ecotourism plans shall be in line with the prescriptions stated in the Working Plan.

A- Ecotourism in Tiger Reserves

In the Tiger Reserve, ecotourism development will be in conformity with the NTCA guidelines in F.No 15-31/2012-NTCA dated 15th October 2012 notified under section 38-O (1) (c) of the Wildlife (Protection) Act, 1972. These guidelines have distinct procedure for management of ecotourism and would form part of approved Tiger Conservation Plan of the Tiger Reserves.

- Proposed strategy /activities to be undertaken should have minimal impact on the wildlife and its habitat, while generating sustainable benefits to the local communities in the fringe areas. All stake holders in and around Tiger Reserves (residing within the Zone of influence) would be involved in Eco tourism activities.
- The Tiger Conservation Foundation (TCF), established in Tiger Reserves as per provisions of the Wildlife Protection (1972) Act, would be the sole organisation that would manage ecotourism infrastructure and running related facilities and gate receipts / income generated through the ecotourism activities, would be utilised for the specific conservation purposes.
- The Tiger Reserve shall have a Local Advisory Community (LAC), duly constituted by the State Government, for the purpose of advising State Government on issues concerning ecotourism, monitoring carrying capacity and facilities in the Tiger Reserve etc.
- Existing rights to visitations of the various places of worship located in the tiger reserves and the buffer areas would be recognized and regulated through the provisions as approved in the tiger conservation plan, along with sharing of revenue generated through temple tourism with local communities.
- Tourism Plan for each Tiger Reserve shall identify and monitor the ecologically sensitive areas surrounding tiger reserves, in order to ensure the ecological integrity of corridor and buffer areas; assess carrying capacity of the tiger reserve, at three levels; physical, real and effective and permissible carrying capacity of visitors and vehicles as well as residential facilities in and around the tiger reserve; area to be designated as 'ecotourism zone'; develop a participatory community-based tourism strategy to ensure long-term local-community benefit-sharing, and promotion of activities run by local communities; develop monitoring mechanisms to assess impact of tourism activities on the wildlife and its habitat so as to minimise them; develop generic guidelines for environmentally acceptable and culturally appropriate practices for all new constructions; set up lists of Do's and Don'ts for visitors etc.
- It should be the endeavour of Tiger Reserve to shift maximum tourism activities out of Core area to Buffer area. Foundation would be the coordinating agency over organised ecotourism in Buffer areas of Tiger Reserves which involves private tour operators, tribal communities, and hospitality industry: latter shall get approval for their tourism activities from respective Foundation, which should be in line with these guidelines.
- Tourism activities should not be permitted along identified Corridors, so that, dispersal of tigers, movement of elephants and other wildlife is not hindered.
- Non-consumptive regulated, low-impact tourism, could be permitted within core or critical tiger habitat (CTH) without in any way compromising the spirit of core/critical tiger habitat for tiger conservation to a maximum of 20% of the core or critical tiger habitat usage (not exceeding the present usage).
- All facilities functioning within Core areas shall be administered only by the respective Tiger Reserve management. No core area in a tiger reserve from which relocation has been carried out, shall in any way be used for tourism infrastructure.

- All tourism facilities located within the eco-sensitive zone in the context of the tiger reserve shall adhere to pollution norms (noise, solid waste, air and water etc.) under the respective laws or rules for the time being in force. Outdoor high intensity illumination shall not be utilized as it disturbs nocturnal habits of wild animals. The use of battery-operated vehicles may be encouraged to minimize pollution wherever terrain permits.
- Tourism infrastructure must conform to environment-friendly, low-impact, low height aesthetic architecture; renewable including solar energy, waste recycling, water management, natural cross-ventilation, no use of asbestos, discharge of only treated sewage, no air pollution, minimal outdoor lighting, and merging with the surrounding landscape.

B- Ecotourism in Protected Areas

- As per Sec 33 (a) of the Wildlife Protection Act 1972, the Chief Wild Life Warden shall be the authority who shall control, manage and maintain all sanctuaries and for that purpose, within the limits of any sanctuary, may construct such roads, bridges, buildings, fences or barrier gates, and carry out such other works as he may consider necessary for the purposes of such sanctuary; provided that no construction of commercial tourist lodges, hotels, zoos and safari parks shall be undertaken inside a sanctuary except with the prior approval of the National Board.
- Each Wildlife Sanctuary shall have an Advisory Committee (AC), duly constituted by the State Government under the provisions of section-33(B) of the Wildlife Protection Act, 1972 for the purpose of advising on measures to be taken for better conservation and management of the sanctuary including participation of the people living in and around the sanctuary. Rendering advice on Ecotourism, monitoring the carrying capacity and creation of various facilities comes under the purview of the Advisory Committee.
- Ecotourism activities to be undertaken would be subject to the sanction of a specific ecotourism plan forming part of approved Management Plan of the Protected Areas or otherwise exclusive Ecotourism Plan.
- As suggested in respect of Tiger Reserve, tourism zone needs to be delineated for the Protected Area and all prescriptions relevant for the Tiger Reserve are also applicable in respect of the Protected Area.

C- Ecotourism in Forest Divisions

- As per the Explanation of Sec 2 (1) (b) (vi) & (vii) of the Forest Conservation (Amendment) Act 2023, establishment of zoo and safaris referred to in the Wild Life (Protection) Act, 1972, owned by the Government or any authority, in forest areas other than protected areas; and ecotourism facilities included in the Forest Working Plan or Wildlife Management Plan or Tiger Conservation Plan or Working Scheme of that area are works relating to or ancillary to conservation, development and management of forests and wildlife and therefore do not attract Forest Conservation Act.
- Ecotourism activities to be undertaken would be subject to the sanction of a specific ecotourism plan forming part of approved Working Plan of the Forest division or otherwise exclusive Ecotourism Plan.
- Unlike Tiger Reserve or Protected Area, here focus could be more on the development of community-based ecotourism (CBET) and all tourism prescriptions relevant for the Tiger Reserve/ Protected Area could also be made applicable here.
- CBET is characterized by small scale outfits in relatively remote scenic locations with rich landscapes where the mass tourism is not established. The visitors generally stay in the few eco lodges available or with the local families if the practice of home stay exits.
- In CBET, the local communities are the care takers of the local environment. They organize accommodation for visitors, provide necessary services such as vehicles, boats for transportation, organize walking trails, prepare local foods, and produce unique handicraft items for the visitors to sell as souvenirs, organize shows of traditional performing arts. This active participation ensures that the profits/benefits stay with the local communities.
- It is emphasized that if tribal communities reside in the area, they may be encouraged and supported in participating process and share responsibilities in the management of eco-tourism activities. By sharing their knowledge about the local terrain, ecology, and cultural

practices with the visitors, the communities develop a sense of pride and respect to their culture.

5.2.8.4 Infrastructure Development and Visitor Services

Infrastructure development in ecotourism is a critical component for creating a positive and sustainable visitor experience while minimizing environmental impact. Well-designed infrastructure helps manage visitor flow, provides necessary services, and contributes to the conservation of natural resources.

When developing infrastructure in ecotourism, it's crucial to prioritize sustainability, conservation, and the well-being of both the natural environment and local communities. Collaboration with environmental experts, local stakeholders, and community members is essential for achieving a balance between visitor services and ecological preservation.

The key aspects of infrastructure development in ecotourism, particularly focusing on visitor services, include:

- *Visitor Centres:* could be designed with eco-friendly materials incorporating energy-efficient systems, and using preferably renewable energy sources. It provides information, orientation, and interpretation to the visitors through interactive displays, maps, educational materials, and staff.
- *Boardwalks:* allows controlled access for visitors to explore natural areas without causing damage through well-laid boardwalks, and interpretive signs using durable and environmentally friendly materials.
- *Viewing Platforms and Observation Areas:* provide safe locations and viewing scopes for visitors to observe wildlife and scenic vistas by construction of elevated platforms that blend with the natural surroundings and the number of platforms is restricted to avoid habitat disruption. The area also provides for interpretive signage in the area.
- *Accommodations:* envisages lodging options for visitors through eco-friendly lodges, cabins, or tents with low environmental impact using locally sourced materials and employing energy and water conservation measures and waste recycling programs.
- *Restrooms and Sanitation Facilities:* includes well-maintained restrooms, waste disposal, and hygiene facilities using water-saving fixtures, eco-friendly sanitation solutions, and proper waste management systems and provides clean and accessible facilities for visitors.
- *Parking Facilities:* includes designated parking areas with proper signage and traffic management for accommodating vehicles of visitors while minimizing environmental impact and use permeable surfaces to reduce runoff.
- *Nature Trails:* is used to educate visitors about the ecological and cultural significance of the area through interpretive signs, educational displays, and guided interpretive trails.
- *Emergency Services and Safety Measures:* ensure the safety and well-being of visitors through features like emergency contact information, first aid stations, and well-marked evacuation routes and providing training staff in emergency response, regularly inspect safety measures, and educating visitors about safety protocols.
- *Visitor Monitoring and Management Systems:* is used to track and manage visitor numbers through ticketing systems, reservation platforms, and visitor tracking technology by implementing daily visitor limits, visitor education programs, and adjusting management strategies.
- *Catering Services:* provides food and beverage services for visitors through sustainable and locally sourced menu options, waste reduction practices and minimizing single-use plastics.
- *Communication and Connectivity:* provides essential connectivity for visitors and limits the extent of connectivity to preserve the natural experience by use of energy-efficient technologies.

5.2.8.5 Interpretation and Education Facilities

Interpretation and education facilities play a crucial role in enhancing the ecotourism experience by providing visitors with valuable information about the natural and cultural aspects of the destination.

These facilities help raise awareness, foster a sense of stewardship, and promote responsible behaviour.

Effective interpretation and education facilities not only contribute to the overall ecotourism experience but also foster a sense of responsibility and appreciation for the natural and cultural resources of the destination. The key considerations for interpretation and education facilities in ecotourism envisages:

- *Interpretation Centre:* serves as the primary hub for interpretation and education activities with features like interactive displays, exhibits, dioramas, and models; audiovisual presentations and multimedia resources.
- *Interpretive Trails, Signs and Signages:* enhance the visitor experience along trails and key points of interest through interpretive signages; guided interpretive trails with educational materials; trailside exhibits providing information about flora, fauna, and landscape.
- *Guided Tours and Programs:* offers in-depth and personalized interpretation through trained guides; themed programs focusing on specific aspects of the environment; workshops, demonstrations, and hands-on activities.
- *Educational Workshops and Programs:* engage visitors in interactive and educational experiences by the help of workshops on topics such as wildlife tracking or bird identification; nature-based educational programs for schools and community groups; and citizen science initiatives involving visitors in data collection.
- *Digital and Mobile Apps:* extend interpretation beyond physical facilities through mobile apps providing self-guided tours; interactive online platforms with educational resources; and virtual reality experiences to showcase the environment.
- *Art and Culture Spaces:* highlights the cultural aspects of the area through art galleries featuring local artists; cultural exhibitions showcasing traditional practices; and performances, storytelling, and cultural demonstrations.
- *Community Engagement Programs:* involve local communities in interpretation and education initiatives by collaborative projects with community members; programs to share traditional knowledge and practices; and cultural exchange opportunities for visitors and locals.
- *Visitor Engagement Technology:* utilizes technology to enhance visitor engagement through features like touchscreen displays and interactive kiosks; augmented reality (AR) or virtual reality (VR) experiences; and social media platforms for sharing experiences and information.
- *Feedback and Evaluation Mechanism:* gathers feedback to improve interpretation and education programs through visitor surveys and comment boxes; monitoring visitor engagement and participation; and regular evaluations of interpretive materials and programs.

5.2.8.6 Organizational Strategy and Institutional Arrangements

- The Forest Department shall be the Nodal Department for implementing the ecotourism plan and may create a special purpose vehicle (SPV), as per the site-specific or state-specific requirements, preferably registering under the Society Registration Act, to assist in delivering the vision and the objectives of Ecotourism plan mainly in the protected areas and other forest areas.
- The Elephant Reserve shall strive to combine both nature-based as well as cultural tourism, and may promote ecotourism development and management that emphasizes the 'sense of place' that is unique to each destination. The ER may further ensure the involvement of viable community-based models of ecotourism by making sure that the 'community' is well-defined and incrementally empowered (in skills & financial resources) to eventually become self-sustaining.
- The Ecotourism Plan may make provisions wherever possible for the development of infrastructure, ecotourism amenities, information and interpretation centres, and facilities for organizing natural and cultural events. The SPV shall steer the ecotourism in the ER and may take policy decision for promotion and development of ecotourism.

5.2.8.7 Product Development, Promotion, Publicity & Marketing

The ecotourism sites identified and developed will have its uniqueness and values in terms of aesthetic, natural, cultural and landscape characteristics which will be recognized and developed into an ecotourism product with which the site could be recognized in future.

- The ecotourism product developed will cater to different target groups and will include hiking, trekking, wildlife sighting, bird watching trails, boating, photography, visit to medicinal plants conservation area, craft making, local handicraft, promoting local festivals, adventure sports etc.
- The pricing and appropriate packaging and branding of ecotourism destination is important to the success of ecotourism. The SPV may finalize strategy in this regard.

5.2.8.8 Training and Capacity Building

The ecotourism management can be improved by developing capacity of the stakeholders including the local communities. Regular training and skill upgradation may be organized for the same by the ER.

- The training material intends to help the local communities to create awareness and orient them on what is Community Based Eco Tourism (CBET). To promote their involvement in eco-tourism, to learn about the advantages and disadvantages due to the activities pertaining to eco-tourism.
- Discuss about communication skill and hospitality which are essential to ensure comfortable stay for the visitors and finally to understand the issue of sustainability of eco-tourism projects.
- A best practice case study collected from the same region is also provided to help the participants to know how eco-tourism is practiced/ managed with the active support of the local communities.
- It is important for the trainers to realize and keep in mind that CBET is a flexible concept, adaptable to the local environment and cultural circumstances. Adaptation is very important and must be made according to local conditions/contexts.
- A 'curriculum' may be developed for training of guides and drivers in the art, craft and ethics of wildlife tourism, resulting in certification. All guides and drivers may go through a short course in interpretation and rules and regulations followed by an oral examination before being certified by the Elephant Conservation Foundation.
- All certified guides and drivers shall wear appropriately designed uniforms with name tags and badges. This will instil a sense of pride, discipline and accountability. Prior to every tourist season, certified guides and drivers may go through a refresher course or workshop. A periodic assessment of their performance may be reviewed before reissuing their license.

5.2.9 Participatory Assessment and Impacts of Intervention

Participatory assessment in ecotourism involves engaging local communities, stakeholders, and relevant experts in the planning, decision-making, and evaluation processes of ecotourism initiatives.

It aims to incorporate diverse perspectives, empower local communities, and ensure that the benefits of ecotourism are shared equitably.

- *Community Involvement:* Local communities are integral to the success of ecotourism initiatives. Engage them in the planning and decision-making processes to ensure that their needs, concerns, and aspirations are considered.
- *Stakeholder Collaboration:* Involve various stakeholders, including government agencies, NGOs, businesses, and indigenous groups, to ensure a comprehensive and inclusive approach to ecotourism planning and management.
- *Local Knowledge Integration:* Incorporate local knowledge and traditional practices into the planning process. Local communities often have valuable insights into the ecological, cultural, and social dynamics of the area.
- *Capacity Building:* Provide training and capacity-building programs for local communities to empower them to actively participate in ecotourism activities, manage resources, and benefit from the economic opportunities.

- *Participatory Mapping:* Use participatory mapping techniques to identify key ecological and cultural features, as well as areas of significance or sensitivity. This helps in spatial planning and minimizing the impact on critical areas.
- *Collaborative Decision-Making:* Adopt collaborative decision-making processes that involve local communities in determining visitor limits, zoning, and other regulations. This fosters a sense of ownership and responsibility.
- *Monitoring and Evaluation:* Establish participatory monitoring and evaluation mechanisms to track the social, economic, and environmental impacts of ecotourism.
- *Benefit-Sharing Mechanisms:* Develop and implement transparent benefit-sharing mechanisms to ensure that the economic benefits derived from ecotourism activities are equitably distributed among local communities.

The impacts of interventions in ecotourism can be both positive and negative, and assessing them is essential for sustainable development. Sustainable ecotourism practices aim to strike a balance that benefits the environment, local communities, and visitors.

- *Positive Impacts:* Ecotourism can contribute to the conservation of natural habitats and wildlife by creating economic incentives for their protection; Local communities can benefit from increased employment, income, and business opportunities; and ecotourism can support the preservation of local cultures and traditions by showcasing them to visitors.
- *Negative Impacts:* Increased human activity may lead to habitat disturbance and impact wildlife behaviour, breeding, and feeding patterns; popular ecotourism destinations may experience overcrowding, resulting in environmental degradation and a diminished visitor experience; and over-commercialization and cultural insensitivity in ecotourism activities can contribute to the erosion of local cultures and traditions.
- *Infrastructure Impact:* The construction of infrastructure for ecotourism, if not carefully planned, can lead to habitat fragmentation, pollution, and other environmental stressors.
- *Environmental Impact:* Irresponsible tourist behaviour, such as littering or disturbing wildlife, can have negative consequences on the environment; and lack of awareness and cultural sensitivity among tourists may lead to conflicts with local communities.
- *Economic Disparities:* Economic benefits may not be distributed equitably, leading to disparities within local communities.
- *Climate Change Impact:* Travel to ecotourism destinations contributes to the carbon footprint, especially if transportation methods are not sustainable.
- *Long-Term Sustainability:* Local communities may become overly dependent on tourism, making them vulnerable to fluctuations in visitor numbers or other external factors.

5.3. ECODEVELOPMENT AND LIVELIHOOD IMPROVEMENT

Ecodevelopment and livelihood improvement refer to approaches that integrate conservation and sustainable development, aiming to enhance both environmental protection and the well-being of local communities. This approach recognizes the interdependence of ecological health and human welfare.

By promoting sustainable practices, community involvement, and economic diversification, these approaches aim to create a balance between human development and environmental conservation.

