Planning for conservation of Elephant Corridors: Case of Ankua- Ambia, West Singhbhum, Jharkhand.

Thesis submitted in partial fulfillment of the requirements for the award of the degree of

MASTER OF ENVIRONMENTAL PLANNING

By,

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Declaration

I **Subin Vattamthanam**, Scholar No. **2018MEP005** hereby declare that the thesis titled Planning for conservation of Elephant Corridors: Case of Ankua- Ambia, West Singhbhum, Jharkhand, submitted by me in partial fulfilment for the award of Master of Planning (Environmental Planning), at School of Planning and Architecture, Bhopal, India, is a record of bonafide work carried out by me. The matter/result embodied in this thesis has not been submitted to any other University or Institute for the award of any degree or diploma.

Signature of the Student

Date: 10-07-2020

Certificate

This is to certify that the declaration of **Subin Vattamthanam** is true to the best of my knowledge and that the student has worked under my guidance for one semester in preparing this thesis.
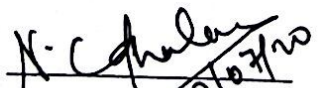
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Signature of the Head,
Department of Environmental Planning

Date: 10|07|2020

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Acknowledgement

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Executive Summary

Unregulated development and rapid growth in rural and urban India have fragmented the natural forest cover. Human-Elephant Conflicts have been on the rise due to the discontinuity of the movement corridor. The ever-increasing demand for land Resources to instill in the required sectors the demand for raw materials to be extracted has been a major sector that puts pressure on the services provided. Conflicts compromise the psychological build-up of the population, making them both physically, mentally and financially vulnerable and weak. HEC causes crop and property loss and occasionally results in the death of both humans and elephants in Jharkhand. Identification of the factors associated with elephant invasion can help mitigate conflict by allowing residents and representatives to address those factors. The prospect of the thesis study is towards, undertaking the planning aspect in consideration for the future - present and giving due heed over the future developments in a resource rich region. To achieve this it requires the study to have an intent to orient and secure the future through my proposals for Ecological Restorations and Conservation as per the UN Decade on Ecosystem restoration 2021-2030 for the Elephant Corridors from exploitation and degradation through the extensive resource extraction and anthropogenic activities which would in turn strengthen the commitment as per the SDG-2030 agenda.*(Government of India & Niti Aayog, 2019; Menon et al., 2017; MOEFCC, 2019)* According to Project Elephant census 2017, 3% of India's land total surface is elephant's country and only 10% of this is affected by conflict. The Ankua – Ambia Elephant corridor in Saranda Elephant Reserve, Jharkhand has 1% population of elephant but is one of the most active conflict corridors. However, wild elephants probably kill far more people than tigers, leopards or lions, says the Ministry of Environment, Forests and Climate Change.*(Menon et al., 2017; MOEFCC, 2019)* According to MoEFCC data, in the three years from 2015-2018, human-elephant conflict caused 1,713 human and 373 elephant deaths by unnatural causes, including electrocution and poaching.*(IUCN, 2018)* Long-term resolution of human-elephant conflict and promotion of peaceful coexistence requires a simultaneous action on focusing the management efforts on site-specific considerations as well as the formulation and application of strategic plans at the landscape level that directly address underlying

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anthropogenic drivers and their spatio-temporal variation. Current conflict management approaches focus on prevention through exclusion and on-site deterrents, and mitigation via elephant translocation or selective culling and monetary compensation for losses. (Wildlife Trust of India, 2016) However, these management approaches merely address the symptoms, rather than the underlying drivers of human-elephant conflict associated with cultural values, resource use decision making, and the increasing fragmentation and isolation of elephant populations. Knowledge of the spatial-temporal patterns of HEC help local government, wildlife officials, and civil organizations plan mitigation measures accordingly. The study would suggest a coupled natural and human systems approach to offer a potential evidence study for understanding the human and elephant interactions, behavioral aspects and resource use at the landscape level, highlighting the need for cooperation to restore the degraded Elephant Corridor. Below the Illustration shows the Conservation Priority that has been compiled by the study done to device this particular planning intervention framework which illustrates the restoration shift that needs to be achieved in the drive for Eco-Restoration and Conservation of the Elephant Corridors.
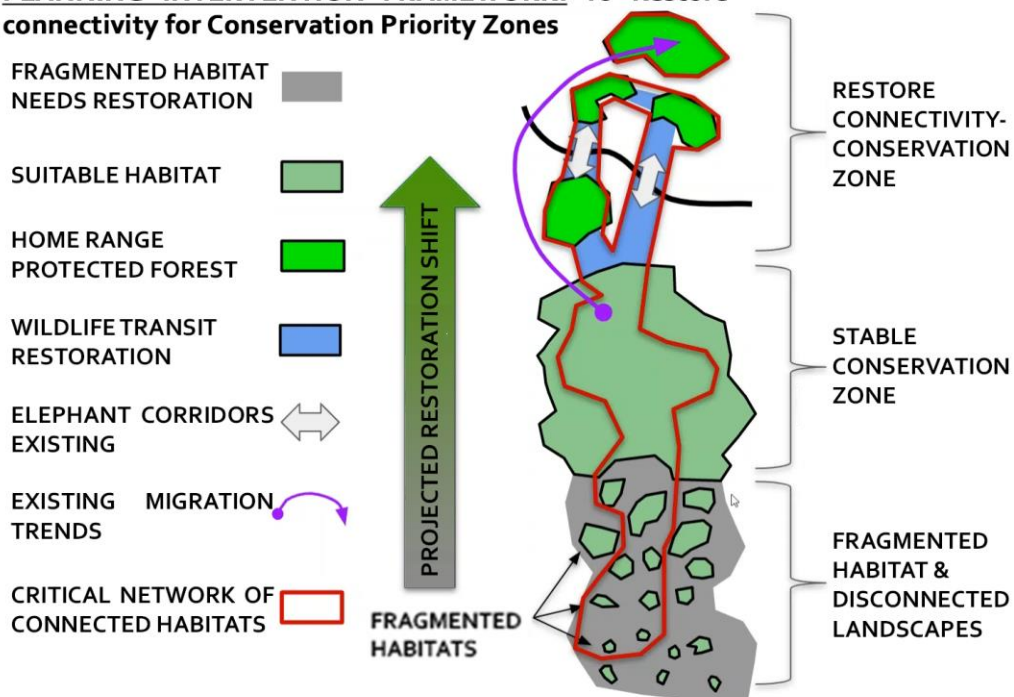
Figure 1: Conservation Priority for Eco-Restoration and Conservation of Elephant Corridors. : Source: Author.

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1. INTRODUCTION

The prospect of the thesis study is towards, undertaking the planning aspect in consideration for the future - present & giving due heed over the future developments. To achieve this it requires the study to have an intent to orient and secure the future through my proposals for Ecological Restorations and conservation of the Elephant Corridors. Contemplating the dependency of various sectors and collaboratively managing the environment (Terrestrial and Aquatic). By addressing the image by its quality and taking evidences based decisions to bring about an intentional intervention to improve the quality of land as well as the quality of life.

The bull's eye sustainability model clearly shows the relation and the dependency of economy driven by the society and all of this has to fall under the omnipresent environment that caters to every activities that we carry out. The inter-relation and this sensitive binding has been understated since long. The sacred relation that every biotic and abiotic resource of the Earth transcripts should be commended and preserved well. Sustainability attained by Equity for all. (Jauher, 2016b; van der Marel et al., 2020)

Environment protection is enshrined in Constitution (Articles 48A on State's responsibility and 51A (g) on Citizens' fundamental duties). There have been several measures to adhere the biodiversity conservation as there have been wide range of policies and acts, In-situ conservation (National Parks, Wildlife Sanctuary, and Biosphere Reserves), Conservation of Ecologically fragile areas(Mangroves, Wetlands, Coral Reefs), Ex-situ Conservation(Botanic Gardens, Zoos, Gene Parks). Convention of Biological Diversity has been one of the two international treaties adopted in June 1992 'Earth Summit'.

The focus of my study is towards one of the endangered species of fauna which is also respectfully called the 'Keystone Species', the majestic 'Asian Elephants' (Elephas maximus).(Singh, 2002) While tusk wildlife continues to be a big phenomenon in India, it is the conflict between the elephants that has caused fury. In compliance with Schedule-1 of the Wildlife Conservation Act, pachyderm is covered to a high level in Indian law. The conflict between human beings and elephants has become a threat to the conservation of biodiversity and its

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management as a primary objective for the conservation of elephants in rural countries. The development of a wide range of approaches to prevention and mitigation have led to an increase in understanding of wildlife behavioral patterns, spatial and temporal patterns and human-wildlife conflict. *(Hoare, 1999; Singh, 2002; State Government, 2011)* Recent solutions to dispute resolution rely on deterrence by isolation and dissuasion on site and on mediation through way of electronic translocation or systematic exploitation and provision of cash for damages. These management approaches, however, only address the symptoms instead of the underlying drivers of cultural values-related human-elephant conflicts, resource management, and increasing fragmentation and isolation of elephant populations. The long-term resolution of conflict between humans and elephants and the promotion of peaceful coexistence require that management efforts concentrate on site-specific considerations and also formulate and implement strategic plans. (FSI, 2017; Jauher, 2016b; Singh, 2002; Vijayakrishnan et al., 2018)

Biodiversity Vision 2050 states "By 2050, biodiversity is valued, conserved, restored and widely used, maintaining ecosystem services, sustain healthy planet and delivering benefits essential for all people." *(MOEFCC, 2019).* The present decade is dedicated for promoting and implementing the strategic plans on biodiversity and its overall vision of harmonizing with nature, as the General Assembly declared the period 2011-2020 as United Nations Decade on Biodiversity. This is followed by the Decade on Ecosystem Restoration which concentrates on reversing the degradation of ecosystems, to restore the ecological functionality which would improve productivity and capacity of ecosystems to fulfill the needs and demands of the society. "Ecosystem restoration promoted through this UN Decade takes a multi-functional landscape approach, looking at the mosaic of interdependent land uses in which ecological, economic, social, and development-based priorities can find convergence, balance and complementarity." – Minister Lina Pohl, El Salvador

Therefore these global initiatives and programs promoting the conservation and restoration of biodiversity and the ecosystems are just the building blocks towards the global notice towards the natural resources and the pressure we have been put over them for the returns claiming human goals and interests. The promotion and

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restoration of healthy ecosystem would proliferate the survival and benefit the existence of a healthy biodiversity as well as help the conservation goals.