Ecodevelopment and livelihood improvement in an Elephant Reserve provides a major opportunity to develop and establish community-centred programmes that can harmonize conservation and development goals, using the approach of community mobilization, micro-planning and establishment of village-based livelihood programmes.

5.3.1 Scope and Purpose

Ecodevelopment, as a concept and practice, encompasses a broad scope with the overarching purpose of promoting sustainable development that harmonizes ecological conservation and human well-being. The scope and purpose of ecodevelopment can be outlined as follows:

Scope of Ecodevelopment:

- Ecodevelopment aims to protect and conserve biodiversity by integrating conservation measures into development initiatives. This includes preserving natural habitats, protecting endangered species, and maintaining ecosystem health.
- The scope involves the sustainable use and management of natural resources, ensuring resource extraction and utilization do not compromise with the long-term ecological integrity of ecosystems.
- Ecodevelopment emphasizes the active involvement of local communities in decision-making processes, acknowledging their traditional knowledge and ensuring that development initiatives align with their needs and aspirations.
- Ecodevelopment seeks to diversify livelihood options for communities, reducing dependence on unsustainable practices. This may involve promoting alternative income-generating activities that are environmentally friendly.
- The scope includes promoting agricultural practices that are environmentally sustainable, such as organic farming, agroecology, and permaculture. These approaches prioritize soil health, biodiversity, and reduced reliance on synthetic inputs. In respect of an ER, it is more of growing crops which are not palatable and do not attract elephants.
- Ecodevelopment recognizes the potential of eco-friendly tourism to generate income for local communities while minimizing negative impacts on the environment. This includes promoting responsible tourism practices and community-based tourism initiatives.
- The scope involves educational initiatives to raise awareness about environmental issues, conservation practices, and the importance of biodiversity. This includes formal education programs and community outreach.
- Ecodevelopment addresses social equity by ensuring that the benefits of development are distributed fairly among all community members. It seeks to minimize negative social impacts and promote inclusive growth.
- Sustainable infrastructure development is a key aspect of ecodevelopment and includes creation of infrastructure that meets human needs while minimizing adverse effects on the environment.

Purpose of Ecodevelopment:

- The primary purpose of ecodevelopment is to achieve holistic development that integrates economic, social, and environmental dimensions. It seeks to balance the needs of the present without compromising the ability of future generations to meet their own needs.
- Ecodevelopment aims to conserve and protect biodiversity, recognizing the intrinsic value of ecosystems and their role in supporting life.
- By promoting alternative livelihoods and sustainable economic activities, ecodevelopment contributes to poverty alleviation, improving the quality of life for communities in a way that is environmentally responsible.
- Ecodevelopment addresses the challenges posed by climate change by promoting practices that reduce greenhouse gas emissions and enhance community resilience to climate-related impacts.
- Ecodevelopment recognizes and respects the cultural heritage of communities, seeking to preserve traditional knowledge, practices, and identities in the face of development pressures.
- The purpose of ecodevelopment includes ensuring environmental justice, where the benefits and burdens of development are distributed equitably, and marginalized communities are not disproportionately affected by environmental degradation.
- Ecodevelopment is geared towards achieving long-term sustainability, fostering a harmonious relationship between humans and the environment that endures over time.
- Through environmental education and community involvement, ecodevelopment aims to empower individuals and communities to actively participate in and contribute to sustainable development initiatives.

- Ecodevelopment recognizes the interconnectedness of global ecosystems and promotes collaboration between nations and communities to address global environmental challenges collectively.

In summary, the scope and purpose of ecodevelopment are intertwined, seeking to create a balance between human development and ecological conservation to foster a sustainable and resilient future for both people and the planet.

5.3.2 Socio-economic and forest dependency survey

A socio-economic and forest dependency survey is a comprehensive assessment designed to gather information about the relationship between local communities and forests. This type of survey aims to understand the socio-economic conditions of communities residing in or near forest areas, as well as their dependence on forest resources for livelihoods and other needs.

- A study on the socio-economic status and forest dependency of the villages abutting Elephant Reserves is essential not only to understand the current levels and trends in dependency by communities on forest-based resources, but also enable strategies to address the issue in a comprehensive manner to evolve during the subsequent micro-planning exercise.

- It is also a premise that the baseline data thus generated could be used to monitor the impact of the ecodevelopment program in terms of socio-economic status and livelihoods of the local communities.

- The villages selected under this sub-component are mostly located within 5 kilometres from the boundary of a PA or an RF.

The key considerations for conducting a socio-economic and forest dependency survey, include:

Components of the Survey:

- Gather basic demographic data (age, gender, education level, household size, and occupation).
- Explore the various sources of income for households (agriculture, NTFPs, livestock etc).
- Examine the extent of reliance on forest resources (fuel, timber, medicinal plants, NTFP etc).
- Understand the types of agricultural practices and role of forest land in supporting these activities.
- Assess the community's access to forest areas, including tenure, rights, and restrictions.
- Investigate the sources of energy used by households, including the use of wood.
- Document the availability of infrastructure (roads, schools, healthcare facilities, market access).
- Explore the social structure including governance, community organizations, and social networks.
- Assess the community's awareness of environmental issues, conservation practices etc.
- Identify the challenges faced by community (HEC, deforestation, limited economic opportunities).

A well-designed socio-economic and forest dependency survey can provide valuable insights to develop informed strategies for sustainable development, conservation, and improved livelihoods.

5.3.3 Identification of key issues

Identifying key issues in ecodevelopment involves recognizing challenges and opportunities that arise at the intersection of ecological conservation and human development.

Some key issues commonly associated with ecodevelopment, include -

- balancing conservation and development goals; human-elephant conflict; poverty and livelihoods; land use change and deforestation; access to resources and land tenure;

climate change impacts; lack of environmental awareness; inadequate infrastructure; policy gaps and enforcement; cultural and social dynamics; and inequitable benefit sharing.

Identifying and addressing these key issues requires a holistic and participatory approach that involves local communities, stakeholders, and policymakers. Effective ecodevelopment strategies seek to find synergies between ecological conservation and human development, aiming for sustainable and inclusive outcomes.

5.3.4 Constitute EDCs and Executive Committees

- Forming Ecodevelopment Committees (EDC) around Protected Areas (unlike Village Forest Committees (VFCs) around forest fringe villages) and an Executive Committee (EC) is a strategic step towards fostering community engagement and ensuring effective decision-making for sustainable development.

- By constituting both EDC and an EC, we create a structured framework for community involvement, effective decision-making, and the successful implementation of ecodevelopment initiatives. Continuous capacity building, community engagement, and adaptive leadership will contribute to the resilience and sustainability of the committees and their projects over time.

5.3.5 Orientation and training of communities and field staff

The orientation and training of communities and field staff in ecodevelopment are crucial components for the successful implementation of sustainable development initiatives.

Both community members and field staff are essential stakeholders in the success of ecodevelopment initiatives. By providing effective orientation and training programs, we empower them with the knowledge and skills needed to collaboratively work towards sustainable development and conservation goals.

5.3.6 Participatory planning process and Ecodevelopment plans

A participatory planning process is essential for the successful development and implementation of Ecodevelopment plans. Involving local communities, stakeholders, and experts in the planning process helps ensure that strategies are contextually relevant, sustainable, and supported by those directly affected. Measures to facilitate participatory planning process for Ecodevelopment plans include -

1. *Stakeholder Mapping:* Identify and map all relevant stakeholders, including local communities, government agencies, non-governmental organizations, businesses, and experts in ecology and community development.
2. *Community Engagement:* Conduct community meetings to introduce the concept of Ecodevelopment, explain its goals, and solicit input from community members and organize focused discussions to understand community needs, priorities, and concerns related to both conservation and development.
3. *Baseline Assessment:* Conduct a baseline assessment to gather information on the existing socio-economic and environmental conditions of the area and involve community members in data collection, incorporating their local knowledge and perspectives.
4. *Visioning and Goal Setting:* Facilitate workshops where community members can collectively envision the future they desire, considering both conservation and development aspects. Based on the community's vision, collaboratively set specific, measurable, achievable, relevant, and time-bound (SMART) goals.
5. *SWOT Analysis:* Conduct a SWOT analysis with community members to identify internal strengths and weaknesses and external opportunities and threats.
6. *Mapping and Resource Identification:* Engage the community in mapping local natural resources, identifying areas of importance for conservation and sustainable resource use and incorporate traditional ecological knowledge held by community members in the mapping process.
7. *Capacity Building:* Conduct training sessions to build the capacity of community members in sustainable agricultural practices, forest management, water conservation, and other

relevant skills and educate community members about the principles of ecodevelopment, emphasizing the interconnectedness of conservation and development.

8. *Joint Planning Workshops:* Organize multi-stakeholder workshops that bring together community members, experts, government representatives, and other stakeholders to collaboratively design Ecodevelopment plans. Facilitate participatory decision-making processes to ensure that all stakeholders have a voice in the planning and decision-making.
9. *Integrated Planning and Prioritization:* Develop an integrated Ecodevelopment plan that outlines specific strategies, actions, and timelines to achieve the community's goals and prioritize actions based on the community needs, resource availability, and the ecological impact.
10. *Review and Feedback:* Share the draft Ecodevelopment plan with the community for review and feedback. Consider their inputs and make necessary revisions. Ensure transparency in decision-making processes, providing clear justifications for choices made in the plan.
11. *Consensus Building:* Hold meetings to build consensus among stakeholders on the final Ecodevelopment plan. Address any disagreements through dialogue and negotiation.
12. *Monitoring and Evaluation Framework:* Develop indicators and metrics to monitor the progress and impact of Ecodevelopment initiatives. Engage community members in monitoring activities to foster a sense of ownership and responsibility.
13. *Capacity Building for Implementation:* Provide training sessions for community members and local organizations involved in the implementation of the Ecodevelopment plan.
14. *Continuous Adaptive Management:* Establish mechanisms for continuous feedback from the community and stakeholders. Use feedback to adapt and refine the Ecodevelopment plan.
15. *Communication and Advocacy:* Develop a communication strategy to share information about Ecodevelopment initiatives with the wider community, external partners, and relevant stakeholders and elicit support from governmental and non-governmental agencies, and other potential partners.
16. *Implementation:* Launch the implementation of the Ecodevelopment plan with a community event, celebrating milestones and generating enthusiasm for the initiatives.
17. *Regular Review and Updating:* Schedule periodic reviews of the Ecodevelopment plan to assess progress, identify challenges, and make adjustments as needed. As circumstances change, update the plan to reflect new priorities, opportunities, and community aspirations.

The trained field staff could facilitate the planning process in collaboration with the EDCs and other stakeholders of ecodevelopment activities. Ideally speaking, part of the process may be facilitated by the EDCs so that ownership of the ecodevelopment activities by the locals is further enhanced.

Facilitating a participatory planning process ensures that Ecodevelopment plans are contextually relevant, sustainable, and embraced by the communities they aim to benefit. It fosters a sense of ownership, empowerment, and collaboration among all stakeholders involved.

5.3.7 Implement Ecodevelopment activities

Implementing Ecodevelopment activities involves translating plans into actionable steps, engaging communities, and fostering sustainable practices.

Indicative list of Ecodevelopment activities (including implementation) includes:

1. *Sustainable Agriculture Initiatives:* Set up demonstration farms to showcase sustainable agricultural practices. Provide communities with access to quality seeds, tools, and organic fertilizers. The initiatives could include activities like agroecology, organic farming, permaculture and sustainable crop rotation.
2. *Reforestation and Habitat Restoration:* Organize community-wide tree planting events to restore degraded areas and implement activities to rehabilitate and protect natural habitats including forest regeneration.

3. *Wildlife Conservation and Protection:* Establish community patrols to monitor and protect wildlife including elephants and educate communities on the importance of wildlife conservation.
4. *Sustainable Forestry Practices:* Implement community-based forest management plans and explore opportunities for sustainable harvesting and processing of value-added forest products.
5. *Water Conservation and Management:* Implement measures to protect watersheds, such as afforestation and erosion control and construct rainwater harvesting structures to enhance water availability including efficient irrigation techniques.
6. *Renewable Energy Projects:* Implement solar energy projects to provide sustainable energy solutions and engage communities in managing and benefiting from renewable energy sources like wind energy projects and biogas production.
7. *Eco-Tourism and Conservation Education:* Develop eco-friendly infrastructure for tourism, organize tours to natural sites, interpretative nature trails and combining conservation education with tourism.
8. *Community Empowerment and Livelihood Diversification:* Support the establishment of eco-friendly microenterprises and facilitate access to markets for locally produced sustainable goods including development of alternate livelihood and skills training programs.
9. *Waste Management and Recycling:* Establish community-based recycling centres, composting initiatives and organize regular waste collection programs.
10. *Eco-friendly Infrastructure Development:* Encourage the construction of green buildings using sustainable materials and promote eco-friendly options and green energy infrastructure.
11. *Community Health and Well-being:* Organize health camps, access to healthcare initiatives, workshops on nutrition and implement projects to improve access to clean water and sanitation.
12. *Community-Based Disaster Risk Reduction:* Establish and communicate early warning systems and conduct workshops on disaster preparedness and response.
13. *Climate Change Adaptation and Mitigation:* Promote practices that enhance resilience to climate change; implement afforestation projects to sequester carbon including climate-smart agriculture.

Implementing Ecodevelopment activities requires a collaborative and adaptive approach, emphasizing the active participation of local communities. Regular communication, ongoing capacity building, and a commitment to sustainability contribute to the success and long-term impact of these initiatives.

5.3.7.1 Capacity building and Skill development of tribal youth

Capacity building of tribal youth is a crucial aspect to empower them with the knowledge, skills, and resources needed for sustainable development.

- The capacity building of tribal youth envisages: thorough needs assessment; skill development programs; entrepreneurship training; introduction of appropriate technologies; training on financial literacy and management; programs focused on environmental education; exposure visits; ongoing learning opportunities; mentorship programs; networking opportunities; and securing employment opportunities.

Capacity building programs for tribal youth may be tailored to their specific cultural context, needs, and aspirations and by fostering knowledge, these programs contribute to the sustainable development of both individuals and their communities.

Skill development programs: for tribal youth empowers them to actively participate in sustainable practices, environmental conservation, and community development. Skill development initiatives in tribal youth envisages:

- Identify key skills relevant to Ecodevelopment, such as: sustainable agriculture and agroecology; forest and wildlife management; eco-friendly handicrafts and traditional art; renewable energy technologies; entrepreneurship and business management.

- Impart training on vehicle driving, computer basics, tailoring (mainly for women), dairy management, poultry farming, honey collection and beekeeping, mushroom cultivation, piggery and other animal husbandry, NTFP development etc
- Provide for entrepreneurial training on starting and managing sustainable businesses and covers aspects of financial management, marketing, and market research. Identify specific job opportunities in the region and provide training accordingly and offer certifications or vocational training in high-demand areas.

Skill development programs for tribal youth may be dynamic, culturally sensitive, and responsive to the evolving needs of the community. By equipping youth with relevant skills, they become key contributors to ecodevelopment initiatives, nurturing sustainability and resilience in their communities.

5.3.7.2 Soil and Moisture conservation measures

Soil and moisture conservation measures are important components of Ecodevelopment, especially in areas where sustainable agriculture and environmental conservation are priorities. Implementing effective soil and moisture conservation practices helps maintain soil fertility, prevent erosion, and ensure the sustainable use of water resources.

- Some key measures include: contour ploughing, terracing, cover cropping, agroforestry, check dams and gabions, mulching, water harvesting structures, percolation pits, vegetative buffers, contour bunding, alley cropping, gully plugging, rotational grazing, bioengineering techniques, check terracing, agro-ecological zoning and soil conservation farming practices etc.
- Conducting educational programs to raise awareness among farmers about the importance of soil and moisture conservation and engaging local communities in watershed management helps ensure that soil and moisture conservation efforts align with local needs and practices.
- Providing incentives or subsidies for farmers adopting sustainable soil and moisture conservation practices and adopting an adaptive management approach that allows for flexibility in adjusting conservation measures based on changing environmental conditions and community feedback, can encourage broader adoption and community participation.

By integrating these measures, it's possible to create a more resilient and sustainable environment.

5.3.7.3 Preservation of Traditional knowledge

Preserving traditional knowledge is significant in Ecodevelopment as it helps maintain cultural heritage, enhances community resilience, and contributes to sustainable practices. Strategies for the preservation of traditional knowledge within ecodevelopment initiatives envisages:

- record traditional knowledge; conduct ethnobotanical surveys; prepare peoples' biodiversity register (PBR); incorporate traditional practices into cultural festivals; promote intergenerational learning; support traditional artisans/ craftsmen; collaborate closely with elders, traditional healers, and knowledge holders; engage communities in participatory mapping exercises; facilitate cultural exchange programs between communities; emphasize the importance of storytelling and oral traditions; acknowledge contributions of traditional knowledge holders; provide incentives/ recognition; and launch awareness campaigns.

Preserving traditional knowledge in Ecodevelopment requires a collaborative and respectful approach that values the wisdom of local communities.

5.3.7.4 Conservation of Heritage sites

Conservation of heritage sites in elephant reserves within the context of Ecodevelopment is critical to maintain cultural richness, promote sustainable tourism, and ensure the preservation of historical and ecological values. Strategies for the conservation of heritage sites in Ecodevelopment envisages:

- *Integrated Conservation Planning:* Develop comprehensive conservation plans that integrate cultural heritage preservation with environmental and community development goals, considering the ecological significance and sustainability of heritage sites (caves, religious sites etc).