According to Project Elephant, 3% of India's land total surface is elephant's country and only 10 % of this is affected by conflict. The Ankua – Ambia Elephant corridor in Saranda Elephant Reserve, Jharkhand has 1% population of elephant but is the most active conflict corridors. However, wild elephants probably kill far more people than tigers, leopards or lions, says the Ministry of Environment, Forests and Climate Change (MoEFCC). According to MoEFCC data, in the three years from 2015-2018, human-elephant conflict caused 1,713 human and 373 elephant deaths by unnatural causes, including electrocution and poaching.*(Menon et al., 2017)(M.D. Madhusudan, 2015)* Experts say various factors, including habitat disturbance and urbanization, could be the cause of the alarming rise in unnatural human and animal casualties. The data showed that the mean number of elephant deaths per year would be 56.6. Habitat loss, fragmentation of elephant populations, human-elephant conflicts (HEC), and the illegal killing of elephants have adversely affected elephant conservation throughout its distribution range.*(JH, 2017; Sankaran & Madhusudhan, 2010)*

Hence, considering the above existing knowledge upon the concern for the coexistence and conservation of the Elephant corridors, these were some of the potential recommendations over which this study will focus on to achieve. The strategies for conserving the Elephant Corridors can be established by the integration between Development and Conservation of the High Conservation Value Areas (HCVAs) and Safe-guarding the natural systems by employing and recommending strategies to conserve the natural setting through Spatial interventions which would let us achieve Sustainability by Equity towards the majestic animal. To be effective, however, conservation planning must deal better with two types of change. First, biodiversity is not static in time or space but generated and maintained by natural processes. Second, humans are altering the planet in diverse ways at ever faster rates. Knowledge of the spatial-temporal patterns of HEC help local government, wildlife officials, and civil organizations plan mitigation measures accordingly. I suggest a coupled natural and human systems approach would offer a potential framework for understanding the

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interaction of human and elephant behavior and resource use at the landscape level.

1.1 Background

Asian elephants 'Elephas Maximus' are an endangered species and human–elephant conflict (HEC) is the major threat to their survival. HEC causes crop and property loss and occasionally results in the death of both humans and elephants in Jharkhand. Identification of the factors associated with elephant invasion can help mitigate conflict by allowing residents and representatives to address those factors. The prospect of the thesis study is towards, undertaking the environmental spatial planning aspect in consideration for the future - present & giving due heed over the future developments. To achieve this it requires the study to have an intent to orient and secure the future through my proposals for Ecological Restorations and Conservation of the Elephant Corridors. According to Project Elephant, 3% of India's land total surface is elephant's country and only 10 % of this is affected by conflict. The Ankua – Ambia Elephant corridor in Saranda Elephant Reserve, Jharkhand has 1% population of elephant but is the most active conflict corridors. However, wild elephants probably kill far more people than tigers, leopards or lions, says the Ministry of Environment, Forests and Climate Change (MoEFCC). According to MoEFCC data, in the three years from 2015-2018, human-elephant conflict caused 1,713 human and 373 elephant deaths by unnatural causes, including electrocution and poaching.*(Anand & Radhakrishna, 2017; Biodiversity & Plan, 2001; FSI, 2017; Menon et al., 2017; Singh, 2002)* Long-term resolution of human-elephant conflict and promotion of peaceful coexistence requires a simultaneous focusing of management efforts on site-specific considerations as well as the formulation and application of strategic plans at the landscape level that directly address underlying anthropogenic drivers and their spatio-temporal variation. *(Anand & Radhakrishna, 2017; Neupane et al., 2017)* Recent solutions to dispute resolution rely on deterrence by isolation and dissuasion on site and on mediation through way of electronic translocation or systematic exploitation and provision of cash for damages. These management approaches, however, only address the symptoms instead of the underlying drivers of cultural values-related human-elephant conflicts, resource management, and increasing fragmentation

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and isolation of elephant populations. Awareness of the HEC spatial-temporal dynamics will help to counteract interventions taken by local authorities, wildlife officers and civic organizations. The study would suggest a coupled natural and human systems approach to offer a potential framework for understanding the interaction of human and elephant behavior and resource use at the landscape level.*(Anand & Radhakrishna, 2017; Neupane et al., 2017).* The Following depicts the demographic distribution of Asian Elephants in the World:

COUNTRY	WILD POPULATION (min–max)	CAPTIVE POPULATION (min–max)
Bangladesh	289–437	96
Bhutan	605–761	9
Cambodia	400–600	70
China	300	243
India	29,964	3,467–3,667
Indonesia		
Sumatra	1,724	467
Kalimantan (Borneo)	60–80	
Laos	500–600	454
Malaysia		
Peninsular	1,223–1,677	92
Sabah (Borneo)	2,040	23
Myanmar	2,000–4,000	5,693
Nepal	109–145	215
Sri Lanka	5,879	230
Thailand	3,126–3,341	3,783
Vietnam	104–132	88
TOTAL	**48,323–51,680**	**14,930–15,130**

Table 1: Estimated minimum and maximum number of Asian elephants in the wild and in captivity in Asia. Source: Sukumar 2003, updates by IUCN SSC Asian Elephant Specialist Group in 2016 and 2018; AERSM, 2017; MoEFCC 2017, Bangladesh elephant conservation action plan 2018-27; National Elephant Survey Report, Bhutan, NCD 2018. Menon and Tiwari, 2019.

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1.2 Research Questions

- Why Conservation of Wildlife corridors a need of the hour?
- Are the Keystone Species in verge of losing their traditional connections?
- How can we integrate Technology with Nature's eccentricity, hence minimizing conflicts?

1.3 Problem Statement

Unregulated development & rapid growth in rural & urban India have fragmented the natural forest cover. Human-Elephant Conflicts have been on a surge due to the corridor discontinuity. The ever increasing demands for land Resources to inculcate the raw material demands for the required sectors the extraction of these have been the major sector that puts pressure on to the Services rendered. Conflicts compromises the psychological build-up of the population making them vulnerable and weak both physically, mentally and financially. Thus making the Human-Elephant Conflicts a global Concern and has several causes and impacts over time involving Human-Elephant Conflict.

1.4 Introduction: Study Area

With the states growing economy and subsequent development drives which in turn encroaches on elephant habitat, people and elephants are forced to share space and resources.(Hoare, 1999). Human elephant conflict threatens not only elephant populations, but also human lives and livelihoods.(Pimm & Lawton, 1998) Each year in India, 400 people and more than 100 elephants are killed as a result of conflict.(Menon et al., 2017) In Jharkhand, an average of 64 people were killed every year by elephants since 2009-10. As per the forest department's 'damages caused by elephants' data, a total of 644 people have been killed by elephants in Jharkhand since 2009-2010.(Jauher, 2016a; Menon et al., 2017) A total of 87 people were killed by rampaging elephants from April 2018 to March 2019.*(Singhbhum & Harkhand, 2013)* Death by elephants has become a major problem in the state. According to Project Elephant, 3% of India's land total surface is elephant's country and only 10 % of this is affected by conflict. The Ankua – Ambia Elephant corridor in West Singhbhum, Jharkhand has 1% population of elephant but is the most active conflict corridors. However, wild elephants probably

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kill far more people than tigers, leopards or lions, says the Ministry of Environment, Forests and Climate Change (MoEFCC). According to MoEFCC data, in the three years between2015-2018, human-elephant conflict caused 1,713 human and 373 elephant deaths by unnatural causes, including electrocution and poaching.(2017, FSI) Experts say various factors, including habitat disturbance and urbanization, could be the cause of the alarming rise in unnatural human and animal casualties. The data showed that the mean number of elephant deaths per year would be 56.6. Habitat loss, fragmentation of elephant populations, human-elephant conflicts (HEC), and the illegal killing of elephants have adversely affected elephant conservation throughout its distribution range.(Menon et al., 2017; Pimm & Lawton, 1998; *Tribal-Act.Pdf*, n.d.)

Figure 2: Location Map; Source: Census 2011

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INDIA
JHARKHAND
DISTRICT PASHCHIMI SINGHBHUM

Km 5   0   5 Km

1.5 Vision

Right of Passage for the Pachyderm.

1.6 Aim

'Developing strategies to Minimize Human - Elephant Conflict in Ankua - Ambia corridor(s)'

1.7 Objectives

In order to address this problem, eco-restoration steps should be adopted to preserve the gene flow, to understand the need to operate within protected areas in order to retain sustainable wildlife populations and to allow species to travel freely through the landscape as they have naturally.**1. Delineation of the region identified under Human Elephant Conflict Corridors as per the Forest Range in Conflict.**

  : Surveys of Hotspot locations: Landscape Connectivity: Define & Select Region Mapping conflict locations.

2**. To analyze the Causes of Human Elephant Conflict in the Delineated Region.**

  : HEC at Global & National Level: Ecosystem Services and its inter-dependence.

3**. To assess the strategies and frameworks adopted to mitigate the Human - Elephant Conflict.**

  : Dependency on forest resources: Identify Gaps: Does HEC affects Growth:

4. **To propose strategies to minimize Human - Elephant conflict in study area.**

: Propose Planning Strategies - Mitigate HEC: "Right to Live" – National Green Tribunal; Exist to Co-Exist.

1.8 Scope

The study focuses on Human-Elephant conflict in villages near the protected areas such that it affects both the villagers and the Elephants, and to suggest ways in Incorporating Planning and implementation strategies and intervention that can help space for wildlife beyond Protected Area Boundaries. The study is based on fragmentation of forest cover due to anthropogenic activities, cultural values, livelihood transition and isolation of Elephant population.

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1.9 Limitation

The Limitations for the Study are:

1.   Study Based on Secondary Data & Primary Data sources

2.   Resettlement of the Villages in HEC not included in scope.

3.   Time constraint to establish an argument for detrimental proposals.

1.10 Methodology

The methodology of the study includes step-wise procedure to complete the objectives to achieve the aim of the study. A comprehensive literature review to understand the gravity of the scenario and the present incorporations that are involved in the process to conserve and protect the Elephant Corridors. The aim of the study by giving an insight into data collection and analysis techniques and approaches adopted worldwide for mitigating human-elephant conflicts/ human-wildlife conflicts. The study started by understanding the relation between the anthropogenic activities and its involvement in the fragmentation of the vegetative forest cover, mobilizing the elephant towards the settlements outside the protected area boundary, thus evolving the need for study.

Several national and international case examples were refereed and comprehensive fact check was done to establish the cause for conservation. This was the evidence and the data required in achieving the first objective of the delineation and selection of the particular region. The first stage comprises of the compilation of the data extracted from the literature to establish the preliminary Aim & Objectives, to orient the primary data analysis techniques that could be incorporated so as to reach the formulated objectives. Thus carrying out the ground level study made the refinement of the objectives as per the projects practical approach to have a reasonable outcome. Several Quantitative and Qualitative surveys were conducted to reason out the people's perception and their experiences over the issue as well as the stakeholder's involvements.

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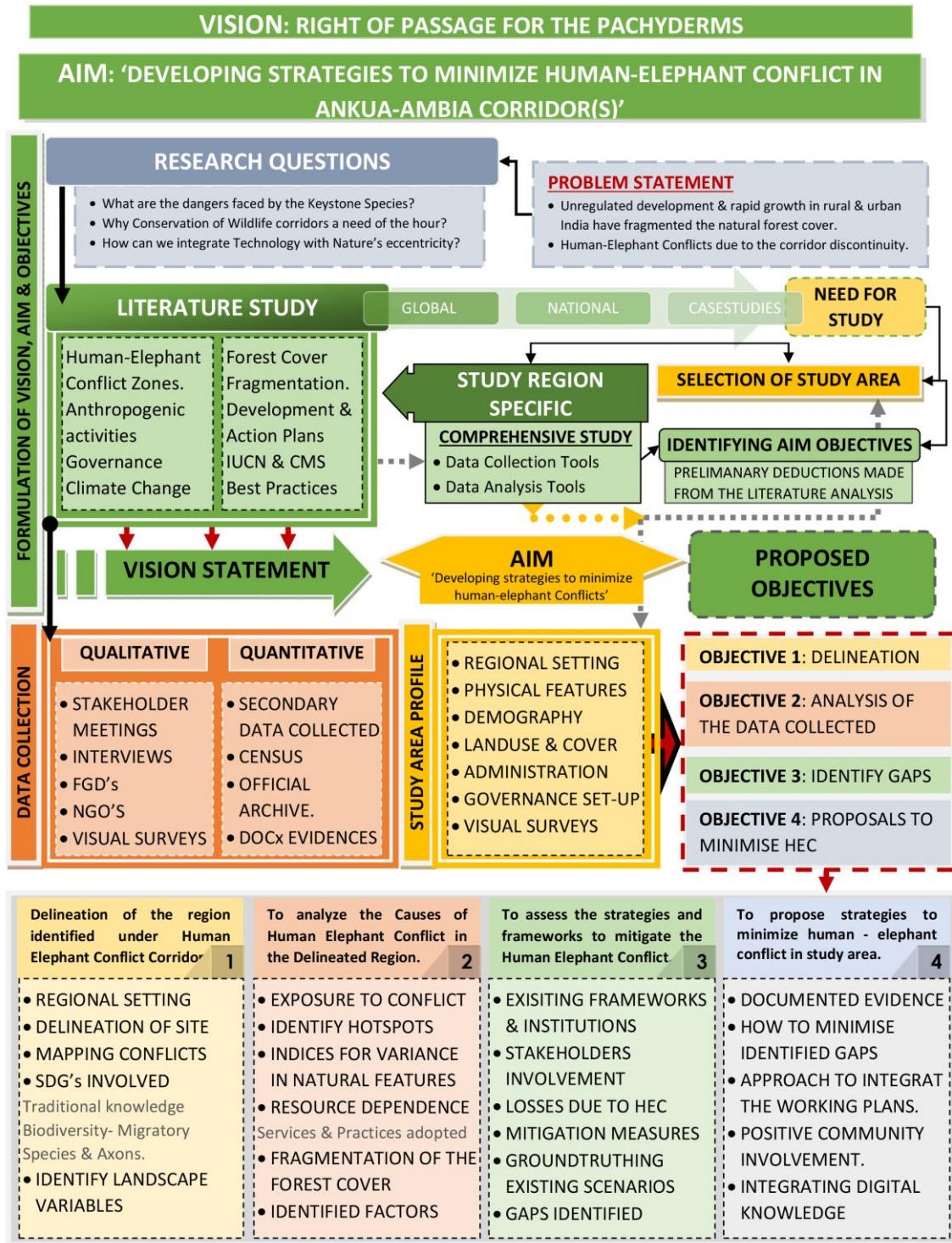
Figure 3 Methodology for the Study. Source: Author

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OBJECTIVE 1: DELINEATION		**OBJECTIVE 2**: ANALYSIS OF THE DATA COLLECTED	
Delineation of the region identified under Human Elephant Conflict Corridors		To analyze the Causes of Human Elephant Conflict in the Delineated Region.	
ASPECTS	TOOLS & METHOD USED	ASPECTS	TOOLS & METHOD USED
• REGIONAL SETTING • DELINEATION OF SITE • MAPPING CONFLICTS • SDG's INVOLVED Traditional knowledge Biodiversity- Migratory Species & Axons. • IDENTIFY LANDSCAPE VARIABLES • Drainage Systems	• Spatial Analyst Tool in GIS. • Satellite Image Classification • Spatial Statistical Tools • Spatial Hydrological Tool • Systematic Search & Review • Supervised & Unsupervised Classifications • Weighted Overlay • Platform: GIS & ERDAS	• EXPOSURE TO CONFLICT • IDENTIFY HOTSPOTS • INDICES FOR VARIANCE IN NATURAL FEATURES • RESOURCE DEPENDENCE Services & Practices adopted • FRAGMENTATION OF THE FOREST COVER • IDENTIFIED FACTORS	• Spatial Analyst Tool in GIS. • Primary Data Collected • Secondary Data Reviews • Spatial Statistical Tools • Systematic Search & Review • Supervised & Unsupervised Classifications • Weighted Overlay • Ground Truthing • Platform: GIS & ERDAS

OBJECTIVE 3: IDENTIFY GAPS		**OBJECTIVE 4**: PROPOSALS TO MINIMISE HEC's	
To assess the strategies and frameworks to mitigate the Human Elephant Conflict.		To propose strategies to minimize human - elephant conflict in study area.	
ASPECTS	TOOLS & METHOD USED	ASPECTS	TOOLS & METHOD USED
• EXISITING FRAMEWORKS & INSTITUTIONS • STAKEHOLDERS INVOLVEMENT • LOSSES DUE TO HEC • MITIGATION MEASURES • GROUNDTRUTHING EXISTING SCENARIOS • GAPS IDENTIFIED	• Ground Truthing • Horizontal & Vertical Integration of the Institutions involved. • Data Analyzed from the Spatial Results. • Case Studies & BPM's • Review Techniques Assessed as per the Chi Square & AnoVA.	• DOCUMENTED EVIDENCE • HOW TO MINIMISE IDENTIFIED GAPS • APPROACH TO INTEGRAT THE WORKING PLANS. • POSITIVE COMMUNITY INVOLVEMENT. • INTEGRATING DIGITAL KNOWLEDGE	• Secondary Data Analysis • Suitable Land-Use Zones • Community Participation & Ownership Responsibilities • Cognitive Approach • Alternative Skill Development • Capacity Building

Figure 4 Methodology: Tasks & Methods for Objective. Source: Author

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2. LITERATURE STUDY

This chapter focuses on detailed understanding of concepts and approaches related to human-wildlife conflicts and its mitigation. It focuses on causes and impacts of human-wildlife conflicts and its relation with city growth and land use planning. Existing legal and institutional mechanism is also documented. Documented evidence over the support of the conservation drive and the measures in which the documentation and the case examples are discussed to provide a better understanding into all the related measures and concepts.(Hoare, 1999; Neupane et al., 2017; Rosa et al., 2020)

Current approaches to conflict management focus on prevention through exclusion and local dissuasion. These strategies only tackle signs and not the reasons underlying the confrontation between humans and elephants. It is the cultural values, resource utilization and increasing division and isolation of the populations of elephants that are responsible. (Jauher, 2016b; Kumar & Singh, 2010)

2.1 Key Concepts

There are certain key concepts associated with the sstudy which are discussed below:

1. **Name of the Corridor:** Corridors have been named based on the names of forests (wherever possible these are the names of the Reserve Forests) being connected. This was done to both standardize the naming process and logically rationalize the function of the corridor, i.e. its connection of the named forests. Since in many cases the corridor was previously referred to by other names, an 'alternate name' listing is also provided to facilitate easy retrieval of data.

2**. Ecological Priority:** In order to accord some level of priority to the corridors, the editors have categorized them as being of High, Medium and Low ecological priority. This is based on the regularity of elephant movement, the population size of elephants in connecting habitats, the area of the habitats being connected, and the presence of alternate routes nearby. Ecological priority can be differently interpreted by different experts and this rating may only be taken as a thumb rule.

3. **Conservation Feasibility:** Completely independent of ecological priority, corridors were also categorized by conservation feasibility. This took into account factors such as the major land use of the corridor, number of human settlements

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and/or linear infrastructure elements passing through it, encroachment, extent of area to be purchased, presence of institutions/ industries, political and community will, and the on-ground feasibility of securing it. The conservation feasibility of a corridor could be low even if it ranks high in terms of ecological priority. As with ecological priority, conservation priority is a reflection of WTI's views and may be interpreted differently by other agencies.

4**. State**: The state or states through which the corridor runs.

5**. Alternate Name:** Other names by which the corridor is referred to.

6. **Forest Division:** The Forest Division in which the corridor is present or the nearest Forest Division to the corridor.

7**. Connectivity:** The two elephant habitats that are being connected by the corridor.

8**. Geographical Coordinates:** The corridor's geographical location was recorded with a Global Positioning System (GPS) reading taken at the two ends of the corridor.

9**. Length and Width:** Length is the distance between two habitats in the direction of elephant movement. Width is the distance of separation at the two closest points. Both are measured in kilometers.

10. **Major Land use:** The land use pattern within the corridor area: forest, agricultural land, settlement, tea garden, plantation, river etc.

11. **Major Habitations/Settlements:** Gives the names of the major settlements located within the corridor area.

12**. Forest Type / Vegetation:** The type of vegetation present within the corridor area using standard vegetation types (Champion and Seth, 1964).

13**. Frequency of Usage of the Corridor by Elephants:** This has been broadly divided into regular, occasional and rare. Seasonal animal movement that is seen every year is classified as regular and seasonal.

14**. Human Artefacts:** Lists the man-made structures present in the corridor area that impede elephant movement.

15**. Habitat Quality:** The habitat quality assessment of the corridors was carried out to determine tree species composition, availability of elephant food plant species, regeneration and recruitment classes of trees and ground cover variables. Random plots of 20m x 20m were laid across the corridor to collect the variables

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such as tree species, height and girth at the breast height (GBH) for each individual tree (GBH> 20cm). Within the plot, four subplots of 5m x 5m were laid to record ground cover variables such as grasses, herbs, shrubs and barren ground. The number of plots varied based on size of corridor.

16**. Elephant Population in and around the Corridor:** The elephant population of the habitats being connected, using data collected from census records of state forest departments and published literature. Elephant dung encounter survey was also carried out in the corridor area to confirm elephant movement.

17. **Forest / Land use:** Provides information on a corridor's legal status and the land use of the corridor area:

a. **Legal status of the corridor:** Denotes the status of the land in the corridor area, viz. National Park, Wildlife Sanctuary, Reserve Forest, revenue land, community forest, private forest, private land etc.

b. **Land use of the corridor:** Provides the land use pattern within the corridor area in detail.

18**. Other Ecological Importance:** this section includes other important ecological aspects like important mountain ranges, tiger/elephant reserves, protected areas, Important Bird Areas (IBA) etc present in the landscape reflecting the importance of the landscape and corridor.

19. **Threats to the Corridor:** Lists all the present and potential threats to the corridor that hinder elephant movement based on direct observations, discussion with forest departments, local NGOs and villagers.