- *Cultural Impact Assessments:* Conduct cultural impact assessments before implementing any development in or around heritage sites with due assessment of the potential impacts on cultural values, historical structures, and ecosystems.
- *Community Involvement and Empowerment:* Involve local communities in the conservation and management of heritage sites and empower communities to take ownership of their cultural heritage and actively participate in decision-making processes.
- *Visitor Management:* Implement sustainable visitor management practices to minimize the impact of tourism on heritage sites; establish visitor guidelines and infrastructure to protect sensitive areas; and regulate and manage tourism activities around heritage sites to prevent overcrowding and mitigate negative impacts on cultural and natural resources.
- *Infrastructure Development:* Design and construct infrastructure around heritage sites with a focus on minimal environmental impact with utilization of eco-friendly construction materials and methods (use traditional building techniques and materials for restoration and conservation of the sites to maintain authenticity, where applicable).
- *Interpretation and Education Centres:* Establish interpretation and education centres near heritage sites to provide visitors with information on the historical, cultural, and ecological significance. Use interactive exhibits and educational programs. Ensure that heritage interpretation includes diverse perspectives, including those of indigenous communities and historically marginalized groups.
- *Conservation and Modern Technologies:* Integrate heritage site conservation with conservation efforts and employ modern technologies such as GIS mapping, and remote sensing for monitoring conservation efforts and identifying potential threats including assessment.
- *Economic Diversification:* Develop sustainable economic opportunities for local communities through heritage tourism and encourage the development of local crafts, traditional performances, and other cultural products.
- *Partnerships and Collaborations:* Collaborate with Archaeological Survey of India (ASI), NGOs, international organizations, and experts in heritage conservation to access resources, expertise, and funding and establish partnerships with academia for research and educational initiatives.
- *Conservation Funding:* Develop sustainable funding mechanisms for the conservation of heritage sites and explore public-private partnerships, endowments, and heritage conservation funds.
- *Capacity Building:* Build the capacity of local communities and authorities in heritage conservation practices including site management, preservation techniques, and tourism management.
- *Monitoring and Evaluation:* Implement regular monitoring and evaluation programs to assess the condition of heritage sites and the effectiveness of conservation measures.

Ecodevelopment initiatives can successfully integrate heritage site conservation into harmonious coexistence of cultural, ecological, and economic values.

5.3.8 Participatory assessment of impacts of intervention

Participatory assessment of impacts of intervention involves engaging local communities, stakeholders, and experts in the process of evaluating the effects of a development intervention on the environment and communities.

Key considerations for conducting a participatory assessment of impacts in Ecodevelopment, include:

- Identify and engage key stakeholders, including local communities, government agencies, NGOs, researchers, and other participants and establish open communication channels to ensure the active participation of all stakeholders in the assessment process.
- Utilize participatory methods and tools such as focus group discussions, community workshops, surveys, and participatory mapping to gather diverse perspectives and experiences and incorporate traditional and local knowledge to enhance the understanding. Build the capacity of local communities to actively participate in the assessment process.

- Establish baseline data on the ecological and socio-economic conditions before the intervention and develop clear indicators and metrics to measure the impacts of the intervention. Collaboratively analyse the collected data with stakeholders to ensure a shared understanding of the results. Based on the assessment, develop policy recommendations that promote sustainable ecodevelopment and the well-being of both the ecosystem and local communities.

Participatory approaches enhance the credibility and relevance of the evaluation including a more holistic understanding of the impacts of interventions in Ecodevelopment.

5.3.9 Livelihood Support Initiatives through Village Micro-plans

Livelihood support initiatives through development of micro-plans involve the strategic planning and implementation of projects at the village level to improve the well-being of communities while ensuring the sustainable use of natural resources.

The key components in the micro-planning process, envisage:

- Engage the local community in the participatory development of Village Micro-plans including identifying community needs, aspirations, and challenges related to livelihood and environment.
- Involve key stakeholders, including local community members, government agencies, NGOs, and other relevant organizations, in the planning and decision-making processes.
- Conduct a thorough mapping of local natural resources, including forests, water sources, and agricultural land and recognize ecological dynamics and identify potential areas for development.
- Explore opportunities for livelihood diversification that are aligned with the local ecosystem (sustainable agriculture, agroforestry, eco-tourism, handicrafts, or income-generating activities).
- Provide training and capacity-building programs to enhance the skills of community members.
- Identify and prioritize infrastructure needs that can support livelihood activities, such as irrigation systems, roads, storage facilities, and markets.
- Encourage and promote eco-friendly and sustainable practices in all aspects of livelihood initiatives (organic farming, water conservation, and waste management).
- Facilitate access to microfinance and credit facilities to empower community members to invest in their livelihood initiatives (community-based savings and credit groups).
- Strengthen or establish community-based organizations to facilitate the planning, implementation, and monitoring of livelihood support initiatives.
- Empower community members to actively participate in decision-making processes, ensuring that their voices are heard and considered in the planning and implementation of livelihood initiatives.
- Develop a robust monitoring and evaluation system to assess the progress and impact of livelihood initiatives over time.

By integrating these elements into the development of Village Micro-plans, ecodevelopment initiatives can create a more comprehensive and sustainable approach.

A- Income generation activities:

In the context of Ecodevelopment, income generation activities may be designed to promote sustainable development, enhance local livelihoods, and contribute to the conservation of ecosystems.

Some income generation activities that align with the principles of ecodevelopment are:

- Sustainable Agriculture; Eco-Tourism; Handicrafts and Artisanal Products; Beekeeping and Honey Production; Fisheries and Aquaculture; Water Harvesting and Management; Renewable Energy Initiatives; Carbon Trading and Forest Conservation; Community-Based Conservation Enterprises; Waste Management and Recycling; and Community-Based Seed Banks etc.

When designing income generation activities, it's vital to involve local communities in the planning and decision-making processes. This ensures that the initiatives are culturally sensitive, socially inclusive, and environmentally sustainable over the long term. Additionally, monitoring and evaluation mechanisms should be in place to assess the impact of these activities on both livelihoods and ecosystems.

B- Community development works:

Community development plays a pivotal role in Ecodevelopment by fostering sustainable practices, promoting environmental conservation, and improving the well-being of local communities.

Some key community development works are:

- Community-Based Natural Resource Management; Eco-Friendly Infrastructure Development; Community Forest Management; Water Conservation and Management; Health and Sanitation Programs; Cultural Preservation; Community-Based Ecotourism; Social Enterprises; and Disaster Preparedness and Resilience etc.

By integrating community development works into ecodevelopment initiatives, it is possible to create a sustainable approach that benefits both the environment and the well-being of local communities.

5.3.10 Integration of Rural Development Programmes

Integrating rural development programs involves creating a cohesive and synergistic approach that addresses various aspects of development in rural areas. Effective integration ensures that different programs complement each other, leading to sustainable and holistic development.

Integrating rural development programs with ecodevelopment involves aligning initiatives to improve the socio-economic conditions of rural communities with sustainable environmental practices.

The key strategies for integrating rural development programs with ecodevelopment envisages:

- Conduct a thorough needs assessment to understand the multifaceted challenges and opportunities in the target rural areas. Identify key sectors that require intervention.
- Develop a comprehensive and strategic development plan that integrates the goals and objectives of various programs. Align interventions with the local context and prioritize initiatives.
- Facilitate collaboration between different government departments, NGOs, and private sector entities working in rural development. Create mechanisms for joint planning & resource sharing.
- Integrate environmental considerations into rural development programs to promote sustainability. Implement eco-friendly practices in agriculture/ forestry/ infrastructure.
- Ensure that development programs are inclusive and address the needs of marginalized groups, including women, youth, and ethnic minorities. Promote gender equality and social equity.

Rural development programs vary widely based on the specific needs and challenges of a region. A list of common types of rural development programs include:

- Agricultural Development Programs; Livelihood Diversification Programs; Education Programs; Healthcare Programs; Infrastructure Development Programs; Social Welfare Programs; Natural Resource Management Programs; Sustainable Tourism Programs; Water and Sanitation Programs; Disaster Management and Resilience Programs; Women's Empowerment Programs; Digital and Information Technology Programs; Climate Change Adaptation and Mitigation Programs; and Cultural Preservation Programs.

By employing these strategies, rural development programs can be integrated in a way that maximizes their impact and contributes to the sustainable development of rural communities.

5.3.11 Monitoring and Evaluation

Monitoring and evaluation (M&E) are crucial components of ecodevelopment initiatives, ensuring that interventions are effective, sustainable, and aligned with ecological goals.

Key considerations for implementing M&E in ecodevelopment programs are:

Monitoring in Ecodevelopment:

- Define and monitor specific ecological indicators that reflect the health and sustainability of the environment, such as biodiversity, soil quality, water quality, and ecosystem services.
- Incorporate indicators that measure the socio-economic well-being of local communities, including income levels, employment opportunities, and access to basic services.
- Monitor the adoption of eco-friendly practices by communities, such as sustainable agriculture, agroforestry, and waste management.
- Track the responsible use of natural resources and ensure that exploitation does not exceed sustainable thresholds.
- Monitor the level of community engagement and participation in ecodevelopment activities.

Evaluation in Ecodevelopment:

- Assess the impact of interventions on the local ecosystem, including changes in biodiversity, soil health, water resources, and overall ecological resilience.
- Evaluate the social and economic impacts of ecodevelopment initiatives on local communities, considering factors such as income generation, employment, and improved livelihoods.
- Evaluate the provision of ecosystem services and the role of the environment in supporting community well-being.
- Assess the effectiveness of conservation measures in protecting endangered species, habitats, and maintaining ecological balance.
- Evaluate the preservation of local cultures and traditional knowledge, ensuring that interventions respect and support indigenous practices.
- Conduct a cost-benefit analysis to determine the economic efficiency of ecodevelopment interventions, considering both short-term and long-term returns on investment.

Implementing robust M&E processes in ecodevelopment not only ensures accountability but also helps refine strategies, optimize resource allocation, and contribute to the continuous improvement of initiatives that balance environmental conservation and community well-being.

5.4. MAINSTREAMING ZONAL MASTER PLAN IN ECO-SENSITIVE ZONE

5.4.1 Background

The Indian Board for Wildlife in its 'Wildlife Conservation Strategy-2002' envisaged 'lands falling within 10 km of the boundaries of NP and WLS should be notified as eco-fragile zones under section 3 (v) of the Environment (Protection) Act and Rule 5 Sub rule (vii) & (x) of the Environment (Protection) Rules'.

The purpose of declaring Eco-sensitive zones (ESZ) around Sanctuaries and National Parks is to create some kind of 'Shock Absorber' for the Protected Areas and they would also act as a transition zone from areas of high protection to areas involving lesser protection.

The Hon'ble Supreme Court of India in WP (C) No. 460 / 2004 (Goa Foundation vs Union of India) filed on 04-02-2006, had also directed for the notification of areas falling within 10 kms from the boundary of the Sanctuaries and National parks as ESZ with a view to conserve the forest, wildlife and environment.

The Union Ministry of Environment Forests and Climate Change, in pursuance to the decision taken by the National Board for Wildlife had requested site specific proposals for declaration of Eco-sensitive zone around National Parks and Sanctuaries and had also issued detailed guidelines vide its letter F. No. 1-9/2007-WL-1 (pt) dated 09-02-2011 to facilitate the zoning activities.

Area and Boundary of the ESZ

- Delineation of the physical boundaries on a topo-sheet with precise description in geographic terms together with a description of the significant features / attributes that would potentially qualify the area as eco-sensitive zone along with the list of villages with exception and exemption in the delineated buffer zone area.

Climate and Natural features

- A description of a climate includes information on, e.g. the average temperature in different seasons, rainfall, and sunshine. Natural features mean components and processes present in or produced by nature, including, but not limited to, soil types, geology, slopes, vegetation, surface water, drainage patterns, aquifers, recharge areas, climate, flood plains, aquatic life, and wildlife.

Demographic profile

- Demography profile examines the size, structure, and movements of human populations over space and time and details the population growth, sex-ratio, population density, household size, literacy rate, age-wise distribution of population, vital rates (birth/ death/ mortality) and migration.

Major source of economy

- A description of the resource base indicating the economic potential and livelihood implication for the people residing in and around the proposed eco-sensitive area including an inventory of the existing legal status of rights, entitlements, privileges and obligations of the local communities.

Importance of the ESZ

- A description of bio-diversity values including bio-geographical representatives, endemism, species richness, geo-morphological characteristics, and unique land use practices including aesthetic and cultural values.

5.4.2 Integration of Zonal Plan

- The State Government shall, for the purpose of the ESZ prepare, a Zonal Master Plan, within a period of two year from the date of publication of the final notification in the Official Gazette, in consultation with local people and adhering to the stipulations given in this notification for the approval of the competent authority of the State.
- The Zonal Master Plan for the Eco-sensitive Zone shall be prepared by the State Government in such a manner as is specified in this notification and also in consonance with the relevant Central and State laws and the guidelines issued by the Central Government, if any.
- A Zonal Master Plan in an Eco-Sensitive Zone (ESZ) is a comprehensive planning document designed to guide land use, development activities, and conservation efforts within the designated eco-sensitive zone. The primary goal is to strike a balance between environmental conservation and sustainable development, ensuring the protection of ecological values while meeting the needs of local communities.

Line Departments and Agencies:

- The Zonal Master Plan shall be prepared in consultation with the following State Departments, for integrating environmental and ecological considerations into the said plan - Environment; Forest and Wildlife; Agriculture; Revenue; Urban Development; Tourism; Rural Development; Irrigation and Flood Control; Municipal; Panchayati Raj; Public Works Department; Highways; State Pollution Control Board and other relevant departments.
- An inventory of the different land use patterns and the multi-various activities that takes place around the protected areas is collected by the Forest Department and verified with the concerned line departments. All activities in the ESZ are governed by the provisions of the Environment (Protection) Act, 1986 and the rules made there under including applicable laws.

Integration of Environmental and Ecological considerations:

- The Zonal Master Plan shall not impose any restriction on the approved existing land use, infrastructure and activities, unless so specified in this notification and the Zonal Master Plan shall factor in improvement of all infrastructure and activities to be more efficient and eco-friendlier.

Restoration of Environmental and Ecological concerns:

- The Zonal Master Plan shall provide for restoration of denuded areas, conservation of existing water bodies, management of catchment areas, watershed management, groundwater management, soil and moisture conservation, wetland management needs of local community and such other aspects of the ecology and environment that need attention.

Demarcation & mapping of existing/proposed land use features:

- The Zonal Master Plan shall demarcate all the existing worshipping places, villages and urban settlements, types and kinds of forests, agricultural areas, fertile lands, green area, such as, parks and like places, horticultural areas, orchards, lakes and other water bodies and also with supporting maps. The Plan shall be supported by Maps giving details of existing and proposed land use features.

5.4.3 Ecofriendly development and regulation of activities:

- The Zonal Master Plan shall regulate development in Eco-sensitive Zone and adhere to prohibited, regulated activities listed in table and also ensure and promote eco-friendly development for livelihood security of local communities.
- All activities in the Eco sensitive Zone shall be governed by the provisions of the Environment (Protection) Act, 1986 and the rules made there under including the Coastal Regulation Zone (CRZ), 2011 and Environmental Impact Assessment (EIA) Notification, 2006 and other applicable laws- Forest (Conservation) Act 1980, Indian Forest Act, 1927, Wildlife (Protection) Act 1972.

A- Prohibited activities

- *Commercial Mining:* All new and existing (minor and major minerals) stone quarrying and crushing units are prohibited except for meeting the domestic needs of bona fide local residents. The mining operations shall be carried out in accordance with the orders of the Hon'ble Supreme Court dt 04.08.2006 in W.P. (C) No. 202 of 1995 and W.P. (C) No. 435 of 2012 dt 21.04.2014.
- *Setting of industries causing pollution:* No new industries and expansion of existing polluting industries in the ESZ shall be permitted. Only non-polluting industries shall be allowed within ESZ as per classification of Industries in the guidelines issued by CPCB in Feb 2016.
- *Establishment of major hydroelectric project:* Prohibited (except as otherwise provided) as per applicable laws.
- *Use or production or processing of any hazardous substances:* Prohibited (except as otherwise provided) as per applicable laws.
- *Discharge of untreated effluents in natural water bodies or land area:* Prohibited (except as otherwise provided) as per applicable laws.
- *Establishment of solid waste disposal site and common incineration facility for solid and bio medical waste:* No new solid waste disposal site and waste treatment/ processing facility of solid waste is permitted within ESZ. Further installation of common or individual incineration facility for treatment of any form of solid waste generated is prohibited.
- *Establishment of large-scale commercial livestock and poultry farms by firms, corporate, companies:* Prohibited (except as otherwise provided) as per applicable laws except for meeting local needs.
- *Setting of new saw mills:* No new or expansion of existing saw mills shall be permitted within the Eco-sensitive Zone.
- *Setting up of brick kilns:* Prohibited (except as otherwise provided) as per applicable laws.

B- Regulated activities

- *Commercial establishment of hotels and resorts:* No new commercial hotels and resorts shall be permitted within one kilometre of the boundary of the PA or up to the extent of ESZ, whichever is nearer. Provided that, beyond above limit, all new tourist activities or expansion of existing activities shall be in conformity with the Tourism Master Plan and guidelines as applicable.

- *Construction activities:* (a) No new commercial construction of any kind shall be permitted within one kilometre from the boundary of the PA or upto extent of the ESZ whichever is nearer. Provided that, local people shall be permitted to undertake construction in their land for their use and beyond one kilometre, it shall be regulated as per the Zonal Master Plan.
- *Small scale non-polluting industries:* Non-polluting industries and non-hazardous, small scale and service industry, agriculture, floriculture, horticulture or agro-based industry producing products from indigenous materials from the ESZ shall be permitted by the competent authority.
- *Felling of Trees:* There shall be no felling of trees on the forest or Government or revenue or private lands without prior permission of the competent authority in the State Government.
- *Collection of Forest produce or Non-Timber Forest Produce:* Regulated under applicable laws.
- *Erection of electrical and communication towers and laying of cables and other infrastructures:* Regulated under applicable laws. Underground cabling may be promoted.
- *Infrastructure civic amenities:* Shall be done with mitigation measures, as per applicable laws, rules and regulation and available guidelines.
- *Widening and strengthening of existing roads and formation of new roads:* Shall be done with mitigation measures, as per applicable laws, rules and regulation and available guidelines.
- *Undertaking other activities related to tourism like over flying the ESZ area by hot air balloon, helicopter, drones, Microlites, etc:* Regulated under applicable law.
- *Protection of hill slopes and river banks:* Regulated under applicable laws.
- *Movement of vehicular traffic at night:* Regulated for commercial purpose under applicable laws.
- *Ongoing agriculture and horticulture practices by local communities along with dairies, dairy farming, aquaculture and fisheries:* Permitted under applicable laws for use of locals.
- *Discharge of treated waste water/effluents in natural water bodies or land area:* The discharge of treated waste water/effluents shall be avoided to enter into the water bodies and shall be regulated as per applicable laws. Efforts to be made for recycle and reuse of treated waste water.
- *Commercial extraction of surface and ground water:* Regulated under applicable law.
- *Open Well, Bore Well etc. for agriculture or other usage:* Regulated and the activity should be strictly monitored by the appropriate authority.
- *Solid Waste Management:* Regulated under applicable laws.
- *Introduction of Exotic species:* Regulated under applicable laws.
- *Ecotourism:* Regulated under applicable laws.
- *Use of polythene bags:* Use of Polythene bags are not permitted within the ESZ. However, based on specific requirement, it shall be regulated under applicable laws.
- *Commercial sign boards and hoardings:* Regulated under applicable laws.

C- Promoted activities

- *Rain water harvesting:* Shall be actively promoted.
- *Organic farming:* Shall be actively promoted.
- *Adoption of green technology for all activities:* Shall be actively promoted.
- *Cottage industries including village artisans, etc:* Shall be actively promoted.
- *Use of renewable energy and fuels:* Bio gas, solar light etc to be actively promoted.
- *Agro-Forestry:* Shall be actively promoted.

- *Use of eco-friendly transport:* Shall be actively promoted.
- *Skill Development:* Shall be actively promoted.
- *Restoration of Degraded Land/Forests/Habitats:* Shall be actively promoted.
- *Environmental awareness:* Shall be actively promoted.

5.4.4 Regulatory framework and monitoring of the ESZ notification

- The Zonal Master Plan shall be co-terminus with the Regional Development Plan.
- Zonal Master Plan so approved shall be the reference document for the Monitoring Committee for carrying out its functions of monitoring in accordance with the provisions of this notification.

5.4.5 Mainstreaming of Zonal Master Plan

Mainstreaming a Zonal Master Plan in an ESZ involves integrating the principles, guidelines, and regulations outlined in the master plan into the broader regional and developmental framework. ESZ are areas that require special attention and conservation efforts due to their ecological significance.

Key steps and considerations for mainstreaming a Zonal Master Plan in an Eco-Sensitive Zone are:

- Clearly define and understand the ecological sensitivity of the zone. Identify key environmental features, habitats, and species that need protection.
- Formulate a comprehensive Zonal Master Plan that includes land-use planning, conservation strategies, sustainable development guidelines, and measures for ecosystem protection.
- Ensure that the Zonal Master Plan aligns with existing environmental laws, policies, and regulations at the national, state, and local levels.
- Involve local communities, stakeholders, and experts in the planning process to gather diverse perspectives and enhance the plan's effectiveness and local ownership.
- Collaborate with relevant government authorities, including environmental agencies, local municipalities, to incorporate the Zonal Master Plan into regulatory framework.
- Conduct a thorough Environmental Impact Assessment to identify potential impacts of development activities and propose mitigation measures in line with the Zonal Master Plan.
- Build the capacity of local authorities, community organizations, and other stakeholders to implement and enforce the provisions of the Zonal Master Plan.
- Integrate climate resilience considerations into the Zonal Master Plan, considering the potential impacts of climate change on the eco-sensitive zone.
- Clearly outline conservation measures, including the protection of critical habitats, biodiversity corridors, and natural resources in the Zonal Master Plan.
- Establish specific land-use zones, distinguishing areas for conservation, sustainable development, and infrastructure development, in accordance with the ESZ.
- Develop a robust monitoring and enforcement mechanism to ensure compliance with the Zonal Master Plan. Assess status of environmental parameters and adherence to zoning regulations.
- Conduct public awareness campaigns and educational programs to inform local communities and stakeholders about the importance of the ESZ and guidelines outlined in the Zonal Master Plan.
- Envisage collaboration among various stakeholders, including government agencies, NGOs, local communities, and private entities, to implement the Zonal Master Plan effectively.
- Embrace an adaptive management approach, allowing for adjustments to the Zonal Master Plan based on ongoing monitoring, changing environmental conditions, and community needs.

- Maintain detailed documentation of the Zonal Master Plan, including regular reports on its implementation, challenges faced, and achievements.

Mainstreaming a Zonal Master Plan in an ESZ requires a concerted effort from various stakeholders to balance conservation goals with sustainable development.

5.4.6 Developing Synergy in the Elephant Reserve

The establishment of Eco-Sensitive Zones can play a significant role in the conservation of elephants and their habitats. Elephants are highly sensitive to changes in their environment, and their survival is closely linked to the preservation of ecosystems that support their natural behaviours and needs.

Some synergistic measures include:

- *Buffer to the Elephant habitat:* ESZs are designated to protect ecologically sensitive areas outside PAs, which often include vital elephant habitats and corridors. ESZs ensure that elephants have a buffer outside ER and same facilitates in migration and conflict reduction.
- *Preventing Habitat Fragmentation:* Habitat fragmentation is a significant threat to elephants. ESZs can help prevent or minimize habitat fragmentation by delineating areas that need protection and planning for wildlife corridors that facilitate elephant movement between different habitats.
- *Maintaining Ecosystem Integrity:* ESZs, by conserving these habitats, contribute to the overall health and integrity of ecosystems, benefiting not only elephants but also other wildlife.
- *Regulating Human Activities:* ESZs often come with regulations and guidelines that control or restrict certain human activities to prevent adverse impacts on wildlife, including elephants.
- *Mitigating Human-Elephant Conflicts:* Designing ESZs with consideration for minimizing human-wildlife conflicts is crucial for elephant conservation. Buffer zones around PAs can help create a transitional space that reduces conflict between elephants and nearby human settlements.
- *Conserving Water Sources:* Elephants require access to water sources, and many ESZs include measures to protect rivers, lakes, and other water bodies. This ensures reliable access to water.
- *Enhancing Connectivity:* Elephant populations often require connectivity between different habitats to maintain genetic diversity. ESZs can identify and protect wildlife corridors, allowing elephants to move between fragmented habitats and promoting gene flow within populations.
- *Educating and Involving Local Communities:* ESZs can include educational programs and community engagement initiatives to raise awareness about the importance of elephants, their habitats, and the benefits of conservation by involving local communities in conservation efforts.
- *Climate Change Adaptation:* ESZ planning can take into account the potential impacts of climate change on elephant habitats and incorporate measures to enhance the resilience of ecosystems, ensuring elephants have necessary resources in the face of changing environmental conditions.
- *Regional Collaboration:* In some cases, elephants migrate across regional borders passing through critical ESZ areas located at the inter-state borders. Collaborative efforts can help.
- *Tourism Management:* If tourism is a component of the ESZ, sustainable tourism practices can be implemented to ensure that visitors can appreciate elephants in their natural habitats without impacting the habitat by infrastructure development.
- *Emergency Response Planning:* ESZs can include plans for responding to emergencies such as natural disasters or disease outbreaks that may affect elephants.

Overall, the establishment and effective management of ESZs contribute significantly to elephant conservation by addressing the various threats faced by the species in a holistic and sustainable manner.

CHAPTER-6
MANAGEMENT CAPACITY DEVELOPMENT

6.1 ACTIVATION OF RESEARCH ACTIVITIES

Activating research activities in an Elephant Reserve involves careful planning, collaboration, and adherence to conservation principles. The goal of research is not only to advance scientific knowledge but also to contribute to the conservation and sustainable management of the ecosystem.

6.1.1 Short-term research

Short-term research can be particularly impactful when addressing urgent issues or specific challenges.

- Focus of the short-term research could be on a particular conservation issue or challenge that requires immediate attention viz. habitat loss, species decline, human-wildlife conflict, socio-economic aspects or any other pressing concern. The objectives should be specific, measurable, and achievable within the limited timeframe.
- Short-term research in conservation can contribute valuable insights and solutions to immediate challenges. By focusing on specific objectives and employing efficient data collection methods, short-term projects can make a meaningful impact on the conservation landscape.

6.1.2 Long-term research

Long-term research in conservation is essential for gaining a comprehensive understanding of ecosystems, species, and the impacts of conservation interventions over time.

- Approach to long-term research in conservation envisages clear and measurable objectives which are adaptable to changes in the conservation landscape over an extended period. We need to collect comprehensive baseline data to understand the current state of the ecosystem or species and this data would serve as a reference point for future comparisons.
- Develop and implement long-term monitoring programs to track changes in biodiversity, habitat quality, and other relevant parameters. Regular data collection ensures that trends and patterns are identified over time and embrace adaptive management principles, allowing for adjustments to conservation strategies based on ongoing research findings.
- Conduct longitudinal studies to follow individuals, populations, or ecosystems over time. This approach allows for a detailed understanding of life cycles, behaviours, and responses to environmental changes and integrate genetic monitoring into long-term research to assess changes in genetic diversity over generations.
- Long-term studies provide an opportunity to observe and document how ecosystems and species respond to changing climatic conditions.
- Incorporate spatial analysis techniques to understand changes in habitat distribution, fragmentation & connectivity. This is crucial for effective conservation planning and management.

By employing a holistic approach that integrates ecological, social, and genetic perspectives, researchers can contribute significantly to the preservation of biodiversity and the sustainable management of ecosystems over time.

6.1.3 Indicative list of Research topics in Elephant Conservation

Research in elephant conservation plays a crucial role in understanding the dynamics of elephant populations, their behaviour, and the challenges they face.

The key aspects which could be considered for research in elephant conservation include:

- *Population Dynamics:* Study the population structure, including age distribution, gender ratios, and birth rates (helps in assessing the health and reproductive success of the population).
- *Migration/ Movement Patterns:* Understand the movement patterns and migration routes of elephant herds. (vital for effective conservation and management strategies).
- *Behavioural Ecology & Social Structure:* Investigate the social organization within elephant herds, including family dynamics, communication, and hierarchy (essential for developing conservation strategies that respect the natural behaviour of elephants).
- *Habitat Quality Assessment including Invasives:* Study the quality of habitat and the impact of invasives on the habitat.
- *Feeding Habits and Nutritional Studies:* Study the dietary preferences, foraging behaviour, and habitat utilization of elephants (critical for managing and preserving their natural habitats).
- *Human-Elephant Conflict:* Study the causes and patterns of human-elephant conflicts, including crop raiding and incidents of aggression (helps develop strategies to mitigate conflicts and promote coexistence between elephants and local communities), human perceptions etc.
- *Health Monitoring & Disease Surveillance:* Conduct health assessments and monitor for diseases that may affect elephant populations (crucial for implementing interventions and preventing the spread of diseases).
- *Ecosystem Impact:* Study the impact of elephants on their ecosystems and vice versa (helps in developing comprehensive conservation plans).
- *Impact on Habitat:* Study impact of developmental programmes including tourism, habitat improvement (interventions)
- *Habitat Use:* Study the elephants' habitat preferences (how changes in land use affect their movement and survival).
- *Conservation Genetics:* Assess the genetic diversity within elephant populations (help understand genetic connectivity between different elephant populations to ensure gene flow).
- *Anti-Poaching Measures: Poaching Trends:* Study the patterns and trends in elephant poaching (to understand the drivers and implement effective anti-poaching measures.)
- *Community-Based Conservation:* Research on community perceptions and attitudes towards elephants (can inform strategies that benefit both wildlife and local livelihoods).
- *Education and Awareness:* Conduct research on the effectiveness of education and awareness programs (in promoting elephant conservation).
- *Climate Change Impacts:* Investigate how climate change affects elephant habitats and their ability to adapt (for developing strategies to enhance climate resilience).

Research findings in elephant conservation should not only contribute to scientific knowledge but also inform evidence-based conservation policies and practices.

6.1.4 Outcome and management applications

Outcome and management applications in conservation refer to the tangible results and practical implications that arise from conservation research. These outcomes are crucial for informed

decision-making, shaping management strategies, and achieving positive impacts on ecosystem and biodiversity.

The key aspects of expected outcomes and management applications include:

- *Data-Driven Decision-Making:* Conservation research generates valuable data that can be used for evidence-based decision-making and the outcomes, whether related to species abundance, habitat quality, or ecosystem health, provide critical information for designing effective conservation strategies.
- *Species Recovery and Population Management:* Research outcomes may contribute to the development of species recovery plans and population management strategies and understanding the factors influencing species decline or recovery helps implement targeted interventions to support struggling populations.
- *Habitat Restoration and Protection:* Conservation research informs habitat restoration efforts by identifying key areas for intervention and helps prioritize regions for protection, restoration, or sustainable management based on the needs of specific species or ecosystems.
- *Mitigation of Human-Elephant Conflict:* Research outcomes assist in understanding patterns of human-elephant conflict, providing insights into mitigating measures and may include strategies to reduce crop raiding, prevent conflicts, or create buffer zones to minimize negative interactions.
- *Invasive Species Management:* Conservation research helps in assessing the impact of invasive species on native biodiversity and the outcomes guide the development of management plans to control or eradicate invasive species, preventing further ecological disruption.
- *Climate Change Adaptation Strategies:* Research outcomes contribute to the identification of climate change impacts on ecosystems and species and is essential for developing adaptation strategies, such as creating climate-resilient habitats or facilitating species migration.
- *Elephant Reserve Management:* Conservation research informs the design and management of elephant reserves and helps identify critical habitats, assess the effectiveness of existing reserves, and guide the establishment of new areas based on ecological needs.
- *Community-Based Conservation:* Research outcomes may facilitate community engagement and empower local communities to actively participate in conservation efforts and also involve in sustainable resource management, ecotourism initiatives, or community-led conservation plans.
- *Monitoring and Adaptive Management:* Conservation research outcomes provide benchmarks for monitoring the effectiveness of conservation interventions and adaptive management strategies can be implemented based on ongoing research to ensure that conservation efforts remain responsive to changing conditions.
- *Conservation Success Stories:* Documenting and communicating successful conservation outcomes serve as inspiration for future efforts and sharing success stories highlights the positive impact of conservation research and encourages continued support for conservation initiatives.

Conservation research outcomes, when effectively applied, play a vital role in shaping policies, guiding management practices, and ultimately contributing to the sustainable preservation of biodiversity and ecosystems. Implementation of these outcomes ensure a holistic and effective approach to conservation.

6.1.5 Research institutions/organizations/NGOs to garner support, expertise & participation

Engaging research institutions, organizations, NGOs, and individual scientists is crucial for garnering support, expertise, transparency and participation in elephant reserve conservation. These entities can contribute valuable knowledge, resources, and research findings to enhance conservation efforts. Some examples of research institutions, NGOs and community-based organizations include:

- *Research Institutions and Organizations:* Wildlife Institute of India (WII); Salim Ali Centre for Ornithology and Natural History (SACON); Centre for Wildlife Studies (CWS); Centre for Conservation and Research (CCR); Ashoka Trust for Research in Ecology and the Environment (ATREE); International Union for Conservation of Nature (IUCN); World Wildlife Fund (WWF); Wildlife Conservation Society (WCS); Bombay Natural History Society (BNHS); The Nature Conservancy (TNC); Conservation International; and Asian Elephant Specialist Group (AESG).
- *NGOs and Community-Based Organizations:* Wildlife SOS; Elephant Family India; Wildlife Trust of India (WTI); Elephant Aid International; People for Animals (PFA); Wildlife Protection Society of India (WPSI); Community-Based Elephant Conservation (CBEC) etc.

6.2. MAP PREPARATION

Maps play an important role in the implementation of a wide range of development activities. Map preparation involves the creation of visual representations of geographical information. Whether for academic research, planning, or communication purposes, maps serve as powerful tools to convey spatial relationships and patterns.

- Common types include: Reference map (shows geographic features and locations); Thematic map (emphasizes a particular theme like population density, land use); Topographic map (represents elevation and terrain features); and Navigational map (aids in navigation) etc.
- Relevant geographical data for the map can include spatial data (GIS data, satellite imagery), attribute data (population statistics, land use types), and any other information pertinent for the purpose of the map.
- GIS software like ArcGIS, QGIS, or Google Earth help to manipulate and visualize spatial data and these tools allow to import, analyse, and represent geographic information.
- Mapping platform like Google Maps, Mapbox, or ArcGIS Online and graphic design tools like Adobe Illustrator, Inkscape (for design-oriented maps) could be used in the map preparation.
- The map preparation requires an appropriate map projection based on the area and purpose of the map. Different projections distort shape, area, distance, or direction differently.

6.3 INFRASTRUCTURE AND MOBILITY

Availability of infrastructure and mobility is a basic requirement for efficient plan implementation. However, the necessity of equipment, office buildings, and means of transport need careful consideration at all levels.

6.3.1 GIS Enhancement

GIS is a very effective tool that assists in planning and monitoring of resources. Due to high cost involved in setting up the infrastructure for GIS, it is important to utilize this tool effectively to fully meet the objective and expectation that includes data creation, periodical updation, quantification and analysis.

Establishment of Geomatics Centre:

The Geomatics Centre needs to be created with the latest equipment, including workstations, survey equipment, satellite imagery, and software, and training need to be provided to the centre to keep up with the IT evolution. The GIS team needs to take advanced training to handle specialised map production and spatial data analysis. Resource persons need to be deputed to handle and coordinate the GIS requirement in the ER. Maps need to be prepared using existing resources on a daily basis and be shared with field offices for use in proposals, micro plans, and pre-treatment maps.

In order to plug in the gaps in the database, it is suggested that the following data layers may be created/procured.