20**. Corridor Villages:** The name of settlements within the corridor, and information especially population size and dependency [fuelwood, Nontimber forest products (NTFP) and other resources] of people on corridor forest and habitat based on socio-economic survey of people living within the corridor.

21. **Corridor Dependent Villages:** The name of settlements at the corridor's periphery (within 1 km), and information especially population size and dependency (fuelwood, NTFP and other resources) of people on corridor forest and habitat.

22. **Human-Elephant Conflict:** Details of human-elephant conflict, especially death and injury to humans due to elephants, elephant deaths due to human factors, and crop depredation in the corridor or the Forest Division.

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23. **Maps:** Two maps have been included for each corridor. The first is a 3D map showing the location of the corridor in the landscape and the topography of the area. The second is a land use map showing the location of the corridor and its demarcation, as well as the area to be secured/protected.

24**. Conservation Plan:** Lists the steps that need to be taken to protect and secure the corridor from current and potential threats both at the policy level and in the form of physical interventions in the corridor.

25. **Fifth Schedule State Declaration:** According to the constitutional provision pursuant to Article 244(1) of the Constitution of India, the 'scheduled areas' are described as 'such areas as may be declared by order by the President to be Scheduled Areas' – as provided for in paragraph 6(1) of the Fifth Schedule of the Indian Constitution. The specification of "Scheduled Areas" in relation to a State shall be, after consultation with the Governor of that State, by notified order of the President. Pursuant to the provisions of paragraph 6(2) of the Fifth Schedule of the Constitution of India, after consultation with the Governor of that State, the President may extend the area of any Scheduled Area in a State; new orders are made to redefine the areas to be scheduled in relation to any State. The same applies to any alteration, increase, decrease, incorporation of new areas or withdrawal of any "Scheduled Areas" Orders. In the states of Andhra Pradesh (including Telangana), Chhattisgarh, Gujarat, Himachal Pradesh, Jharkhand, Madhya Pradesh, Maharashtra, Odisha and Rajasthan, Scheduled Areas have been declared at present.

26. **Mining Development Plan:**

Village Munda: The successor of the Village Tribe Patrimony. (Munda Tribe).
'Biodiversity Conservation; Human Wildlife Conflict; Habitat Fragmentation; Land-use Planning; Edge Habitat; Retaliatory Killing; Culling Drives, Mining Development Plan, Project Elephant, IUCN, Ananda Kumar, Mining Leases, Forest Village'.

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2.2 Study Area Profile

With the states growing economy and subsequent development drives which in turn encroaches on elephant habitat, people and elephants are forced to share space and resources.(Hoare, 1999) Human elephant conflict threatens not only elephant populations, but also human lives and livelihoods.(Pimm & Lawton, 1998) Each year in India, 400 people and more than 100 elephants are killed as a result of conflict. In Jharkhand, an average of 64 people were killed every year by elephants since 2009-10. As per the forest department's 'damages caused by elephants' data, a total of 644 people have been killed by elephants in Jharkhand since 2009-2010. A total of 87 people were killed by rampaging elephants from April 2018 to March 2019.*(Singhbhum & Harkhand, 2013)* Death by elephants has become a major problem in the state. According to Project Elephant, 3% of India's land total surface is elephant's country and only 10 % of this is affected by conflict. The Ankua – Ambia Elephant corridor in West Singhbhum, Jharkhand has 1% population of elephant but is the most active conflict corridors. However, wild elephants probably kill far more people than tigers, leopards or lions, says the Ministry of Environment, Forests and Climate Change (MoEFCC). According to MoEFCC data, in the three years between2015-2018, human-elephant conflict caused 1,713 human and 373 elephant deaths by unnatural causes, including electrocution and poaching.(2017, FSI) Experts say various factors, including habitat disturbance and urbanization, could be the cause of the alarming rise in unnatural human and animal casualties. The data showed that the mean number of elephant deaths per year would be 56.6. Habitat loss, fragmentation of elephant populations, human-elephant conflicts (HEC), and the illegal killing of elephants have adversely affected elephant conservation throughout its distribution range.(Menon et al., 2017; Pimm & Lawton, 1998; *Tribal-Act.Pdf*, n.d.)

2.3 Institutional Framework

The highest authority dealing with wildlife and biodiversity conservation in India is the Union Ministry of Environment, Forest and Climate Change (MoEFCC). A minister in-charge heads the ministry and is supported by sectary and an Additional Director General of Forests, who is also the highest wildlife official in the country. A Deputy Inspector General of Forest and an Assistant Inspector General and Joint

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Director (Wildlife) provides administrative and technical support to the wildlife wing of MoEFCC. Adding to this, there are three autonomous bodies for wildlife protection: Wildlife Institute of India (WII) for wildlife research and training, Central Zoo Authority (CZA) for conservation and zoo management and National Elephant Conservation Authority (NECA) for conservation of Elephants. The Forest Conservation Division of MoEFCC deals with aspects mentioned in the Forest Act 1980. State Advisory Groups are constituted by the ministry for looking into these aspects. Chief Conservator of Forests (CCF) assists the SAGs.

In the states, District Forest Offices and Forest Departments are headed by District Forest Officers (DFO) and Principal Chief Conservator of Forest (PCCF) respectively. The PCCF is assisted by CCFs. There are separate in0charges for Wildlife circles (Conservator of Forests), Divisions (Deputy Conservator of Forests) and Subdivisions (Assistant Conservator of Forests). Moreover, the front-line or ground staff consists of Assistant Conservator of Forests, foresters, range officers, forest guards and other designations which vary from state to state. The Wildlife Division of MoEFCC provides technical and financial support to the State/UT Government for Conservation of Wildlife.

2.4 Administrative Setup of the Study Area

The West Singhbhum district in Jharkhand is considered to be one of the richest in terms of forest resources, biodiversity particularly elephant and also minerals. Concerns have been raised on the impact of mining activities on the wildlife, habitat and the people. Mining and its impact on forest, wildlife and the people around have been one of the recent topics discussed among the policy makers and conservationists all over the country. Minerals play an important role in the economic development of the country as minerals are the basic raw materials to promote the growth. However, indiscriminate and unplanned mining causes irreversible damage and deterioration of natural resources. Mining activities affect the surroundings i.e. Air, Water, Soil, Land, Biological diversity etc. (*IWMP, West Singhbhum, 2017*)

Increasing globalization of the mining industry has led to changing public attitudes regarding the costs and benefits of mineral extraction and an increase in public

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pressure to minimize the environmental and social costs associated with mineral development. *(In-Depth Forest Tales, DTE)*

Located in the central Indian tribal region and spread over an area of 13,440 sq km, Singhbhum district (bifurcated into East and West Singhbhum districts in 1990) has one of Asia's finest sal forests - the Saranda forests. The Ho tribals, akin to the Mundas, but unique in preserving their traditional cultures, dominate the Saranda, Kolhan, Porahat, and South Forest divisions. The district is also very rich in iron ore, uranium, copper, asbestos, kainite, china clay and other minerals. This explains the emergence of 20 industrial mining towns in the region, including the industrial city of Jamshedpur. Besides the incomes from non-timber forest products, not- so-modem agricultural practices are followed in almost all its 32 community development blocks. The Dhalbhum region of the district has many tanks and a second crop of vegetables is grown in many such pockets to meet the growing needs of the mining towns. The firewood and timber needs of these towns have exerted pressure over forests in these regions.

2.5 Demography Data: West Singhbhum, Jharkhand

CENSUS DATA		
Description	2011	2001
Population (in lakhs)	15.02	12.33
Male	749385	619302
Female	752953	614643
Growth Rate	21.75%	13.48%
Area Sq.Km	7224	7224
Density/Sq.Km	208	172
Proportion to State Population	4.55%	4.58%
Sex Ratio (per 1000)	1005	992
Child Sex Ratio (0-6 age)	983	978
Average Literacy	58.63	46.82

As per projections Growth Rate is estimated of +2.6% p.a. population.

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2.6 Elephant Demography

The elephant is without doubt the flagship animal in Jharkhand's West Singbhum. The elephant population migrates from one forest patch to another particularly for particular seasons, i.e. allowing for the regeneration of fodder stocks in one region and allowing for the continuous transfer of genetic material between different populations.(Menon et al., 2017) So forest cover status, diversity of tree species, distribution and abundance of fodder species, availability of shed, water and ecological parameters were considered to finally arrive at a reasonable assessment of the status of the flora and fauna resources of the region.

The study of forest division census figures from 2007-12, which are performed in the summer, suggests the existence of restricted distribution to some pockets of the forests. Such areas form the permanent home ranges, where elephants can be found all year round. The primary home range includes RFs in and around Tholkobad, covering three divisional ranges Samta, Sasangda and Koina. The population present in the ranges are distributed approximately as 65% in Samta, 25% in Sasangda and 10% in Koina Ranges.(Menon et al., 2017)

2007 – 124; 2010 – 139; 2012 – 154 Elephants (out of total population of nearly **200-253** in these years.) (*Wildlife census 2007-12*)

The congregation of Elephants swell up in the area with the on-set of winters, by the incoming herds from Saraikela - Kharsawan, Porahat, Chaibasa and Saranda. (*IWMP, West Singhbhum*). Below the Conflicts that have been happing past few years, Figure 5: Mammoth Concern- Conflicts in past few years. Source: The Hindu,

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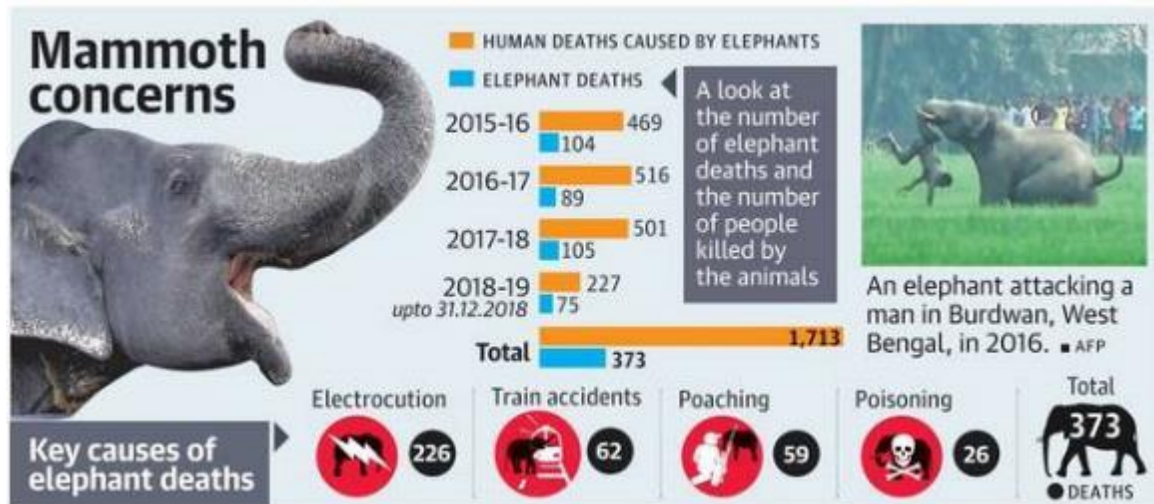
Figure 5: Mammoth Concern- Conflicts in past few years. Source: The Hindu, Cover story.