- *Basic Data layer creation:* Village boundary map - Survey of India provides village boundary database in vector form under Open-Source Series Maps (OSM) category. The ER may procure the dataset as appropriate, in order to facilitate village level assessment of forest within their jurisdiction as well as of tree cover outside forest land areas for better planning, assessment and management of resource. This data layer would also assist in extracting village level land use / cover, quantification of tree cover and comparative assessment and temporal analysis of land use/ cover dynamics.
- *Baseline Geo-coded Data:* Some of the administrative boundary information is available but detailed database need to be developed with respect to geo-coded information pertaining to flora and fauna through field-based biodiversity survey, geo-coding of secondary information from on-going and past research, geo-coding of RF pillars, incidences of fire, poaching, nos. of human-elephant conflicts reported etc. There is dearth of location specific information with respect to endemic flora and fauna as well. This data needs to be collected from the various sources and a sound geo-spatial database could be generated.

Enhancing Geographic Information System (GIS) in an Elephant Reserve:

It involves leveraging spatial data and technology to better manage and protect the habitat and well-being of elephants in an Elephant Reserve by envisaging as under:

- *Habitat Mapping:* Utilize high-resolution satellite imagery and aerial surveys to create detailed habitat maps which helps in understanding the distribution of vegetation, water sources, and other key elements essential for elephant survival.
- *Migration Patterns:* Use GPS tracking collars on elephants to monitor their movement patterns and data can be integrated into GIS to create maps showing seasonal migration routes.
- *Human-Elephant Conflict (HEC) Analysis:* Incorporate data on human activities, such as agriculture, settlements, and infrastructure, into GIS and analyse the data layers alongside elephant movement patterns to identify areas of potential conflict.
- *Zoning:* Implement GIS for zoning within the reserve based on the specific needs of elephants. Designate core areas (elephant conservation zone) for breeding, feeding, migration corridors, and buffer (elephant-human co-existence zone) to minimize disturbances from human activities.
- *Monitoring and Enforcement:* Integrate GIS with real-time monitoring technologies, such as camera traps and sensor networks, to track and identify potential threats to elephants, such as poaching or illegal felling which also helps in quick response and enforcement actions.
- *Water Resource Management:* Map water sources within the reserve and monitor changes in water availability. GIS can help in assessing the impact of climate change on water resources, allowing for proactive conservation measures.
- *Fire Management:* Implement GIS for monitoring and managing wildfires within the reserve and includes mapping fire-prone areas and planning firebreaks to protect critical elephant habitats.

- *Wildlife Health Monitoring:* Integrate GIS with health monitoring data to track the health status of individual elephants and populations for implementing timely veterinary interventions and disease control measures.
- *Climate Change Impact Assessment:* Incorporate climate data into GIS to assess the potential impact of climate change on the elephant habitat for developing adaptive management strategies.
- *Education and Outreach:* Use GIS to create interactive maps and visualizations for educational purposes as this can help raise awareness about the importance of elephant conservation and promote community engagement.

By enhancing GIS in an Elephant Reserve, forest officers can make more informed decisions, implement targeted strategies, and ensure the long-term sustainability of elephant populations and their habitats.

6.3.2 MIS Enhancement

Management Information System is a very important tool for systematic and effective management of the activities and helps in periodical progress monitoring and timely & effective decision making. It facilitates the automated flow of standardised information between the users in the organisation and enhances productivity, accountability, and transparency.

Software Specifications:

The MIS application needs to customised and strengthened to accommodate components for planning, activity progress tracking and monitoring.

- We need to develop a simple web-based MIS application system focusing on specific crucial information required for effective implementation and monitoring of activities. The design of the software interface needs to be simple and user friendly. In the software there could be a provision of drop and down menu so as to reduce manual typing, logical checks, etc as an internal mechanism of quality checking.
- The software could also have the following capabilities such as: provision of data entry from anywhere; security levels with permission to access, view, data entry and edit; printing and exporting of reports; provision of e-mail facility; uploading and downloading of sharable maps; automatic data backup facility; and GPS data uploading facility.
- User profiles, activity calendars, interactive dashboard, alert notification, and progress indicators are the features that need to be added in MIS application.

Enhancing Management Information System (MIS) in an Elephant Reserve:

It involves improving the collection, processing, analysis, and dissemination of information for effective decision-making and conservation efforts. Here are several ways MIS can be enhanced in an Elephant Reserve:

- *Data Standardization and Integration:* Ensure that data from various sources, such as research studies, monitoring programs, and ranger reports, adhere to standardized formats and integrate diverse datasets into a unified system to provide a comprehensive view of the reserve's status.
- *Digital Data Collection:* Implement mobile applications and digital tools for field data collection which can streamline the process of gathering information on elephant movements, habitat conditions, and human activities, reducing errors and improving efficiency.
- *Real-time Monitoring:* Utilize sensors, camera traps, and other monitoring devices to collect real-time data on elephant behaviour, environmental conditions, and potential threats and integrate this information into the MIS to enable rapid response to emerging issues.

- *GIS Integration:* Integrate GIS with the MIS to combine spatial and non-spatial data as this allows for a more comprehensive understanding of the spatial relationships between elephant movements, habitat features, and potential threats.
- *Incident Reporting and Response:* Develop an online reporting system for incidents such as poaching, illegal felling, or human-elephant conflicts and implement a streamlined process for responding to and resolving reported incidents.
- *Population Monitoring:* Enhance the MIS with tools for tracking and monitoring elephant populations which includes demographic data, health status, and reproductive patterns.
- *Community Engagement:* Facilitate communication and engagement with local communities through feedback mechanisms, awareness programs, and collaborative initiatives.
- *Resource Allocation and Budgeting:* Use the MIS to track resource allocation and budgeting for conservation activities.
- *Performance Metrics and Key Performance Indicators:* Define and track key performance indicators to measure the success of conservation initiatives related to reduced human-elephant conflicts, improved habitat conditions, and successful breeding events.
- *Training and Capacity Building:* Integrate modules into the MIS for training and capacity building of reserve staff as the same ensures that personnel are equipped with the necessary skills to use MIS tools effectively and stay updated on best practices in conservation.
- *Data Security and Privacy:* Implement robust data security measures to protect sensitive information related to elephants, their habitats, and conservation activities which is especially important when sharing data with external partners and stakeholders.
- *Reporting and Visualization:* Develop customizable dashboards and reporting tools within the MIS to present data in a visually accessible format for interpreting complex information.

By enhancing the MIS in an Elephant Reserve, forest officers can improve their ability to monitor, manage, and conserve elephant populations effectively, while also collaborating with other stakeholders.

6.3.3 Equipment

Managing an elephant reserve involves a range of tasks, from habitat monitoring to anti-poaching efforts and community engagement. The equipment needed will vary depending on the specific goals and challenges of the reserve.

However, an indicative list of equipment commonly used in the management of elephant reserve, includes:

- *GPS and Tracking Devices:* Collars or implants with GPS and tracking capabilities for monitoring the movements of individual elephants.
- *GIS Software and Hardware:* Geographic Information System (GIS) software, hardware and satellite images for mapping and analysing spatial data.
- *Communication Equipment:* Two-way radios, satellite phones, and other communication devices to facilitate real-time communication among reserve staff.
- *Camera Traps:* Motion-activated cameras placed in strategic locations to monitor wildlife activity, including elephant movements, and to detect illegal activities such as poaching.
- *Surveillance Drones:* Unmanned aerial vehicles (UAVs) equipped with cameras for aerial surveillance, mapping, and monitoring of large areas.
- *Field Monitoring Equipment:* Binoculars, spotting scopes, and camera equipment for field monitoring and research.

- *Medical and Veterinary Equipment:* Equipment for conducting health assessments on elephants, including veterinary supplies, tranquilizer darts, and equipment for immobilization if necessary.
- *Anti-Poaching Equipment:* Night vision goggles, thermal imaging cameras, and other surveillance equipment to support anti-poaching efforts (protective gears/ first-aid kits).
- *Weather Monitoring Tools:* Weather stations for monitoring environmental conditions, which is essential for understanding the impact of climate on elephant habitats.
- *Water Management Equipment:* Tools for monitoring and managing water sources, such as water quality testing equipment etc.
- *Educational and Outreach Materials:* Audiovisual equipment, educational materials, and community engagement tools.
- *Data Storage and Management Systems:* Computers, servers, and data storage devices for managing and storing research data, monitoring reports, and other relevant information.
- *Emergency Response Equipment:* First aid kits, emergency medical supplies, and evacuation equipment for responding to emergencies.
- *Community Engagement Tools:* Materials for community outreach, including brochures, signage, and audiovisual presentations.
- *Training Equipment:* Training materials, simulators, and other tools for educating reserve staff on wildlife management, conservation techniques, and emergency response procedures.

It's important to regularly assess and update the equipment to ensure that it meets the evolving needs of the elephant reserve. Proper training for staff on the use and maintenance of equipment is also critical.

6.3.4 Vehicles

Choosing appropriate vehicles for an Elephant Reserve is crucial for effective management, monitoring, and conservation efforts. The exact number of vehicles and types to be procured may be decided keeping into consideration, the existing fleet and the site-specific conditions.

The types of vehicles, which could commonly be used in elephant reserves, include:

- *4x4 Vehicles:* Robust and versatile vehicles, such as SUVs or trucks with four-wheel drive capabilities, are essential for navigating varied and sometimes challenging terrains within the ER.
- *All-Terrain Vehicles (ATVs):* ATVs can be used for quick response and patrolling in areas with rough or inaccessible terrain.
- *Tracked Vehicles:* Tracked vehicles, such as modified bulldozers or tracked ATVs, can be effective in dense vegetation and swampy areas.
- *Utility Task Vehicles (UTVs):* UTVs, also known as side-by-sides, are off-road vehicles designed for utility tasks. They are suitable for transporting equipment, personnel, and supplies.
- *Elephant Patrol Vehicles:* Customized vehicles with elevated viewing platforms can be used for elephant patrols. These vehicles are designed to allow a better view of elephants & surroundings.
- *Electric or Hybrid Vehicles:* Consider incorporating electric or hybrid vehicles into the fleet for reduced environmental impact and lower noise levels, which can be less disruptive to wildlife.
- *Boats and Canoes:* In reserves with water bodies, boats and canoes are essential for patrolling and monitoring wildlife along riverbanks and lakeshores.

- *Surveillance Drones:* Unmanned aerial vehicles (UAVs) or drones can be used for aerial surveillance to monitor elephant movements, detect illegal activities, and survey large areas.
- *Communication Vehicles:* Vehicles equipped with communication equipment, such as two-way radios and satellite phones, are essential for maintaining contact among reserve staff.
- *Ambulance or Veterinary Vehicles:* Specifically equipped vehicles for transporting injured or sick elephants to veterinary facilities within or outside the reserve.
- *Educational and Awareness Vehicles:* Vehicles designed for educational purposes, equipped with audiovisual facilities, can be used for outreach programs and raising awareness.

When selecting vehicles for an Elephant Reserve, it's essential to consider the specific needs of the reserve, the types of terrain, and the tasks required for conservation and management.

6.3.5 Buildings

Buildings within an elephant reserve serve various purposes, ranging from research and monitoring facilities to infrastructure that supports conservation efforts and visitor education. The design and construction of these buildings could consider the unique needs of the reserve, as well as the safety and well-being of both wildlife and humans.

The types of buildings commonly found inside an elephant reserve, include:

- *Staff Housing:* Residential buildings for the frontline staff, including other officials. The structures may be designed to minimize their impact on the environment and provide a comfortable living.
- *Ranger Stations:* Stations strategically located throughout the reserve for the reserve rangers and field staff and serve as bases for anti-poaching patrols and monitoring.
- *Research and Conservation Centre:* A facility equipped for researchers to conduct studies the centre may include laboratories, offices, and conference hall.
- *Visitor Centre:* An educational centre for visitors that provides information about elephant reserve and may include interactive exhibits, audiovisual displays, and educational programs.
- *Visitor Accommodations:* Lodging facilities for tourists who wish to experience the reserve and could range from eco-friendly lodges to camping sites.
- *Training Centre:* A facility for training reserve staff, local communities, and volunteers on elephant conservation, and sustainable practices.
- *Veterinary Clinic:* A facility equipped with medical tools and equipment for the health assessment and treatment of elephants.
- *Communication Hub:* A central communication hub equipped with radio equipment, satellite communication systems, and monitoring screens.
- *Equipment Storage and Maintenance:* Buildings to store and maintain vehicles, surveillance equipment, and other tools used for reserve management and protection.
- *Educational and Interpretive Centres:* Facilities that offer educational programs, workshops, and interpretive displays to raise awareness about elephants, biodiversity, and conservation efforts.
- *Anti-poaching Camps:* The anti-poaching facilities created for housing anti-poaching watchers and staff for protection measures and for conducting patrolling.
- *Guard Posts and Observation Towers:* Elevated structures for wildlife observation and surveillance, particularly for tracking elephant movements and detecting potential threats like fire.

- *Emergency Response Centre:* A dedicated building equipped for emergency response and coordination during incidents such as wildfires, natural disasters, or medical emergencies.
- *Waste Management Facilities:* Structures for waste disposal and recycling to ensure that the reserve maintains a minimal environmental footprint.

When planning and constructing buildings inside an elephant reserve, sustainable construction practices and materials may be employed, and structures designed with the safety and conservation in mind.

6.4 TRAINING

Training is necessary for introducing new technologies and for updating the existing manpower with knowledge and skills.

- *TOT:* To improve the technical capacity training needs to be provided to the key resource persons who in turn will act as master trainers to train others. To maintain the consistency and quality of trainings, the help of experts could be taken.
- *General Training:* These trainings need to be conducted in-house, through the master trainer. Before these trainings, the standard training manuals and standard operating procedures need to be developed. The target persons need to be selected as per experience and proficiency. A training monitor also may be designated to assess the quality of these trainings along with feedbacks from the participants for future qualitative improvement of trainings.
- *Thematic Training:* critical topics include elephant biology and behaviour; habitat assessment and management; human-elephant conflict mitigation; anti-poaching techniques and crime investigation; population estimation and monitoring; community engagement; conservation laws; elephant health and veterinary care; communication and outreach; GIS and technology in conservation etc
- *Key training methods:* includes field workshops; seminars and lectures; internships and apprenticeships; e-learning modules; on-site training; participatory learning; simulations etc.

Training in elephant conservation may be comprehensive, addressing a range of topics and employing diverse methods to cater to the needs and preferences of participants. Continuous learning, updates on emerging research, and networking within the conservation community are also crucial components.

6.4.1 On the Job Training

- On-the-job training (OJT) is a method of employee training that takes place within the workplace as individuals learn through hands-on experience and exposure to real-world tasks. This type of training is practical, relevant, and often tailored to the specific requirements of the job.
- Considerations for Implementing On-the-Job Training envisages customization, integration with daily tasks, clear objectives, support system, continuous improvement, and feedback loops.
- On-the-job training is particularly effective for jobs that require practical skills and experience. It offers a dynamic and interactive learning experience that can lead to faster integration of new employees into their roles.

6.4.2 Formal and Customised Training Courses

Designing a formal or customised training courses involve careful planning and consideration of various elements to ensure the effective transfer of knowledge and skills. The key components when developing any formal or customized training course includes:

- Conduct a thorough needs assessment to identify the specific knowledge and skills that learners need including current proficiency levels of the target audience, and gaps in their competencies.
- Define the learning objectives of the course which may be specific, measurable, achievable, relevant, and time-bound (SMART) and guide the development of course content/ assessments.
- Organize the content into a structured curriculum and break down the material into modules or units, ensuring a logical flow of information and align each module with the defined objectives.
- Apply instructional design principles to create engaging and effective learning experiences and consider use of multimedia, and varied instructional methods to cater to different learning styles.
- Determine the most appropriate delivery methods for the content which may include in-person classroom sessions, virtual classrooms, e-learning modules, webinars, or a combination of these.
- Develop comprehensive training materials, including presentations, handouts, manuals, and multimedia resources and ensure that materials support the learning objectives.
- Design assessments to measure learners' understanding and application of the material and develop evaluation criteria to measure the overall effectiveness of the training.
- Incorporate interactive elements to keep learners engaged which can include group discussions, case studies, role-playing, simulations, and practical exercises.
- Establish mechanisms for collecting feedback from participants during and after the course and use the feedback to make improvements and adjustments to future iterations of the training.
- Provide additional learning resources such as recommended readings, articles, or supplementary materials to enhance participants' understanding of the subject matter.
- Consider offering a certification or recognition for participants who successfully complete the training as this can serve as motivation and provide tangible proof of their accomplishment.
- Regularly review and update the course content based on feedback, changes in the field, and evolving best practices as continuous improvement ensures that the training remains relevant.

By incorporating these elements into the design and development of a formal or customised training course, we can create a structured and effective learning experience for participants, promoting skill acquisition and knowledge retention.

6.4.3. Establishing a Learning Centre

Establishing a learning centre involves careful planning, resource allocation, and consideration of various factors to create an environment conducive to effective learning. Establishing a learning centre within an elephant reserve presents a unique opportunity to educate the public, researchers, and local communities about elephants, biodiversity conservation, and sustainable practices. The specific steps to consider when establishing a learning centre in an elephant reserve, envisages:

- Collaborate with wildlife experts, local communities, government agencies, and conservation organizations and engage stakeholders in the planning process to ensure a comprehensive and inclusive approach.
- Conduct a needs assessment to identify the educational needs and preferences of the target audience, including local communities, schools, tourists, and researchers.

- Clearly define the educational goals and objectives of the learning centre and determine what knowledge and skills are to be imparted participants.
- Choose a suitable location within the elephant reserve that allows easy access for visitors/ participants and blends harmoniously with the natural surroundings and consider environmental impact and sustainability in the building design.
- Design learning spaces that complement the natural environment and showcase sustainable construction practices; and incorporate eco-friendly features, and ensure the facility has the necessary infrastructure for educational programs.
- Develop curriculum that covers topics such as elephant biology, behaviour, conservation efforts, and broader ecosystem and include hands-on experiences, guided tours, and interactive exhibits.
- Integrate technology such as multimedia displays, virtual reality, and interactive exhibits to enhance the learning experience and use these tools to convey information about elephants and conservation efforts effectively.
- Establish partnerships with local experts, researchers, and conservationists and invite guest speakers to share their knowledge and experiences.
- Create engaging and interactive exhibits, displays, and activities that appeal to visitors of all ages which also creates a sense of curiosity and appreciation for elephants and wildlife conservation.
- Develop a variety of educational programs, including guided tours, workshops, seminars, and outreach initiatives which cater to different age groups and levels of interest.
- Involve local communities in the learning centre's activities and offer programs that address community needs, provide employment opportunities, and creates a sense of ownership.
- Demonstrate and promote sustainable practices in the operation of the learning centre and implement waste reduction, energy conservation, and water management strategies.
- Implement a monitoring and evaluation system to assess the effectiveness of educational programs and gather feedback from visitors and adjust programs based on their experiences and suggestions.
- Develop a marketing strategy to promote the learning centre and utilize online platforms, community events, and collaborations with travel agencies to attract visitors.
- Provide amenities such as restrooms, a cafeteria, and shaded areas for visitors and create a comfortable and welcoming environment that encourages longer stays.
- Document the outcomes of educational programs and conduct research on the impact of the learning centre on visitors' knowledge and attitudes towards elephants and conservation.
- Stay adaptable to changing educational trends, visitor preferences, and conservation priorities and continuously improve programs based on feedback, emerging research, and evolving educational needs.

By carefully considering above steps, we can establish a learning centre within an Elephant Reserve that not only educates and inspires visitors but also contributes to the overall conservation efforts.

6.5 MONITORING & EVALUATION

Systematic M&E may be carried out to monitor performance of various development and management interventions, and to ensure that lessons learned are replicated accordingly. M&E being integral part of management will require adequate resources, including budget, institutional capacity, clear institutional responsibilities, and reporting mechanisms.

6.5.1 Developing M&E Protocols

Monitoring and evaluation (M&E) are critical components of effective conservation efforts in an elephant reserve. They involve systematic data collection and analysis to assess the progress, impact, and effectiveness of conservation initiatives. A guide on implementing M&E in an elephant reserve envisages:

- Clearly define the conservation objectives of the elephant reserve.
- Identify key indicators that can measure the success or progress toward conservation objectives.
- Establish a baseline by collecting initial data on key indicators before implementing interventions.
- Choose appropriate monitoring methods for each indicator.
- Define protocols for data collection, methodology, sampling strategies, and data recording.
- Carry out regular monitoring activities according to the defined protocols.
- Integrate technology such as GIS, satellite imagery, and data management software
- Involve local communities in monitoring efforts, especially in gathering data related to HEC.
- Analyse collected data to assess trends, identify patterns, and evaluate the success of initiatives.
- Develop a regular reporting system to communicate findings to stakeholders.
- Use M&E findings for adaptive management.
- Assess the impact of conservation interventions on both elephants and the ecosystem
- Evaluate the effectiveness of specific conservation works or activities.
- Analyse data related to HEC, including frequency, locations, and severity.
- Build the capacity of local staff / community to participate and contribute to the M&E process.
- Plan and allocate sufficient budget and resources for ongoing M&E activities.
- Collaborate with research institutions to leverage scientific expertise & research methodologies.
- Implement a long-term monitoring plan to track changes and trends over an extended period.
- Establish a regular review process and feedback loop to continuously improve the M&E system.

Effective monitoring and evaluation in an elephant reserve contributes to evidence-based decision-making, adaptive management, and the long-term sustainability of conservation efforts.

6.5.2 Operation and Effect Indicators

Operation and effect indicators are key elements in monitoring and evaluating the performance and impact of various programs, or operations. These indicators help assess the effectiveness of activities, measure progress toward goals, and informed decision-making.

In the context of an elephant reserve, operation and effect indicators play a crucial role in monitoring and evaluating conservation efforts. These indicators help assess the efficiency of various activities and interventions within the reserve and measure the broader impact on both elephants and the ecosystem.

Operation indicators measure the efficiency, implementation, and outputs of specific activities within a program or operation. They provide insights into whether planned activities are being carried out as intended. Examples in respect of ER include:

- *Patrol Efforts Indicator:* Number of patrolling hours conducted by wildlife rangers.
- *Law Enforcement Actions Indicator:* Number of law enforcement actions taken.
- *Habitat Management Indicator:* Percentage of invasive species removed from elephant habitats.
- *Water Resource Maintenance Indicator:* Number of water sources maintained or created.
- *Community Outreach Events Indicator:* Number of community outreach events conducted.
- *Infrastructure Development Indicator:* Number of infrastructure projects completed.
- *Research Initiatives Indicator:* Number of research studies conducted within the reserve.
- *Community-Based Monitoring Indicator:* Number of community members involved in monitoring.

Effect indicators assess the impact and outcomes of a program or operation on the intended beneficiaries or the broader community. They help answer questions about the effectiveness of interventions and whether desired changes are occurring. Examples in respect of ER include:

- *Elephant Population Trends Indicator:* Annual change in elephant population size.
- *Human-Elephant Conflict Incidents Indicator:* Number of reported HEC incidents.
- *Biodiversity Index Indicator:* Changes in overall biodiversity within the reserve.
- *Tourist Engagement Indicator:* Number of tourists participating in educational programs.
- *Vegetation Health Indicator:* Changes in vegetation health and diversity.
- *Livelihood Improvement Indicator:* Increase in income levels of communities adjacent to ER.
- *Cultural Preservation Indicator:* Maintenance of cultural practices related to elephants.
- *Education and Awareness Levels Indicator:* Improvement in community members' knowledge.
- *Reduction in Poaching Incidents Indicator:* Decrease in reported incidents of elephant poaching.
- *Eco-Tourism Revenue Indicator:* Increase in revenue from eco-tourism activities.

Integrating Operation and Effect Indicators:

The successful monitoring and evaluation of conservation efforts in an elephant reserve involve integrating both operation and effect indicators. Regularly collecting and analysing data related to these indicators enables managers to make informed decisions, adapt strategies as needed, and demonstrate the overall impact of their efforts on elephant conservation and the surrounding ecosystem.

6.5.3 M&E Activities

Monitoring and Evaluation (M&E) activities, including baseline surveys, mid-term evaluations, and terminal evaluations, are integral components of conservation programs in an elephant reserve. These activities provide critical insights into the progress, effectiveness, and impact of conservation initiatives.

- ***Baseline Survey:*** The objective is to establish the initial status of key indicators before the implementation of conservation interventions. The activities include comprehensive data collection on relevant indicators, such as elephant population size, habitat health, human-elephant conflict incidents, and community perceptions; stakeholder consultations to understand baseline conditions and gather local perspectives; and establishment of benchmarks for future comparison. The survey is conducted during the pre-implementation phase, typically 3-6 months before the start of conservation activities. The

output is in the form of baseline report outlining the current state of the elephant reserve, key challenges, and initial data on relevant indicators.

- ***Mid-Term Evaluation:*** The objective is to assess the progress and effectiveness of conservation efforts halfway through the project duration. The activities include data analysis and review of key indicators to measure progress; evaluation of the efficiency of implemented strategies and identification of challenges; stakeholder consultations and community feedback sessions; and assessment of changes in human-elephant conflict incidents, habitat conditions, and other targeted outcomes. The mid-term evaluation is conducted 1-2 years after the initiation of conservation activities. The output is in the form of mid-term evaluation report highlighting achievements, challenges, and recommendations for adjustments.
- ***Terminal Evaluation:*** The objective is to conduct a comprehensive assessment of the overall impact and outcomes of conservation initiatives at the end of the project lifespan. The activities include in-depth analysis of final data on key indicators; evaluation of the sustained impact on elephant populations, habitat health, and community well-being; stakeholder consultations to gather final feedback; and review of lessons learned and identification of best practices. The end-term evaluation is conducted at the completion of the conservation project, typically 3-5 years after the initiation. The output is in the form of terminal evaluation report summarizing the overall success of the conservation efforts, lessons learned, and recommendations for future projects.

Key Considerations:

- Ensure that indicators selected for the baseline survey, mid-term evaluation, and terminal evaluation align with the management goals and objectives.
- Emphasize the importance of reliable and accurate data collection methods during baseline surveys and regular monitoring to ensure the validity of evaluation results.
- Engage key stakeholders, including local communities, government agencies, and conservation partners, throughout the M&E process to gather diverse perspectives.
- Use findings from the baseline survey and mid-term evaluation to inform adaptive management strategies, making adjustments as needed for improved management effectiveness.
- Build the capacity of field staff and local stakeholders to actively participate in data collection and M&E activities.
- Regularly communicate M&E findings to stakeholders through reports, workshops, and presentations and transparent reporting enhances accountability and facilitates learning.
- Consider the establishment of a long-term monitoring plan to continue tracking indicators and sustaining positive outcomes beyond the project lifespan.

By integrating these M&E activities into the conservation management plan for an elephant reserve, we can systematically assess, learn, and adapt their strategies to ensure the long-term success of elephant conservation efforts.

6.5.4 Scientific spatial monitoring

Scientific spatial monitoring in an elephant reserve involves the use of advanced technologies and scientific methodologies to track and analyse spatial patterns and changes in the reserve's ecosystem. This monitoring is crucial for understanding elephant movement, habitat use, and overall biodiversity. The key components involved in scientific spatial monitoring in an elephant reserve include:

- *Geographic Information System (GIS):* Used for mapping of elephant movements, habitat types, water sources, and human settlements including overlaying spatial layers to identify areas of high conservation significance.
- *Remote Sensing:* Used for monitoring changes in land cover and vegetation over time including detecting deforestation, encroachments, or changes in habitat quality.

- *GPS Tracking:* To monitor the movement and behaviour of individual elephants GPS collars are attached to elephants to collect real-time location data for analysing movement patterns, migration routes, and habitat preferences.
- *Camera Trapping:* Used to capture images or videos of wildlife for population monitoring by deploying camera traps in strategic locations to capture elephant and other wildlife activities by analysing imagery for population estimates and behaviour studies.
- *Spatial Analysis:* Purpose is to analyse and interpret spatial data to derive meaningful insights. The activities envisage identifying corridors and critical habitats for elephants by analysing spatial relationships between human settlements and elephant movements.
- *Habitat Suitability Modelling:* Purpose is to predict suitable habitats for elephants based on environmental variables by integrating environmental data (e.g., vegetation, water availability) to model habitat preferences and identifying areas with high suitability for conservation interventions.
- *Human-Elephant Conflict Mapping:* Purpose is to map and analyse incidents of human-elephant conflict by recording and mapping locations of conflicts and analysing spatial patterns to identify hotspot areas and inform mitigation strategies.
- *Data Integration and Analysis:* Purpose is to integrate various spatial datasets and conduct comprehensive analyses by integrating GPS tracking, camera trap, and remote sensing data for holistic assessments and conducting spatial analytics to understand ecological processes.
- *Monitoring Vegetation Health:* Purpose is to assess the health and composition of vegetation in the elephant habitat by using satellite imagery and on-the-ground assessments to monitor changes in vegetation including identifying areas where habitat restoration may be needed.
- *GIS-Based Decision Support Systems:* Purpose is to support decision-making processes using spatial data by developing GIS-based decision support tools for reserve management and providing spatial information for informed conservation planning.
- *Community Mapping:* Purpose is to involve local communities in mapping and monitoring efforts by engaging communities in participatory mapping exercises and incorporating local knowledge into spatial analyses.
- *Spatial Monitoring Software:* Purpose is to utilize specialized software for spatial data management and analysis by implementing software solutions for data storage, analysis, and visualization and training staff in the use of spatial monitoring tools.

Benefits of Scientific Spatial Monitoring:

- Informed decision-making for habitat protection, restoration, and corridor planning.
- Identifying areas prone to conflict and implementing targeted mitigation measures.
- Understanding population dynamics and trends for effective conservation strategies.
- Monitoring changes in vegetation, water bodies, and overall ecosystem health.
- Using scientific evidence to guide conservation interventions and resource allocation.

Scientific spatial monitoring provides a comprehensive understanding of the spatial dynamics within an elephant reserve, enabling conservationists to make informed decisions for the protection and sustainable management of the ecosystem.

6.5.5 Concurrent evaluation and application

Regular monitoring is necessary to ensure that implementation is on right track. Concurrent evaluation refers to the simultaneous assessment of various factors and processes within the reserve to ensure the effective management and conservation of elephants and their habitat. Output-related parameters for monitoring may be established that are related to physical and financial progress. This process involves the integration of ecological, social, economic, and

administrative considerations. Some key aspects in concurrent evaluation along with potential application includes:

- *Ecological Assessment:* Evaluate the condition of the elephant habitat, including vegetation cover, water sources, and overall ecosystem health and assess the diversity of plant and animal species within the reserve, as a healthy ecosystem supports elephant populations.
- *Elephant Population Dynamics:* Monitor the size and age/sex structure of the elephant population to understand demographics and potential threats and study elephant movement patterns and migration corridors to ensure connectivity between different areas.
- *Human-Elephant Conflict (HEC):* Assess the frequency and extent of human-elephant conflicts, particularly incidents of crop raiding and evaluate the effectiveness of existing mitigation measures such as electric fences, early warning systems, or community-based initiatives.
- *Community Engagement:* Assess the impact of elephants on local communities and vice versa including the effectiveness of community-based conservation programs and also evaluate the success of educational programs aimed at raising awareness about elephant conservation among local communities.
- *Law Enforcement and Anti-Poaching Measures:* Evaluate the efficiency of anti-poaching patrols and law enforcement efforts within the reserve and monitor and assess any illegal activities within the reserve that may pose a threat to elephants, such as poaching or illicit felling.
- *Infrastructure and Administrative Aspects:* Evaluate the training and capacity of rangers and frontline staff to ensure effective wildlife protection and assess the condition of infrastructure such as roads, watchtowers, and communication systems.
- *Data Management and Technology:* Utilize Geographic Information System (GIS) and remote sensing technologies for mapping and monitoring habitat changes and implement systems for integrating data from various sources to facilitate holistic analysis.

Applications

- Use evaluation findings to adapt and refine management strategies in real-time, responding to changing ecological and socio-economic conditions.
- Inform policymaking at local, regional, and national levels by providing data-driven insights into the status of the elephant reserve.
- Involve local communities in the evaluation process, creating a sense of ownership and responsibility for elephant conservation.
- The evaluation results can be used to attract funding for conservation initiatives and research projects in the elephant reserve.
- Share evaluation findings with the international community, fostering collaboration and support for transboundary conservation efforts.

Concurrent evaluation in an elephant reserve thus is a comprehensive approach that involves continuous assessment of ecological, social, and administrative aspects. It plays a crucial role in ensuring the long-term conservation and sustainable management of elephant populations and their habitats.

6.5.6 Review Meetings & Workshops

Annual planning, review meetings, and workshops are essential components of effective management and conservation efforts within an elephant reserve. These activities help in setting goals, reviewing progress, addressing challenges, and initiating collaboration among stakeholders.

- *Annual Planning:* The objective is to define conservation and management goals for the upcoming year, allocate resources effectively and establish priorities for habitat protection, anti-poaching efforts, community engagement, and research. This envisages evaluation of data on elephant populations, habitat health, human-elephant conflict, and law enforcement efforts including trends and patterns to informed decision-making. The goal setting establishes clear and measurable goals for the upcoming year, considering both short-term and long-term objectives and the goals are prioritized based on the urgency and impact. The resource allocation, financial, human, and technological resources, is based on the identified priorities ensuring a balanced distribution of resources across different aspects of management. Detailed action plan may be developed for each goal, outlining specific tasks, responsible parties for implementation, timelines, and performance indicators.
- *Review Meetings:* The objective is to assess progress towards goals set during the annual planning, identify challenges and successes and adjust strategies based on lessons learned. This requires presentation of a comprehensive progress report on each goal, backed by data and case studies, highlighting achievements and challenges. Based on the feedback, adjustments in strategies or resource allocation based on the outcomes and challenges encountered may be carried out. We need to document the outcomes of the review meeting, including decisions made, action items, and recommendations for future planning.
- *Workshops:* The objective is to have collaboration and communication among stakeholders, provide training on new technologies, methodologies, or best practices and address specific challenges through brainstorming and problem-solving. This envisages theme identification for the workshop based on current challenges or emerging opportunities (e.g. Human-elephant conflict mitigation, community engagement strategies, advanced anti-poaching techniques) through expert presentations, group activities, training sessions and networking opportunities. Collaboratively, we may develop action plans based on the insights and knowledge gained during the workshop. Ensure that all relevant stakeholders are represented, including local communities, and participants get to know the practical steps, for implementation in their respective areas.

6.5.7 Pilot studies

Pilot studies play a crucial role in understanding and addressing specific challenges or testing new approaches within an elephant reserve. These studies are typically small-scale, experimental initiatives designed to gather information, assess feasibility, and inform larger-scale interventions.

- Clearly articulate the purpose of the pilot study. Whether it's testing a new anti-poaching technique, assessing the impact of a community engagement program, or evaluating the feasibility of a technology, the objectives may be well-defined.
- Choose a specific issue or challenge within the elephant reserve that the pilot study aims to address and identify a manageable geographical area within the reserve to conduct the pilot, ensuring it's representative of the larger ecosystem.
- Engage relevant stakeholders, including communities, government agencies, NGOs, and researchers, in planning and execution of the study. Also, gather insights from local communities who often possess valuable knowledge about the area and its challenges.
- Clearly state the hypotheses or questions the pilot study aims to answer and choose appropriate data collection methods, which may include surveys, interviews, camera traps, or other observational techniques.
- Develop a realistic timeline for the pilot study, taking into account seasonal variations and other environmental factors and allocate necessary resources, including personnel, equipment, and funding.

- Depending on the nature of the study, plan for both qualitative and quantitative data analysis and establish benchmarks or baseline data against for comparing the results.
- Based on the results of the pilot study, decide whether to scale up the intervention, refine the approach, or discontinue if deemed ineffective. Document lessons learned to inform future initiatives and studies.
- If successful, integrate the lessons learned from the pilot study into the long-term conservation and management plan for the elephant reserve.