Elephants cannot be conserved only by Jharkhand's initiatives hence it requires the support from the neighboring states as well, all anti depredation measures are to ward off the elephants, which are temporary.

2.7 Biodiversity Profile of India

India is one of the world's most known mega-diverse nations. More than 1,00,690 species of fauna and 47,480 species of flora have been recorded in the 10 BZs of the world. It is a recognised centre for the variety of crops and wild relatives of crops. Urban and urban cultures also respect nature and conserve biodiversity through religious rituals and administrative frameworks such as sacred groves. The Biodiversity Profile of India covers cultural ethos and legal support for the conservation and exploitation of biodiversity. Below the *Figure 6 Biogeographic Zones of India: Source- Indian National Biodiversity Action Plan 2016.Figure 7: Forest typologies of India.(2019) ; Source: Indian National Biodiversity Action* Plan. Maps the Biogeographic Zones of India & Forest Typologies of India, my site for study falls in the Deccan Peninsula (Light Green).

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Figure 6 Biogeographic Zones of India: Source- Indian National Biodiversity Action Plan 2016.

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Figure 7: Forest typologies of India.(2019) ; Source: Indian National Biodiversity Action Plan.

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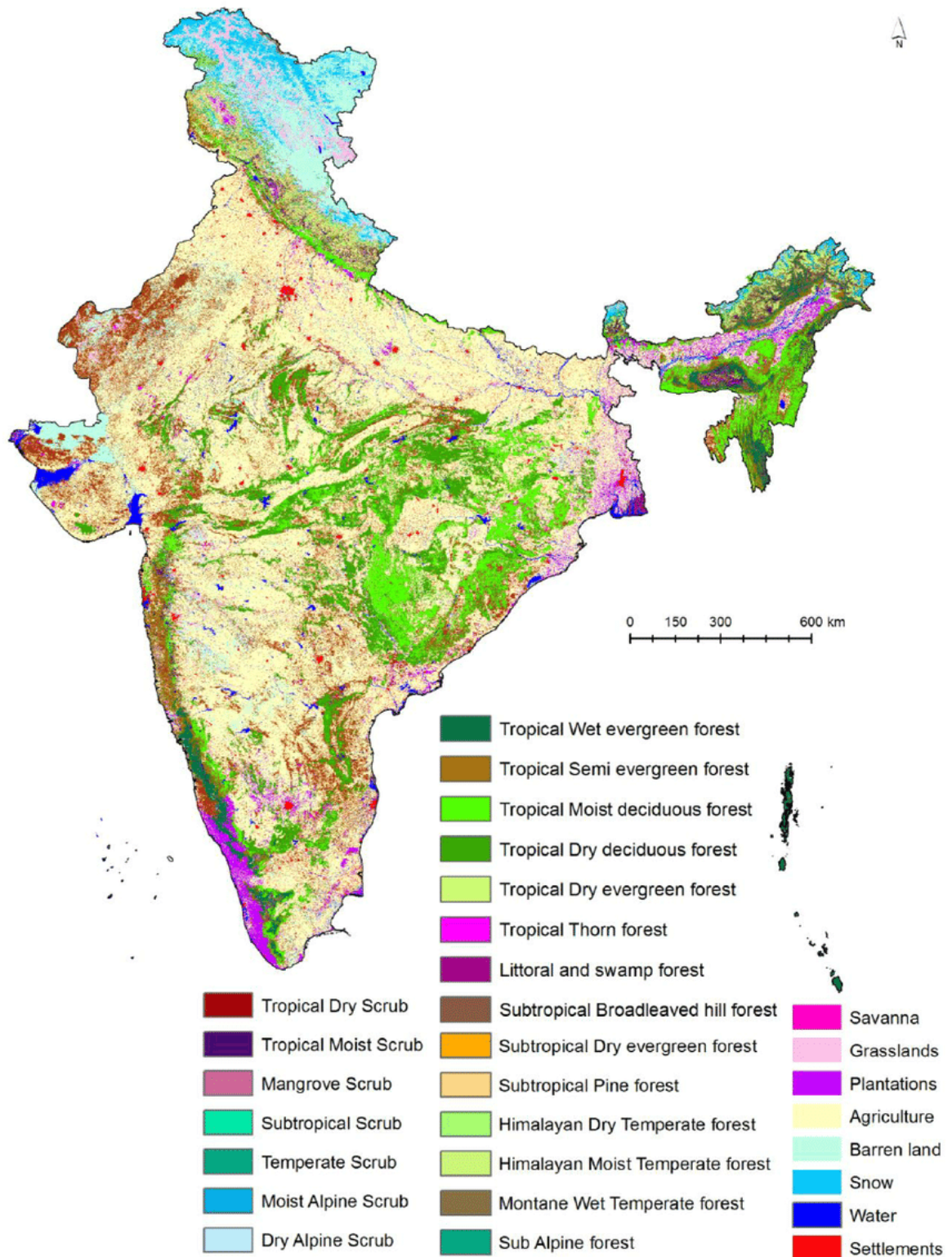
2.8 United Nations Decade on Biodiversity and Strategic Plan for Biodiversity

UN General Assembly has declared 2011-2020 as the UN Decade on Biodiversity, to raise awareness about importance of and threats to biodiversity. Coinciding with UNDB, Strategic Plan for Biodiversity 2011-2020 with five Goals and 20 Aichi Biodiversity Targets adopted under CBD in 2010. Strategic Plan gives a general framework on Biodiversity, not just linked to biodiversity Conventions but for the entire UN system, and for all Management and policy development on Biodiversity.*(National Biodiversity, n.d.)* All Parties are required to develop national targets in line with Aichi targets, and to review and revise / update NBSAP through integration of national objectives. The Five Strategic Goals for biodiversity are as follows- Firstly, address the underlying causes of biodiversity loss by mainstreaming biodiversity across government and society. Secondly, reduce the direct pressures on biodiversity and promote sustainable use. Thirdly, to improve the status of biodiversity by safeguarding ecosystems, species and genetic diversity. Fourthly, enhance the benefits to all from biodiversity and ecosystem services. Fifthly, enhance implementation through participatory planning, knowledge management and capacity building.*(National Biodiversity, n.d.)* The Strategic Plan was conceived with due diligence and utmost importance towards the Sustainable Development Goals and the targets anointed to them and the prioritized in sequence to achieve it as the most valuable proponent of the goals to be achieved, primarily the SDG 15 (Life on Land).(Government of India & Niti Aayog, 2019) The following Figure 9: NBT's & Aichi Biodiversity Targets in line with the Strategic Goals. Source: NBT, NR6. Shows they fall under the Five SBP.

The 2030 Agenda for Sustainable Development with 17 Sustainable Development Goals and 169 targets has been adopted by the UN Members as a framework to contribute to human well-being and development priorities. Jharkhand holds one of the worst rank among Indian states, in the National Sustainability Index, where it has fared particularly in the lowest quarter of the standing in both the reports prepared by United Nations over the past decade, and the SDG India Index Report

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2019-20, the GOI have initiated most of the schemes and projects in the state and being politically sensitive state from its initiation days the results have due to these steps have been severely delayed.(Government of India & Niti Aayog, 2019) The Following Figure 8: SDG India Index 2.0 Source: UN, SDG 2019-20; shows the performance of the concerned state which is second to the last. SDG12 (Responsible consumption & Productivity) & SDG1 (No Poverty) are least ranked.

Figure 8: SDG India Index 2.0 Source: UN, SDG 2019-20

Figure 9: NBT's & Aichi Biodiversity Targets in line with the Strategic Goals. Source: NBT, NR6.

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2.9 Human-Wildlife Conflict: A Global Concern

Around the world from the time of human existence, human have protected themselves, their livestock and their property from the wild animals in conflict. Whenever human and wildlife have co-existed there has been conflicts with loss of both the resources. It's been a trend throughout the globe for decades. Reducing this conflict has been the top priority in the landscapes were density and growth possibilities are high. *(Barua et al., 2013; Biodiversity & Plan, 2001; Ecology, 2015).*

In the 5th Annual World Parks Congress held in Montreal in 2003 and Conference of Parties for Conservation of Migratory Species held in Ahmedabad in 2020, It was mentioned that Human-Wildlife Conflicts occur when the consumption and the nutrient demands of the particular species is not met and thus helplessly or ignorantly they merge down to the human settlements and they impact negatively over both the human and wildlife goals. As the Human populations expand into wildlife habitats, the latter's natural territory is displaced, as shown in the

Human-Wildlife Conflicts manifests itself in numerous ways, from crop-raiding and livestock predation to destruction of property and even wildlife poaching. At times retaliatory killing of wildlife species also occurs but out of these human-wildlife conflicts in agro-pastoral landscapes have become a topic of great concern. *(Anwar & Borah, 2014; Barua et al., 2013; Biodiversity & Plan, 2001).* Such conflicts involve a wide range of stakeholders and multitudinous socio-cultural and environmental problems. The fact that rural communities are dependent on the natural ecosystem that conservationists seek to protect is gaining increasing recognition. *(Barua et al., 2013).* To resolve these issues, both local and global challenges must be managed. This implies that it is necessary to reconcile local concerns for security and economic growth with international concerns of protecting threatened species. Thus the most sustainable solutions for HWC are those which are targeted towards the welfare of rural communities as well as enhancing the status of conservation targets. *(Barua et al., 2013; Treves et al.,)*

Human-Wildlfie Conflicts are a serious threat to wildlife conservation and the livelihoods of people living near wildlife habitats. Such conflicts are becoming more prevalent as human population expands, development needs rise and global climate change and other anthropogenic factors escalate the scarcity to resources

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for both human as well as the wildlife. Over the last few decades, human have intruded into the natural habitats of animals through agriculture and settlements sprawling out to support the population. With their habitats being fragmented, degraded and compressed due to such intrusions; wildlife species now spill out of the protected areas as notified reserves and come into human settlements thereby causing conflicts. *(Kshettry et al., 2020)*

The behavior of human towards the wildlife management and conservation is the key factor in human-wildlife conflicts. Also a person's social network, social standing, gender, financial stability, traditional beliefs, customs and values all contribute to the decisions about how they react and be engaged towards the environment. *(Kshettry et al., 2020; Valparai et al., 2016)*

Human-Wildlife conflicts have a range of visible and hidden impacts on biodiversity and human populations of the region. While the visible or direct impacts are mitigated at some levels, rarely the attention is paid to the hidden impacts, including additional labor costs, loss of earning members of the family, loss of sleep due to fear and exaggeration depression due to the active threats, restriction towards the travel and plying routes and great emotional and mental stresses. Community hit by wildlife conflict are often found to be vulnerable towards sustaining there livelihoods in comfort rather being too stressed about the prevailing threat over them. Social Costs usually remain unaccounted, delayed and psychological. *(Valparai et al., 2016; Vijayakrishnan et al., 2018)*. The components of human well-being affected due to human-wildlife conflicts are shown in Figure

The Population which are highly vulnerable to human-wildlife conflicts are the ones which are dependent on the forest resources for their livelihood and the vulnerability decreases henceforth. The settlements in periphery of the reserves of forest habitats are majorly dependent on the forest ecosystem for the livelihood and these belong to the low income group or poverty ridden population. The population residing in the periphery of the forests but not dependent over the resources from the forest are less affected by the conflicts but still are poverty stricken. As the distance from the forest increases, the poor population living in the cities become less vulnerable to these conflicts. While the HIG and MIG population are least vulnerable followed by the global population. *(Anand & Radhakrishna, 2017)*. Apart from psychological disturbances to human. Human-Wildlife conflicts

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also adversely affect the wildlife Population in similar ways.*(Jacobs et al., 2018).* The feeding and breeding characteristics of animals are highly altered due to such conflicts, Long-term effects on individual animal include changed attitude and behavior, productivity and in some cases death; on populations includes altered demographics and distribution; and on communities include modified species interaction.*(Jacobs et al., 2018).* Thus it is clear the fate of both humans and animals depends on their capacity to coexist.

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2.10 Investigating trends in human-wildlife conflict: is conflict escalation real or imagined?

Humane wildlife conflict (HWC) has a history that is as old as human civilization; yet currently the phenomenon poses a serious environmental challenge for human society. Both due to their biogeographical and social characteristics, developing regions of the world such as South and Southeast Asia are particularly vulnerable to this problem. Although the popular perception is that HWC intensity has escalated over the past few decades, there is little published literature to support this view. We argue that insights into the historical trajectories of HWC are important to comprehend past trends and set up future priorities. *(Anand & Radhakrishna, 2017)*. As a case study, we review conflict literature from India to analyze trends in HWC in the country over the past four decades. Our analysis reveals that there has been a consistent increase in the number of HWC publications, and that nearly 90% of the country is currently afflicted by HWC. A total of 88 species belonging to nine taxonomic groups are involved in HWC. *(Anand & Radhakrishna, 2017)*. Yet, research has been limited to select species and geographical locations. We discuss potential causes for this bias and set out research directions for efficient management of this issue.
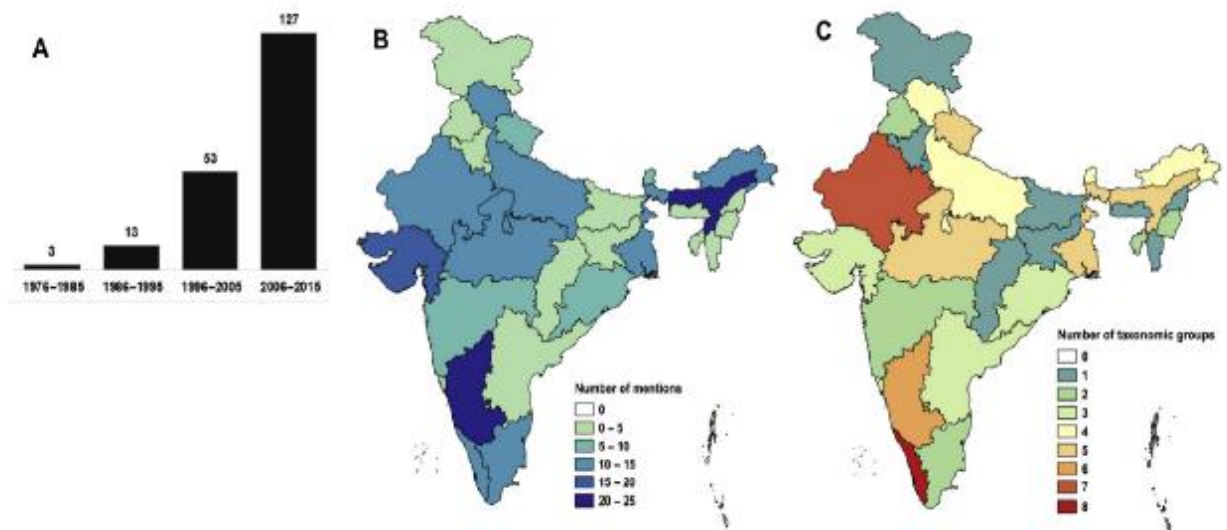
Figure 10 Characteristics of Conflicts; (A)- Number of HWC over-time. (B)- Number of HWC reports across regions. (C)- Number of Taxonomic groups involved. (HWC- Human Wildlife Conflicts) | Source : ENVIS

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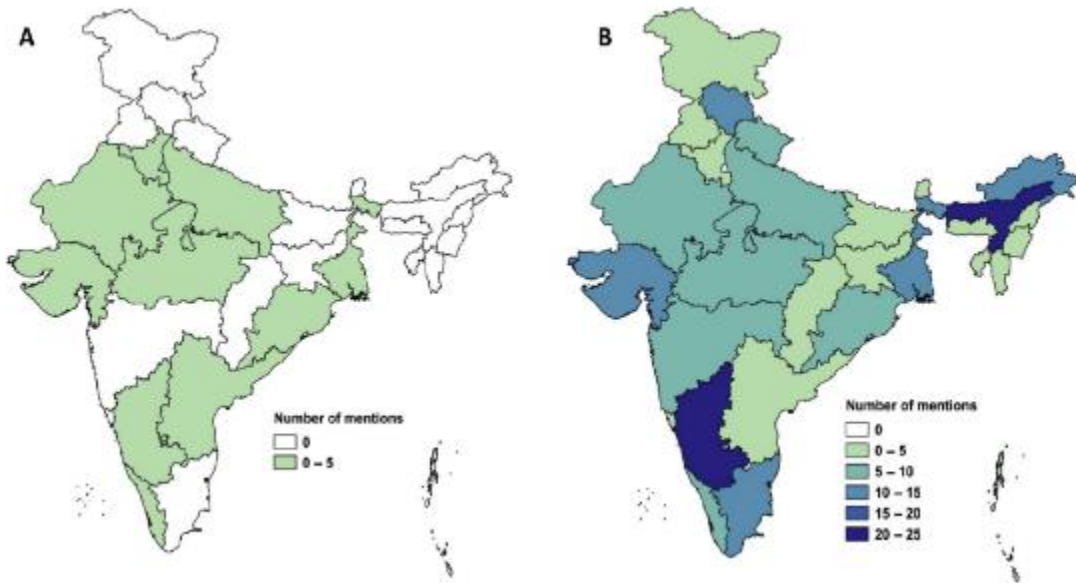
Figure 11: Geographical Distribution of HWC; A- Based on records publised. (1976-1995); B- Based on records published. (1995-2005)
Source: ENVIS
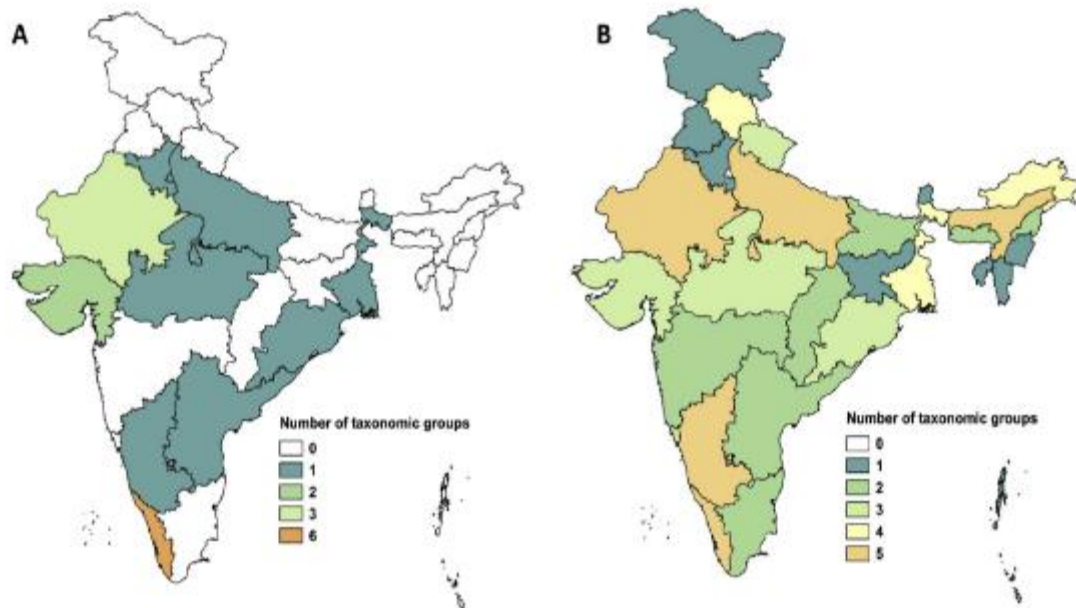
Figure 12: Number of Taxonomic groups involved in HWC; A- Based on records publised. (1976-1995); B-Based on records published. (1995-2005)
Source: ENVIS

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2.11 Right of Passage: Elephant Corridors of India

The Fragmentation and depletion of natural habitats are major drivers of global ecosystem destruction and the loss of biodiversity. Among the species most affected by habitat alteration and loss of habitat connectivity were mega herbivores such as elephants, with large home range and food requirement.*(Laverty & Gibbs, 2007)*. The fragmented nature of the Indian landscape has increased human-elephant conflict in most regions of the country, with people all around. About 400-450 people on average lose their lives annually because of such conflict in India, and about 100 elephants are killed in retaliation for the damage they cause to human life and property.*(IUCN, 2018; M.D. Madhusudan, 2015; Menon et al., 2017)*. Various strategies for managing and overcoming the adverse effects of habitat fragmentation and loss are being endlessly debated.

Wildlife corridors are an important means of ensuring greater availability of habitat for species, genetic exchange within and between populations, and mitigating conflict between human elephants in changed habitats.