Conducting pilot studies allows for a more nuanced understanding of the unique challenges within an elephant reserve and provides valuable insights to inform evidence-based conservation strategies.

6.5.8 Thematic studies and documentation

Thematic studies and documentation in an elephant reserve involve in-depth research and analysis focused on specific themes or topics relevant to the conservation and management of elephants and their habitats. These studies aim to generate detailed insights, provide a knowledge base for decision-making, and contribute to the overall understanding of key issues within the reserve.

- The thematic areas and examples include:
    - *Habitat Ecology:* To understand the dynamics of the elephant habitat by assessing vegetation cover, water sources, and land-use changes using remote sensing and document changes in habitat quality and identify factors influencing habitat degradation.
    - *Human-Elephant Conflict (HEC):* To analyse patterns and drivers of human-elephant conflict by surveying conflict incidents, assessing mitigation measures, and gather community perspectives and document hotspots, frequency of incidents, and the effectiveness of existing mitigation strategies.
    - *Population Dynamics:* To study the demographics and behaviour of elephant populations by conducting elephant counts, monitoring age/sex structures, and analysing migration patterns and document population trends, reproductive rates, and social structures.
    - *Biodiversity Assessment:* To assess the diversity of flora and fauna in the elephant reserve by conducting biodiversity surveys, including plant and animal species and document RET species, changes in biodiversity over time, and potential threats.
    - *Anti-Poaching Measures:* To evaluate the effectiveness of anti-poaching efforts by assessing patrolling strategies, law enforcement effectiveness, and incidence of poaching and document successful interventions, identify challenges, and propose improvements.
    - *Community Engagement and Livelihoods:* To understand the impact of elephants on local communities and vice versa by surveying community perceptions, assessing economic impacts, and documenting traditional knowledge and identify successful community engagement initiatives and challenges faced by local residents.

Conducting thematic studies and documentation in an elephant reserve contributes significantly to evidence-based conservation, providing a foundation for informed decision-making and sustainable management practices.

6.5.9 Publications

Publishing annual reports and newsletters in local language is an effective method to communicate the activities, achievements, challenges, and important information related to an elephant reserve. These publications serve as valuable tools for engaging stakeholders, sharing knowledge, and raising awareness about conservation efforts.

- *Annual Reports:* summarizes the conservation and management activities conducted within the elephant reserve over the past year, highlighting achievements, challenges, and progress toward long-term goals and provides stakeholders with a comprehensive overview of the reserve's status. The report needs to clearly outline the goals and objectives set for the reporting period and detail all the activities and achievements including milestones, research projects, monitoring activities, HEC incidents and mitigation efforts, community engagement initiatives and their impact. The report needs to present a transparent breakdown of financial allocations and expenditures and discuss challenges encountered and strategies for overcoming them including outlining plans for the upcoming year and any adjustments to existing strategies. The report may be shared with the government agencies, NGOs, researchers, and other stakeholders.
- *Newsletters:* provide regular updates on ongoing activities within the elephant reserve, share success stories, upcoming events, and important announcements and foster a sense of community among stakeholders. The newsletter features recent accomplishments and activities in a concise manner and explores one or two topics in-depth, such as a specific research project, community initiative, or conservation success story. The newsletter provides information on upcoming events, workshops, or conservation campaigns, highlights community perspectives, stories, or contributions and features information about individual elephants or other wildlife in the reserve with captivating images from the reserve. We need to determine the frequency of newsletters (e.g., monthly, quarterly) and distribute through email subscriptions, on the reserve's website, and in print if feasible and also encourage social media sharing to expand reach.

Creating and disseminating annual reports and newsletters for an elephant reserve fosters transparency, builds community support, and keeps stakeholders informed about conservation efforts. Regular communication through these channels strengthens relationships and encourages a collaborative approach to elephant conservation.

6.5.10 Website and information dissemination

Establishing a website and utilizing effective information dissemination strategies are essential for promoting transparency, engaging stakeholders, and raising awareness about the conservation efforts within an elephant reserve.

- *Website Development:* We need to choose a domain name that reflects the identity of the elephant reserve and select a reliable hosting service to ensure the website's accessibility preferably through National Informatics Centre (NIC). The website structure should feature a visually appealing homepage with a brief overview of the reserve's significance and current activities and provide detailed information about the elephant reserve, its history, and its conservation goals including highlighting of the ongoing conservation and management initiatives, research projects, anti-poaching efforts, and community engagement programs. We need to dedicate a section on the wildlife and biodiversity, human-elephant conflict (HEC) and community engagement. The website should also provide a section for news, newsletters, and updates; high-quality visuals to showcase the natural beauty of the reserve and its wildlife and research and publications. We also need to ensure that the website is mobile-friendly and accessible to users with varying levels of internet connectivity, keeping the website content up-to-date by implementing a content management system (CMS) and providing multilingual support to cater to diverse audiences.
- *Information Dissemination Strategies:* Establish and maintain active profiles on popular social media platforms (e.g., Facebook, Twitter, Instagram); implement an email subscription service for newsletters and updates; organize virtual or in-person educational programs for local communities, schools, and interested stakeholders; collaborate with local newspapers, radio stations, and television channels to disseminate information;

conduct workshops and seminars to engage with stakeholders, share research findings, and address community concerns; foster partnerships with non-governmental organizations (NGOs) and other conservation entities to leverage their communication networks; create interactive maps and infographics to visually represent important data and trends; utilize community radio stations or podcasts to share information with local communities; provide a platform for stakeholders to provide feedback, ask questions, and share their perspectives; and establish online forums or discussion boards to facilitate community discussions and knowledge sharing.

Creating a comprehensive website and implementing effective information dissemination strategies are integral components of a successful conservation communication plan for an elephant reserve. Regular updates, community engagement, and leveraging various communication channels contribute to building a supportive network and fostering a culture of conservation awareness.

6.6 USE OF INNOVATIVE TECHNIQUES/ TECHNOLOGIES

The use of innovative techniques and technologies in an elephant reserve is crucial for enhancing conservation efforts, improving monitoring capabilities, and mitigating human-elephant conflict. Several innovative approaches and technologies that can be applied in an elephant reserve, include:

- *Geographic Information System (GIS) and Remote Sensing:* can be used for mapping and monitoring habitat changes, land-use patterns, and migration corridors & enables the creation of detailed spatial databases, aids in habitat management, and supports informed decision-making.
- *Camera Traps and Sensor Networks:* are deployed to monitor elephant movement, behaviour, and population dynamics and provides for non-invasive data collection, helps track individual elephants, and contributes to anti-poaching efforts.
- *Unmanned Aerial Vehicles (UAVs) or Drones:* offers a cost-effective and efficient way to cover large areas, collect high-resolution imagery, and enhance surveillance and can be used for aerial surveys, monitoring habitat conditions, and conducting anti-poaching patrols.
- *Collar and Tracking Technology:* GPS and satellite collars are used to track the movements of elephants, especially in areas with high human-elephant conflict and provides real-time data on elephant locations, helps identify migration patterns, and supports early warning systems.
- *Machine Learning and Data Analytics:* algorithms are implemented to analyse large datasets, such as camera trap images or satellite imagery which enhances the efficiency of data analysis, aids in identifying patterns, and supports predictive modelling for elephant behaviour.
- *Remote Sensing for Vegetation Health:* The technology is used to assess vegetation health, identify changes in plant species composition, and monitor food availability for elephants and also supports habitat management and ensures the availability of suitable forage for elephants.
- *Acoustic Monitoring:* Acoustic sensors or listening devices are deployed to monitor elephant vocalizations and detect their presence in specific areas. It provides a non-invasive method for monitoring elephant activities and can be integrated into early warning systems.
- *Human-Elephant Conflict Mitigation Technologies:* such as smart fences, sensor-based alarms, and deterrent systems are utilized to reduce human-elephant conflict and it enhances the effectiveness of conflict mitigation measures, protecting both human communities and elephants.
- *Virtual Reality (VR) and Augmented Reality (AR):* VR and AR technologies are used for educational programs, allowing stakeholders to virtually experience the challenges faced

by elephants and the importance of conservation efforts and enhances public awareness and engagement through immersive experiences.

- *Blockchain Technology for Anti-Poaching:* is implemented to create secure and transparent databases for tracking and verifying the origin of ivory and other wildlife products, helping combat poaching and also enhances traceability, reduces illegal wildlife trade, and supports law enforcement efforts.
- *Community-Based Mobile Apps:* Mobile applications that enable communities to report elephant sightings, incidents, or potential conflict situations, are developed and it facilitates real-time communication, enhances community involvement, and improves the effectiveness of response.
- *Environmental DNA (eDNA) Analysis:* is used to detect the presence of elephants through DNA traces in soil, water, or vegetation samples and provides a non-intrusive and cost-effective method for monitoring elephant populations.
- *Social media and Crowdsourcing:* is leveraged to gather information on elephant movements, incidents, and community perceptions and it expands the reach of conservation messages, engages the public, and facilitates information sharing.
- *Smartphone Applications for Reporting and Education:* is used for reporting wildlife sightings, receiving educational materials, and promoting responsible tourism and enhances public participation, educates visitors, and supports conservation initiatives.
- *Satellite Communication for Anti-Poaching Patrols:* is used for real-time tracking and communication during anti-poaching patrols and improves the efficiency of patrols, enhances the safety of frontline staff, and enables rapid response to poaching incidents.

The integration of innovative techniques and technologies in an elephant reserve can significantly enhance conservation efforts, support sustainable management practices, and contribute to the coexistence of elephants and local communities.

6.7 COMPLIANCE OF MANAGEMENT EFFECTIVENESS EVALUATION

Management Effectiveness Evaluation (MEE) in an elephant reserve involves assessing how well conservation and management strategies are implemented to achieve conservation goals. The evaluation helps identify strengths, weaknesses, and areas for improvement.

MEE Framework has already been developed, clearly outlining the objectives of the MEE process and specifying what aspects of management effectiveness will be assessed including criteria and indicators that align with the goals and objectives of elephant conservation within the reserve. Compliance with MEE is crucial for ensuring the effective conservation of elephants and their habitats.

- Relevant data needs to be gathered on various aspects such as habitat health, wildlife populations, human-elephant conflict, anti-poaching efforts, and community engagement and there is a need to use a combination of quantitative and qualitative analysis methods to assess performance against defined criteria.
- MEE needs to align with existing conservation plans, policies, and strategies for the elephant reserve and we may consider any updates or changes required to align with evolving conservation priorities besides implementing regular review cycles for MEE to ensure that assessments are conducted at predefined intervals. The review outcomes could be used to adapt and improve management strategies in real-time.
- There is a need to integrate MEE findings with performance indicators to track progress over time and consider incorporating performance-based incentives for staff based on MEE outcomes besides establishing a mechanism for communities to provide feedback on the MEE outcomes.
- There is a need to learn from previous MEE cycles and incorporate feedback into subsequent assessments and embrace adaptive management principles, making adjustments based on lessons learned and changing circumstances.

- There is need to communicate MEE processes, outcomes, and improvement strategies transparently to the public and use the MEE process as an opportunity to educate the public about the importance of elephant conservation.
- There is a need to allocate resources appropriately including funding, personnel, and technology to support the compliance of MEE results effectively.
- There is a need to establish a mechanism that enables continuous improvement and adaptation based on MEE outcomes and be flexible in adjusting strategies based on MEE recommendations.

By adopting adaptive management practices, and integrating MEE into the overall conservation framework, the reserve can continually improve its management strategies for the benefit of elephant populations and their habitats.

6.8 ORGANISATION AND ADMINISTRATION

The organization and administration of an elephant reserve involves the establishment of a structured framework to manage and conserve the reserve's natural resources, particularly the elephants and their habitats. Effective organization and administration are critical for achieving conservation goals, managing human-elephant conflicts, and ensuring sustainable practices.

- There is a need to establish a dedicated authority or organization responsible for the overall management and administration of the elephant reserve besides collaborating with government agencies, non-governmental organizations, local communities, and international partners.
- The successful organization and administration of an elephant reserve requires a multidimensional approach that integrates ecological, social, and economic considerations. By ensuring effective governance, engaging local communities, implementing science-based management practices, and staying adaptable in the face of challenges, an elephant reserve can contribute significantly to the conservation of these majestic animals and their ecosystems.

6.8.1 Structure and Responsibilities

The structure and responsibilities in an elephant reserve are designed to facilitate effective management, conservation, and sustainable development. A well-organized structure helps allocate responsibilities, streamline communication, and achieve conservation goals.

The elephant reserves are constituted into several administrative and functional units. Some lie under the PA network governed by the WLPA, 1972 and others are managed as forest divisions as per the National Working Plan Code, 2023, prescriptions emanating from the IFA, 1927 or/ and the State enacted Forest Acts and other environmental legislations.

A typical organizational structure for an elephant reserve, along with key responsibilities at each level for different functional units may include:

1. *Elephant Reserve Management Co-ordination Committee (ERMCC):* Overseeing and coordination of all activities within the elephant reserve - develop and implement reserve management policies; allocate resources and funding; engage with stakeholders and partners; and oversee the overall management effectiveness.
2. *Elephant Reserve Coordinator:* Day-to-day management and coordination of reserve activities - implement the management plan; coordinate and supervise reserve staff; liaise with governmental bodies and other organizations; and report to the ERMCC. One of the Directors of the Tiger Reserve or Protected Area could be designated as the Elephant Reserve Coordinator. He may also be made responsible for constituting various functional units in the elephant reserve as per necessity under ERMCC.
3. *Functional Units:* The ERMCC may form one or more functional units as per necessity as under:

- *Research and Conservation Unit:* Conduct research and monitor conservation efforts - conduct scientific studies on elephants, flora, and fauna; monitor population dynamics and habitat health; implement conservation initiatives based on research findings; and contribute to the development of management plans.
- *Law Enforcement Unit:* Enforce wildlife protection laws and prevent poaching - conduct regular patrols to deter illegal activities; investigate and address instances of poaching; implement anti-poaching strategies; and collaborate with local law enforcement agencies.
- *Community Engagement and Liaison Unit:* Create positive relationships with local communities - facilitate communication between the reserve and local communities; implement community-based conservation initiatives; address human-elephant conflict issues; and organize educational programs and workshops.
- *Habitat Management and Restoration Unit:* Preserve and rehabilitate the natural habitat - monitor vegetation health and implement habitat management strategies; conduct ecological restoration works; collaborate with researchers to assess habitat changes; and integrate climate change adaptation measures.
- *Visitor Services and Tourism Unit:* Manage responsible eco-tourism activities - develop and maintain visitor facilities; educate tourists on responsible wildlife viewing; implement visitor guidelines to minimize impact; and generate revenue to support conservation efforts.
- *Environmental Education and Outreach Unit:* Raise awareness and promote conservation education - develop educational programs for schools and local communities; organize outreach events and workshops; collaborate with media for public awareness campaigns; and monitor and evaluate the effectiveness of educational initiatives.
- *Technology and Data Management Unit:* Utilize technology for data collection and analysis - implement Geographic Information System (GIS) and remote sensing technologies; manage databases for wildlife monitoring; integrate technology for anti-poaching efforts; and support research initiatives with modern tools.
- *Legal Compliance and Policy Unit:* Ensure adherence to conservation laws and policies - monitor legal compliance in all reserve activities; develop and update policies as needed; liaise with legal authorities; and conduct regular audits to ensure compliance.
- *Emergency Response Unit:* Plan for and respond to emergencies - develop emergency response protocols; coordinate with local authorities for disaster preparedness; ensure staff safety during emergencies; and conduct regular drills and training.
- *Communication and Public Relations Unit:* Manage communication and public relations - disseminate information to the public and media; manage the reserve's website and social media; organize public events and awareness campaigns; and respond to media inquiries.
- *Monitoring and Evaluation Unit:* To assess and improve management effectiveness - conduct regular evaluations of conservation programs; monitor the implementation of the management plan; collect feedback from stakeholders; and adapt strategies based on evaluation outcomes.

By establishing a well-defined structure and clearly assigning responsibilities, an elephant reserve can optimize its efforts toward conservation, habitat management, and community engagement, ultimately contributing to the long-term sustainability of elephant populations and their ecosystems.

6.8.2 Staff Adequacy and Amenities

Ensuring adequate staffing and providing appropriate amenities in an elephant reserve are crucial components of effective conservation and management efforts. A well-supported and equipped staff contributes to the successful implementation of conservation programs, habitat management, and community engagement initiatives.

- *Staff Adequacy:* envisages assessment of the current and future needs of the elephant reserve in terms of human resources; constitution of a multidisciplinary expert team and

equipping staff members with diverse skills; implementation of training programs to enhance the skills of reserve staff; establishment of frontline staff teams responsible for patrolling, anti-poaching efforts, and wildlife monitoring; and constitution of various functional units as detailed under ERMA.

- *Amenities and Infrastructure:* envisages well-maintained residential facilities for on-site staff; establishment of well-equipped office and technology infrastructure; creation of training facilities; acquisition of tools, equipment, vehicles, and communication devices; establishment emergency response facilities, research facilities, visitor facilities and information dissemination facilities; create community engagement spaces and community infrastructure; security infrastructure; implement proper waste management facilities; and explore the use of renewable energy sources and implement energy-efficient practices; ensure that amenities and infrastructure are accessible to all staff and establish a routine maintenance schedule for facilities, equipment, and infrastructure by allocating a portion of the budget specifically for maintaining and improving amenities and infrastructure.

By ensuring adequate staffing and providing appropriate amenities, an elephant reserve can create a conducive environment for effective conservation efforts, research, community engagement, and overall sustainable management of natural resources.

6.8.3 HRD & Performance linked Incentives

Human Resource Development and performance-linked incentives play a significant role in enhancing the effectiveness of staff members in an elephant reserve. These strategies contribute to professional growth, motivation, and improved performance in various aspects of conservation and management.