Right of Passage: Elephant Corridors of India in 2005. 88 corridors identified Right of Passage: Elephant Corridors of India in 2015. 101 corridors. 25 in Central India, Railway Lines Central India, 35.7% have railway lines passing through hem.40% of the corridors in Central India are affected by Irrigation canals. In Central India, almost 88% of corridors are jointly under forest, agriculture and settlements and only 4% are totally under forest cover.*(IUCN, 2018; Menon et al., 2017)*

In order to ensure that corridors are safe and preserved, it is crucial that they be legally protected to prevent further habitat destruction and increased conflict between the human and elephant. To achieve this, state governments should first demarcate and notify these corridors as State Elephant Corridors, which could then be legally protected under relevant sections of the 1972 Wild Life (Protection) Act, the Environmental Protection Act, and other legislation.*(Menon et al., 2017)*

Wildlife Trust of India also suggests that, wherever possible, efforts should be made by State Forest Department, Project Elephant and conservation organizations to protect and secure corridor lands through the purchase and voluntary relocation of residents. Corridors could also be protected by working with local communities and municipalities (Autonomous District Councils) to minimize local reliance on corridor land and by notifying the corridors by the Council or the

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State Forest Department as Village Reserve Forests.*(Menon et al., 2017)* In the *Figure 13: Elephant Corridors of India; Central India Corridors in Blown-Up image.* The four different geographical zones which are identified and demarcated as the present elephant habitats and the corridors are represented as red dots in the following Map, it has a blown-up image showing the Green Forest Cover and the Corridors in Red Dots of the Chotanagpur Plateau which falls in the Central India Zone, the corridors

RIGHT OF PASSAGE ELEPHANT CORRIDORS OF INDIA

51 Ankua - Ambia
52 Raibera - Pulnanuru (Leda - Bera)
53 Dalma - Chandil
54 Dalma - Rugai
55 Dalma - Asanbari
56 Dumriya - Nayagram
57 Anjadbera - Bichaburu
58 Mahilong - Kalimati
59 Chandil - Matha

60 Jhunjhaka - Banduan (Dalma - Banduan)
61 Dalapani - Kankrajhor (Ghatsila - Kankrajhor)
62 Baula - Kuldiha
63 Similipal - Satkosia
64 Kahneijena - Anantapur
65 Anathpur - Aswakhola via Jiridimal Maulanhanja
66 Aswakhola - Sunajhari
67 Kotgarh - Chandrapur
68 Tal - Kholgarh
69 Nuagaon - Baruni
70 Buguda - Central
71 Karo - Karampada
72 Badampahar - Karida East
73 Badampahar - Dhobadhobin

Figure 13: Elephant Corridors of India; Central India Corridors in Blown-Up image.
Source: Wildlife Trust of India (WTI); IUCN; Author.

Development policies in elephant habitats should be thoroughly discussed, involving various stakeholders to prevent further fragmentation and degradation and a consequent rise in human-elephant conflict.*(IUCN, 2018)* While planning infrastructure development in such regions, appropriate mitigation measures

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should be finalized during the planning stages to minimize impact. The overall policy in these areas should aim towards the long-term conservation of wildlife by ensuring the protection of larger forest areas.

In the past decade seven corridors have been impaired and many more are on the verge of impairment. This was due to the lack of any agency to keep a close eye on those corridors so that changes in land use could be detected in time and mitigation measures begun. It is therefore important to involve local community organizations as 'Green Corridor Champions' in corridor areas. GCC's will be in charge of the sensitizing, motivating and mobilizing local communities to spur a sense of pride and ownership among them towards elephant corridor. This will be in the group that will ensure the security and monitor thee activities at the corridor and will keep in touch with the local self-government, state government and central government and the other stakeholders in loop for any information or updates over the status of the corridors. (Menon et al., 2017)

The Destruction, Fragmentation and Degradation of the natural ecosystems are the main causes of the global biodiversity loss. (IUCN, 2018)

The loss of habitats leads to fragmentation; the separation of vegetation into smaller and more fragmented fragments, divided by a human-transformed ground cover matrix. Loss of habitat and increased exposure of human land uses along the edges of fragments cause long-term changes in the structure and function of the remaining fragments and are detrimental to biodiversity survival *(Haddard et al., 2015).*

Such scattered ecosystems along the fringes of human populations often intensify tensions between humans and wildlife. Knowing the effects of habitat change and designing effective strategies for conserving biodiversity in disturbed landscapes is a major challenge for both scientists and land managers. The goal for land management is to formulate and enforce land use plans that will ensure natural resource management in the midst of conflicting land-use demands. Of example, this could be achieved by the landscape connectivity across corridors-the bandages for a wounded natural landscape *(Soule et al, 1991).* The conservation and maintenance of natural ecosystems and the connection between the remaining wild areas in fragmented landscape are a holistic approach, both in public and in private lands.

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In India wildlife habitats are no exception to the omnipresent pattern of destruction and degradation. This has adversely affected the populations of larger herbivores such as elephants, which have extensive home ranges and need large amounts of food. This has resulted in increased conflict between humans and elephants, resulting in crop-raiding, property damage and loss of human and elephant life.

2.12 Determinants of Human-Elephant conflict in a land-use mosaic.

This study examined the severity of problem elephant activity in a number of rural settlements practicing subsistence agriculture within the same semi-arid environment. Incident levels varied widely without corresponding local changes in the elephant population. PAs serving as elephant shelters in the Sebungwe are reported to have nearly twice the elephant density of shelters in the CL wards but neither the form of shelter nor the elephant density within it seemed to determine the level of problem elephant activity in adjacent human settlement. Significant local rainfall differences often mean that better crops don't automatically draw more elephants to cultivated fields.*(Anand & Radhakrishna, 2017; Hoare, 1999)*

The present study did not provide strong evidence of problems with elephants, depending on the density of the elephant population. The data support an explanation that the problem of elephant incidents represents an opportunistic feed for a segment of the male elephant population, and that their intensity depends on the behavioral ecology of these individuals. The factors that tend to sustain human elephant conflict in African savannas may thus be a combination of human occupation in a matrix of natural habitat, the presence of some individual male elephants at the margins of the declining herd, and the possible selective pressure on male elephants. This will also favor as a risky strategy to derive better nutrition from crops.*(Anand & Radhakrishna, 2017; Gubbi et al., 2014; Hoare, 1999)*

Evidence from this analysis also revealed that the degree of problem elephant activity is not related substantially precisely to the gross area of human occupation over which cultivation has gradually changed the ground cover. The geometry of natural habitat fragmentation induced by agriculture indicates that the interface of potential human contact with wildlife must increase as wildlife range contracts in the face of human expansion.*(Hoare, 1999)*

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The present research is suggested as sufficient for both spatial and temporal analyses of injury surveys. Measurement of problem elephant activity in standard area units used for both human and elephant density (km2) allows for better comparison across a wide range of physical situations and between different times than previous raid frequency indices. They were rated on the basis of the strength of the raids by individual farms, households or villages.*(Hoare, 1999)* An area based index avoids the pitfalls of

a. Assessing economic damages per incidents
b. Statistical comparison of situations where farms, villages or households vary in sizes and crop production.

The proposed index assumes instead a certain amount of effect on humans and a certain amount of effect on humans and a certain risk to elephants for each raid. In present study, large between –year variations suggest that this data should be ingested through a several years of calculated statistics. The relationship between the relative outgrowth and population of the elephants in the savannah the elephants & the human co-exist and hence the proposed study is more of a spatial analysis than a numeric one.*(Hoare, 1999; Madhusudan & Sankaran, 2010)*

2.13 Community Resilience: Conceptual Framework and Measurement Feed the Future Learning Agenda

The main aim of this paper is to educate the policies and practices of donors, implementation sponsors, NGOs, government and other stakeholders. The

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definition of group resilience discussed here is compatible with previous household resilience frameworks. The authors suggest the development of complementary indexes for the five different yet interrelated aspects of collective action to assess resilience at the group level. This paper suggests the use of HLM to participate in a systematic study of how impacts at various rates influence the stability of interconnected networks. It is important to recognize that the communities themselves are nestled within such systems, which is a key contribution.
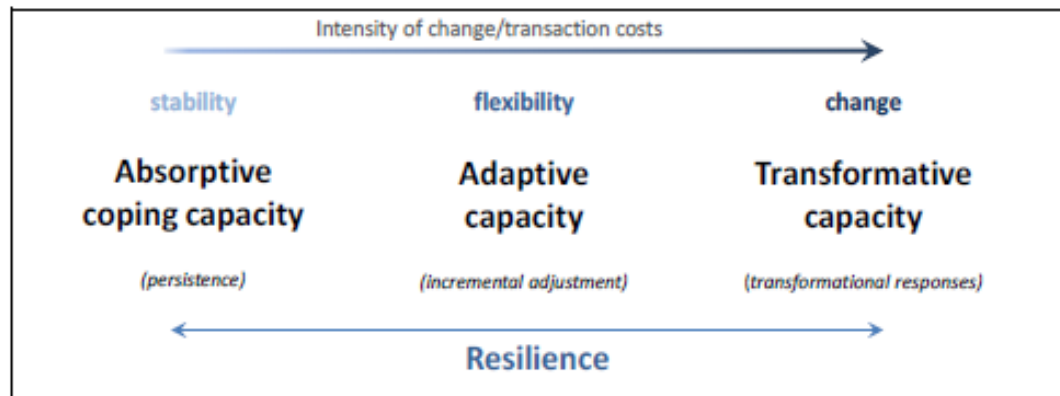
Reproduced with permission from Béné et al. (2012). Resilience: new utopia or new tyranny? Reflection about the potentials and limits of the concept of resilience in relation to vulnerability reduction programmes. IDS Working Paper, (2012) (405, 21)

Figure 14: Key capacities for achieving resilience.

This paper suggests the use of HLM to participate in a systematic study of how impacts at various rates influence the stability of interconnected networks. HLM requires data on results and their determinants to be used in an applied study at all applicable stages of research. An significant first step is to reach consensus on a specific overall theoretical context and to establish a standard collection of indicators. Longer-term, it is envisioned that continued assessment and identification of new indicators to better measure resilience. *(Mueller et al., 2013)*

2.14 Project Elephant – 1992

To conserve and protect and, where necessary, to restore natural habitats and traditional corridors/migratory routes or movement paths used by the elephants — through eco-restoration, acquisition etc.

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2.15 Conference of Parties: Conservation of Migratory Species 2020:

The 13th meeting of the conference of parties to the convention on the conservation of the migratory species of Wild Animals (CMS COP13) will convene a review implementation of the convention. CMS, also known as the Bonn Convention, recognizes that States must be the protector of the migratory species that live within or pass through the administrative boundaries of the state, and aims to conserve the terrestrial, marine, and avian migratory species throughout their range.

2.16 Landscape level conservation planning for elephants in Karnataka

Following up on the preliminary findings of the Karnataka Elephant Task Force, this collaborative effort strives, firstly, to describe elephant distribution in the state reliably, and then, based on objective ecological and social criteria, to delineate these habitats in Karnataka into appropriate management zones.

2.17 Policy Initiatives in Context to Human –Wildlife Conflicts.

The first approach to managing forests in India was initiated in 1861 during the Colonial rule. The First Forest Policy of 1894 and the Second National Forest Policy, 1952, did not include the value of forest ecosystems and wildlife conservation. Almost till 1988, the policy was to use forestland for commercial purposes, or development purposes for that matter (Semwal, 2005). Forest Management strategies were only in favor of commercial and industrial expansion with little attention to sustainability and conservation practices. In 1988, a paradigm shift took place when decision makers acknowledged the need for involving local communities in protection of forest management, owning to large number of population dependent on forest resources (Lynch, 1992). In subsequent years certain acts and policies were formulated for conservation of biodiversity, wildlife and ecosystem for the Indian Subcontinent, as mentioned below. In 1976, protection of forest and wildlife was also included in the Directive Principles of the State Policy, the Fundamental Duties and the Concurrent List (Lynch, 1992).