A- Human Resource Development (HRD):

- Develop a comprehensive training program covering various aspects of elephant conservation and collaborate with external experts, organizations, and institutions to provide specialized training opportunities.
- Conduct skill enhancement workshops to keep staff members updated on the latest conservation methodologies, technological advancements, and research findings and encourage participation in conferences and events related to elephant conservation.
- Identify and groom potential leaders within the organization; and implement leadership development programs to enhance managerial and decision-making skills.
- Provide opportunities for staff members to gain experience in different roles within the reserve as it ensures a diverse skill set and facilitates adaptability.
- Establish mentorship programs to pair experienced staff with newer team members as it enhances knowledge transfer, skill development, and professional relationships.
- Offer educational sponsorship programs to support staff members pursuing higher education or specialized certifications relevant to their roles as it enhances expertise and qualifications within the organization.
- Facilitate training programs on the use of technology for data collection, GIS, remote sensing, and other tools relevant to conservation efforts and ensure staff members are proficient in utilizing modern conservation technologies.

B- Performance-Linked Incentives:

- Implement performance-based incentives for individual staff members based on achievements, milestones, or exceptional contributions to conservation and management efforts.
- Introduce incentives for teams that demonstrate outstanding collaboration, achieve conservation targets, or successfully implement projects as it initiates teamwork and a collective approach.

- Establish a recognition program that publicly acknowledges and rewards staff members for exceptional performance through awards, certificates, or mentions in communications.
- Encourage and reward innovative ideas that contribute to more effective conservation practices and create a culture that values creativity and problem-solving.
- Tie incentives to the measurable impact on conservation outcomes, such as successful elephant rehabilitation, habitat restoration, or reduction in HEC.
- Offer financial support or incentives for staff pursuing additional professional certifications, courses, or workshops that directly benefit their roles in the reserve.
- Introduce long-term performance incentives for staff members who consistently demonstrate high performance over an extended period as it encourages sustained commitment and dedication.
- Reward staff contributions to sustainability initiatives within the reserve, such as reducing carbon footprint, implementing eco-friendly practices, or adopting renewable energy solutions.

By combining effective HRD initiatives with performance-linked incentives, an elephant reserve can create a motivated and skilled workforce that is dedicated to the successful conservation of elephants and their habitats.

6.8.4 Complaints monitoring

Monitoring and addressing complaints in an elephant reserve is crucial for maintaining transparency, accountability, and effective management. Complaints can come from various stakeholders, including local communities, tourists, staff, and other individuals concerned with conservation efforts. Implementing a systematic complaints monitoring system helps identify and resolve issues promptly.

- Designate a team responsible for managing and monitoring complaints and create a comprehensive complaints policy outlining the procedures.
- Provide multiple channels for submitting complaints, including: dedicated complaint hotline; email address; physical complaint boxes in strategic locations; and online complaint submission forms.
- Implement a centralized database to track and manage complaints, define specific timeframes and develop a systematic process for investigating complaints.
- Establish a feedback mechanism to update complainants and regularly review and assess the effectiveness of the complaints monitoring system

Implementing a robust complaint monitoring system in an elephant reserve promotes a culture of accountability, transparency, and responsiveness.

6.9 THE BUDGET

The financial allocation or budgeting for an elephant reserve would depend on various factors such as the size of the reserve, the number of elephants, conservation goals, and the specific activities undertaken for the management and protection of elephants and their habitat.

6.9.1 The Plan Budget

Typically, the budget for an elephant reserve may include the following components:

- *Habitat Protection and Management:* Funds may be allocated for maintaining and improving the natural habitat of elephants, including habitat restoration, fire protection measures, removal of invasives, creation of water harvesting facilities and wildlife monitoring.

- *Anti-Poaching Measures:* This includes funding for establishing and maintaining anti-poaching camp facilities including remuneration, equipment, and technology to prevent poaching and trafficking of elephants and their parts.
- *Research and Monitoring:* Budget may be set aside for scientific research, population monitoring, and data collection to better understand elephant behaviour, health, and population dynamics.
- *Community Engagement:* Conservation efforts often involve local communities. Budgeting may include funds for community outreach, education, and programs that promote coexistence between elephants and local residents including anti-depredation squads.
- *Infrastructure:* Funds may be allocated for the development and maintenance of infrastructure within the reserve, such as roads, disaster management centres, staff quarters and buildings, vehicles, and facilities for researchers.
- *Emergency Response:* Funds may be allocated for establishment of rapid response teams, equipment, and resources for immediate actions in crisis situations.
- *Veterinary Care:* This involves budgeting for the health and well-being of elephants, including veterinary services, medical supplies, and any necessary interventions for injured or sick elephants.
- *Public Awareness and Education:* Budget may be set aside for public awareness campaigns to educate the public about the importance of elephant conservation and the role of the reserve.
- *Capacity Building and Training:* Funds may be allocated for training programs, workshops, and skill development initiatives for enhancing the capacity of ER staff and local communities.

The specific budget breakdown will vary from one elephant reserve to another, and it's usually managed by the relevant conservation or wildlife management authorities. The goal is to ensure sustainable management and conservation of elephant populations and their ecosystems.

6.9.2 Operational cost

The operational costs in an elephant reserve encompass various expenses associated with the day-to-day management, conservation efforts, and maintenance of the reserve. These costs are critical for ensuring the effective functioning and protection of the reserve.

- *Personnel Salaries:* includes salaries for the field and administrative staff, and other personnel involved in reserve management.
- *Vehicles Maintenance:* includes fuel for vehicles including repairs and maintenance costs
- *Stores and Equipment:* includes equipment such as uniforms, boots, and communication devices including medical supplies.
- *Infrastructure Maintenance:* includes costs for maintaining roads, office and residential buildings, and other infrastructure within the reserve.
- *Upkeep of Camp Elephants:* includes food supplies, medicines and maintenance costs of an elephant camp,
- *Administrative Expenses:* includes general administrative costs, including office supplies, utilities, and other day-to-day operational expenses.

It's important to note that the specific operational costs can vary based on the size of the reserve, its location, the number of elephants, and the conservation goals in place.

6.9.3 Resource mobilisation other than Plan

Resource mobilization for an elephant reserve also involves acquiring funds and support beyond government-funded plan schemes. Conservation initiatives often require a mix of funding sources and partnerships to ensure sustainability.

Some strategies for additional resource mobilization, envisages:

- *Public-Private Partnerships (PPPs):* Collaborate with private companies, foundations, and non-profit organizations for joint conservation projects and develop partnerships that align with corporate social responsibility (CSR) goals of businesses.
- *Corporate Sponsorship:* Attract corporate sponsors interested in supporting wildlife conservation and offer sponsorship packages that include naming rights, visibility, and branding opportunities.
- *Grant Funding:* Apply for grants from national and international conservation organizations, foundations, and funding agencies and seek out grants specifically dedicated to wildlife conservation, biodiversity, and environmental protection.
- *Tourism Revenue:* Develop responsible tourism programs within the reserve to generate revenue and promote ecotourism initiatives that highlight the importance of elephant conservation.
- *Merchandising and Souvenirs:* Develop merchandise such as branded apparel, souvenirs, and artwork related to the elephant reserve and sell these items to visitors, with proceeds going toward conservation projects.
- *Philanthropy and Individual Donors:* Appeal to philanthropists who are passionate about wildlife conservation and launch fundraising campaigns to attract individual donors, leveraging online platforms and events.
- *Conservation Trusts and Endowments:* Establish a conservation trust or endowment fund to secure long-term financial support and encourage donors to contribute to a fund that generates interest, providing a continuous income stream.
- *Carbon Credits and Environmental Markets:* Explore opportunities to generate revenue through carbon credit sales or participation in environmental markets and implement sustainable practices that contribute to carbon sequestration and biodiversity conservation.

Resource mobilization often involves a combination of these strategies. Developing a diverse funding portfolio helps reduce dependence on any single source and ensures the sustainability of conservation efforts in the elephant reserve. Additionally, effective communication and transparency in fund utilization are crucial for building trust among donors and supporters.

6.10 THE IMPLEMENTATION SCHEDULE

Developing an implementation schedule for activities in an elephant reserve requires careful planning and is based on the specific needs, priorities, and constraints of the reserve.

The schedule provides a general framework, and the specific timeline and activities will depend on the unique characteristics of the elephant reserve and the conservation goals established.

6.10.1 The Schedule of Operations and Regulations

Creating a schedule of operations and regulations for an elephant reserve involves defining activities, rules, and guidelines that govern various aspects of management and it aims to ensure the effective protection of elephants, conservation of habitat, and harmonious coexistence with local communities.

- *Daily Operations:* includes patrols and anti-poaching measures; wildlife monitoring; emergency response; and infrastructure maintenance.
- *Weekly Operations:* includes community engagement activities; and research and data analysis.

- *Monthly Operations:* includes health checks and veterinary care; and staff training.
- *Seasonal Operations:* includes habitat restoration activities; and tourism management.
- *Regulations:* includes on habitat protection; anti-poaching; tourism; community coexistence; research and data sharing; noise and disturbance; waste management; fire prevention and management; livestock grazing; and conservation easement and land use planning.

Regular reviews and updates of both the operations schedule and regulations are essential to adapt to changing circumstances and emerging conservation challenges.

6.10.2 Record of Deviations and Implemented Targets

Maintaining a record of deviations and implemented targets in an elephant reserve is crucial for effective management, accountability, and continuous improvement. The record helps identify challenges, adjust strategies, and track progress over time.

- *Deviations Log:* includes description of the deviation from the planned activities or goals; reasons for deviation; assessment of the impact of the deviation on the overall conservation goals and reserve management; corrective actions implemented to address the deviation including its status; and outlining any additional steps or measures taken to avoid similar deviations in future.
- *Implemented Targets Log:* includes target description; details of implementation including its status; key performance indicators or metrics used to measure the success of implementation; positive outcomes or benefits realized as a result of achieving the target; lessons learned during the implementation; and outlining any subsequent actions or targets related to the achieved goal.
- *Considerations for Record Keeping:* maintain a standardized format for recording deviations and implemented targets for clarity and consistency; regularly update the log as deviations occur or targets are achieved because timely documentation ensures accuracy; ensure data integrity by verifying the accuracy of the information recorded and cross-referencing with other relevant documentation; and use the recorded information for continuous improvement, adjusting strategies, and setting realistic goals based on past experiences.

By maintaining detailed records of deviations and implemented targets, the elephant reserve management can enhance decision-making processes, learn from experiences, and demonstrate accountability to stakeholders.

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ANNEXURES

LIST OF TABLES

- An elephant conservation plan document typically includes various tabular statements to organize and present information in a structured format.
- Examples of potential tabular statements that could be included in an elephant conservation plan: Population and demographic data; Habitat assessment; Threat assessment; Anti-poaching measures; Emergency response plan; Conservation goals and objectives; Action plan; Budget allocation; Monitoring and evaluation metrics; Community engagement; Research and data collection; and Infrastructure development etc.
- These tabular statements help organize information systematically, making the conservation plan document clear, concise, and accessible for stakeholders involved in elephant conservation efforts. It's essential to customize tables based on the specific requirements and characteristics of the elephant reserve and regularly update them as part of adaptive management practices.

LIST OF PLATES

- In an elephant conservation plan document, "plates" often refer to visual elements such as maps, charts, graphs, and photographs. These visual aids enhance the presentation of information, providing a more comprehensive understanding of the conservation plan.
- Examples of potential plates or visual elements that could be included in an elephant conservation plan: Map of the Elephant Reserve; Elephant population distribution map; Habitat assessment diagram; Threat assessment infographic; Conservation goals and objectives flowchart; Action plan Gantt chart; Budget allocation pie chart; Monitoring and evaluation metrics dashboard; Community engagement photo collage; Research and data collection timeline chart; Anti-poaching measures schematic diagram; Infrastructure development before-and-after photos; Emergency response plan flowchart; and Educational materials snapshot etc.
- The plates and visual elements serve to complement the textual content of the elephant conservation plan, making it more engaging and accessible to a wide range of stakeholders. Each plate should be carefully designed to convey information effectively and contribute to the overall understanding and support for the conservation efforts outlined in the plan.

LIST OF MAPS

- In an elephant conservation plan document, maps play a crucial role in visually conveying spatial information and helping understand the geographical context of conservation efforts.
- Examples of potential maps that could be included in an elephant conservation plan: Elephant Reserve boundaries map; Elephant population distribution map; Historical elephant population changes map; Habitat assessment map; Threat hotspot map; Elephant Zonation map; Tourism management zone map; Infrastructure development map; Anti-poaching patrol routes map; Research and data collection sites map; Emergency response plan map; Livestock grazing zones map; Conservation easements map; and Land use planning map etc.
- Each map should be accompanied by a legend, clear labelling, and a brief description explaining its significance in the context of the conservation plan. These maps collectively provide a spatial understanding of the reserve, helping visualize the interconnected elements of elephant conservation efforts.

LIST OF FORMS

- Forms in an elephant conservation plan document are typically used for data collection, reporting, and documentation purposes. They help standardize information, streamline processes, and ensure consistency in record-keeping.

- Examples of potential forms that could be included in an elephant conservation plan: Elephant sighting report form; Habitat assessment form; Threat reporting form; Research data collection form; Community engagement feedback form; Anti-poaching patrol log form; Infrastructure development request form; Emergency response report form; Livestock grazing permit form; Tourism activity permit form; Community conservation agreement form; Budget request form; Training and capacity building form; and Monitoring and evaluation data submission form etc.

- These forms should be designed to capture relevant information efficiently and facilitate data analysis and reporting. Including clear instructions and guidelines with each form is essential to ensure accurate and consistent data collection. Regular review and updates to these forms based on evolving needs and feedback will contribute to the effectiveness of the conservation plan.

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GLOSSARY

A glossary of terms in an elephant conservation plan document is essential to provide clarity and a shared understanding of key terminology used in the document. This helps stakeholders, including policymakers, researchers, and the general public, comprehend the conservation plan more effectively. An indicative list of potential terms to include in the glossary are:

- *Biodiversity:* The variety of life in a particular habitat or ecosystem, including the variety of species, genetic diversity, and ecosystems.
- *Carrying Capacity:* The maximum population size of a species that an environment can sustain without degradation of the habitat.
- *Community-Based Conservation:* Conservation initiatives that involve and empower local communities in the planning and implementation of conservation projects.
- *Corridor:* A strip of natural habitat that connects two larger areas, facilitating the movement of wildlife, such as elephants.
- *Ecosystem:* A biological community of interacting organisms and their physical environment.
- *Endangered Species:* A species at risk of extinction due to a decline in population numbers.
- *Habitat Fragmentation:* The process by which large and continuous habitats are broken into smaller, isolated fragments.
- *Human-Wildlife Conflict:* Conflicts that arise when the interests of wildlife and humans overlap, leading to negative interactions.
- *Keystone Species:* A species that has a disproportionately large impact on its ecosystem compared to its abundance.
- *Migration Routes:* Paths regularly used by animals during migration, often in search of food, water, or breeding grounds.
- *Non-Invasive Monitoring:* Monitoring techniques that do not disturb or harm the subjects being observed, often using technology such as camera traps.
- *Poaching:* The illegal hunting, killing, or capturing of wild animals.
- *Resilience:* The ability of an ecosystem to resist or recover from disturbances.
- *Stakeholder:* Any individual or group that has an interest or is affected by the outcomes of conservation efforts.
- *Sustainable Development:* Development that meets the needs of the present without compromising the ability of future generations to meet their own needs.
- *Translocation:* The intentional movement of animals from one area to another for conservation purposes.
- *Wildlife Corridor:* A pathway of habitat connecting separated wildlife populations.
- *Zoning:* The division of a conservation area into zones with specific regulations and permitted activities.

Including a glossary in the elephant conservation plan document enhances the accessibility of information and ensures a common understanding of terms among diverse stakeholders. It also serves as a helpful reference tool for individuals who may not be familiar with conservation terminology.

ABBREVIATIONS USED

The use of abbreviations in an elephant conservation plan document can help streamline the text and make it more concise. However, it's important to include a list of abbreviations to ensure clarity and facilitate understanding.
Examples of abbreviations that might be used in an elephant conservation plan document:

- ADS: Anti-depredation Squad
- APC: Anti-poaching Camp
- CBET: Community Based Ecotourism
- CCM: Crowd Control and Management
- CFR: Community Forest Resources
- CWH: Critical Wildlife Habitat
- DLCC: District-level Coordination Committee
- ECP: Elephant Conservation Plan
- EDC: Ecodevelopment Committee
- EIA: Environmental Impact Assessment
- EPT: Elephant Proof Trench
- ER: Elephant Reserve
- ESZ: Eco-sensitive Zone
- EHR: Elephant-Habitat Relationship
- ERMCC: Elephant Reserve Management Coordination Committee
- ETMC: Ecotourism Management Committee
- EWRR: Early Warning and Rapid Response
- GIS: Geographic Information System
- HEC: Human Elephant Conflict
- IAS: Invasive Alien Species
- JFM: Joint Forest Management
- LULC: Land Use Land Cover
- MEE: Management Effectiveness Evaluation
- OHS: Occupational Health Safety
- PA: Protected Areas
- PRT: Primary Response Team
- RRT: Rapid Response Team
- RF: Reserved Forests
- SOP: Standard Operating Procedure
- TCP: Tiger Conservation Plan
- TEV: Total Economic Value
- VFC: Village Forest Committee
- WP: Working Plan
- ZMP: Zonal Master Plan

Including this list near the beginning of the document allows readers to easily reference the meaning of any abbreviations used throughout the conservation plan. It enhances overall readability and helps to avoid confusion, especially for those who may not be familiar with the specific acronyms and abbreviations used in the field of conservation.

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- 5.2. Ecotourism, Interpretation and Conservation Education
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ISBN: 978-81-972769-2-7

ISBN (Online): 978-81-972769-6-5

Ministry of Environment, Forest & Climate Change

हाथी परियोजना भारत सरकार
PROJECT ELEPHANT GOVT. OF INDIA

भारतीय वन्यजीव संस्थान
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