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1. The Indian Forest Act 1927

The Act was formulated during the British period and focused on consolidating the then existing laws of forest, the transit of forest product and the duties that can be levied on it. The Act establishes three categories of Forests namely protected forests, Reserve Forests and Village Forests. Its also includes the declaration of reserve forests, protected forests and village forests in India.

2. The Wildlife Protection Act 1972

The Government of India enacted this Act for the protection of the wildlife of the country and to control illegal activities like poaching, trade, smuggling in the wildlife and its derivatives. The Act was amended in January 2003 and penalty for the offences mentioned in the Act have been made more stringent.

3. The Forest Conservation Act 1980

This Act was formulated to help conserve the forest of the country, due to rising rate of deforestation and resulting environmental degradation. Under this Act the de-reservation of forest or use of forest land for non-forest purposes is strictly restricted, without the prior approval of Central Government. The Act also includes the pre-requisites for conservation of forest land for non-forest purposes. Wildlife under this Act includes biodiversity as a whole, i.e. both flora and fauna.

4. The National Environmental Protection Act 1986

This Act was enacted in the wake of the Bhopal Gas Tragedy of 1984. It seeks to implement the decisions of the United Nations Conference on the Human Environment that relate to protection of human environment. The Environmental Impact Notification under this act makes it mandatory to seek environmental clearance for infrastructural development.

5. The Biological Diversity Act 2002

This Act focuses on preservation of biological diversity in the country and provides mechanism for equitable sharing of the benefits arising out of the use of biological resources and knowledge. The Act was formulated to meet the obligations under

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the United Nations Convention on Biological Diversity 1993, to which India is a Party

6. National Environmental Policy 2006

This policy presents an integrated approach to reduce the degradations of environment by taking proactive measures at various fronts. This also includes regulatory reforms to enhance and conserve environmental; resources and prevent land degradation and take into account all factors that influence the environment.

7. Joint Forest Management

This is a program initiated in the context of the National Forrest Policy of 1988 Wherein the State Forest Departments support local communities residing near forests for protection and conservation of forest resources and share the cost and benefits form the forests worth these communities (MoEFCC). Under this Forest committees are constituted and a micro plan is prepared by the Forest department and Forest committees. The main purpose of this plan is to protect and develop forests along with fulfilling the forest based needs of the local population, by regulated use of the forest resources (MoEFCC). Employment opportunities are created through such programs and thus, it discourages villagers from illicit felling and encroachment in the forests (MoEFCC).

8. Guidelines for Buffer Zones

URDPFI Guidelines 2014 define buffer zone as area demarcated to enhance the protection of a conservation area and are often peripheral to it. Within these zones, certain legal or customary restrictions are placed upon land use change and resource utilization to reduce the negative impacts of nearby *communities (MoUD 2014)*.

9. National Wildlife Action Plan (2017-2031)

The NWAP is prepared based on the facts that essential ecological processes are necessary for food production, health and other aspects of human sustenance and sustainable development (MoEFCC, 2017). It focuses on preservation of Genetic diversity ad sustainable utilization of species and ecosystems. AS per National

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Wildlife Action Plan (2006-2016), Eco-Sensitive Zones should be declared around Protected Areas and Wildlife Corridors. The width of Eco-Sensitive Zone can go up to 10 kms around a Protected Area as mentioned in the Wildlife Conservation Strategy 2002. The NWAP 2017-2031 details out measures to be taken to mitigate human-wildlife conflicts. The priority projects under this plan are listed below:

1. Conduct surveys to collect data on HWC and prioritize species and areas for interventions.
2. Create a centralized analytical database to understand temporal changes in frequency of conflicts.
3. Prepare a Land-Use Practices Assessment and Planning Committee to identify land-use practices promoting HWC.
4. Ascertain population status for various species involved in conflicts to develop population management strategies.
5. Develop nation level conflict-mitigation plans.
6. Promote suitable mitigation measures focusing on land use practices and cropping patterns.
7. Streamline the compensation mechanism for victims of HWC.
8. Set-Up Conflict Mitigation Squads
9. Set-Up necessary arrangements for emergency care to people injured by wild animals.
10. Ensure that Environments Impact Assessment of development projects takes into consideration HWC.
11. Establish a center of Excellence for HWC mitigation under MoEFCC
12. Awareness campaigns should be conducted.
13. Constitute a network of Primary Response Teams (PTR).
14. Encourage participation of local bodies in management of HWC and formulation of Wildlife squads and PRTs.

10. Eco-tourism Policy 2011

The ecotourism policy lays out a detailed set of framework guidelines on the selection, planning, development, implementation, and monitoring of ecotourism in India. It aims to ensure responsible travel to natural areas that

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does not harm the environment and also improves the well-being of local people. Under this policy, the State Government must develop a State-level Ecotourism Strategy. A comprehensive plan should be prepared to ensure wilderness conservation in the ecologically sensitive landscapes, incorporate sound environmental design practices using sustainable materials, spread awareness regarding conservation, encourage local communities in planning, providing and managing ecotourism facilities.

11. International Science-Policy Platform on Biodiversity and Ecosystem Services.

IPBES is the intergovernmental body which assesses the status of biodiversity and ecosystem services provided to society. It is placed under the aegis of four United Nations entities: UNEP, UNESCO, FAO and UNDP and is administered by UNEP. The IPBES focuses on conservation and sustainable utilization of biodiversity and ecosystem services respectively, to promote long-term human well-being and sustainable development.*(Government of India & Niti Aayog, 2019)*

12. Mining Development Plan

The Mining Development Plan considers the Finding, Extraction & Restoration of the mining locations and the plans for it to have minimum impact on the ecosystem and the surrounding so as to have a sustainable mining phase and the natural conditions of the landscape is restored after the mining activity is complete and the procedures to be considered when they are carrying out the mining which is a limited time activity of a 10-25 years of extraction limit from a source so the eco-restoration of the region should be considered and the biodiversity affected in consideration.*(Change, 2018)*

2.18 Elephants in Exile: R.K Singh

The paper is actually a review of the events that took place in Chhattisgarh that of wandering revisit of the elephants after several decades of absence. This caused many encounters between human and Elephant and lead to losses to human as well as property & raiding of the crops. The Wildlife Trust of India sent one of its

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senior officers to carry out a quick evaluation of the state's extent of violence, and the findings were hardly unexpected. *(Singh, 2002)* Jharkhand was destroyed by large-scale open-cast mining and the migration of elephants to a more suitable and secure habitat was a direct result of this. He also clearly mentions that if there has to be any solutions to this issue then there has to be a thinking and planning so as to address it in the long term ways so as to clear out this conflict. *(Barua et al., 2013)* Have a landscape level planning, land-use solutions in transboundary ways and conservation measures then there will be any level of success.

The suggestions that he gave were

- Policy decisions by Chhattisgarh government.
- Conflict alleviation and Public Awareness
- Creation of inter-state committee
- Role of WTI to interfere and problem solving researches. (Singh, 2002)

2.19 Where Elephants Roam: Mapping the Distribution of an Endangered Mega-Herbivore

Elephants do not understand administrative boundaries and often range widely within and outside protected areas. Protecting them within the key wildlife reserves where they occur is absolutely necessary, of course, but by no means sufficient. Devising a reasonable strategy to secure spaces for these giants on unprotected lands without undermining human well-being there is perhaps the most crucial need for elephant conservation. But it isn't possible to get at any of these without strong and reliable baselines, and that's precisely what the study is all about.

The paper inferred that Elephants do not understand administrative boundaries and often range widely within and outside protected areas. Study found elephants occurred in 972 of Karnataka's 2,855 forest beats. Of the 972 forest beats with elephants, only 385 occurred within notified PAs. 60% of the remaining 587 beats (or 60%) were outside PAs and included lands designated for agricultural production. This indicates a significant overlap of elephant range and human-dominated areas, a perfect recipe for conflict.

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2.20 Case Studies

The human-elephant conflicts have been existed for long now and these have been managed and mitigated with different approaches and methods. These are some of the following ways in which different international and our nation has been trying to manage and minimize the conflicts that arise. The cases vary as per regions but the motive behind each of the cases remain the same. These majorly depend upon the village characteristics, availability of forest resources, perception of people, dependence in forest resources, nutritious value of Forest, fragmentation of forest cover, other anthropogenic activities, etc.

2.20.1 Elephant Movement, Human-Elephant Conflict, Cox's Bazar, Bangladesh. 2018

With the support of the UNHCR, IUCN Bangladesh has launched a project entitled 'Biodiversity Conflict Mitigation in Cox's Bazar District Refugee Camp' to minimize human-elephant conflicts in and around the Kutupalong Camp. At the start of the project, IUCN Bangladesh had meetings with all relevant government agencies, including the Commissioner for Refugee Relief and Repatriation (RRRC), Cox's Deputy Commissioner for Bazar, and the Bangladesh Forest Department. After receiving required authorisation from the RRRC, it began field work. In the period from 21 January to 13 February 2018, IUCN Bangladesh hired a trained elephant survey team to assess the presence and population size of elephants, recent human-elephant conflict situation, and possible intervention spots in and around the Camp in Ukhia, Cox's Bazar. *(IUCN, 2018)*

IUCN team surveyed about 70 square kilometers of bare hills around the camp and completed some 240 kilometers of transect walk. A total of 160 piles of elephant dung and 630 footprint points of various ages were recorded and mapped around the Camp area. The survey showed that the movement of elephants across Camp area was regular, with the highest concentration all along the west boundary. Footprint points have also been found on the Camp's eastern side. According to the 'Dung Count System,' the average mean elephant number is 38 (range 31 to 45) in the Cox's Bazar South Forest Division's five Forest Ranges (on the west and southwest of the Camp). A total of possible 56 spots are identified for the installation of watch-towers based on the distribution and strength of the elephant

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dung. 25 Elephant Response Teams (ERTs) are required to shape and develop their capacity to protect the Camp. It has been realized that travel alarm might not be useful as an elephant deterrence device due to high human activity around the camp, adjacent hills and forest areas. The survey showed the camp is highly exposed with a greater number of open points from which elephants could reach the camp. Owing to high deforestation rate, the hills around the Camp are now barren.*(IUCN, 2018*) The following table shows

Forest Range	Total Area (sq. km.)	Elephant Number in 2018*			Elephant Number in 2015**		
		Mean	Lower Limit	Upper Limit	Mean	Lower Limit	Upper Limit
Ukhia	72.76	0	0	0	7	5	8
Inani	65.8	18	16	21	12	10	14
Teknaf Sadar	47.5	10	8	12	7	6	8
Shilkhali	29.42	7	5	8	6	5	7
Whykhong	50.97	3	2	4	3	2	5
Total		38	31	45	35	28	42

Table 2: Status of Elephants in five Forest Ranges of Cox's Bazaar South Forest Division on N-W, West and S-W sides of the Kutupalong Camp, Ukhia, Cox Bazaar. Source: IUCN, Bangladesh.
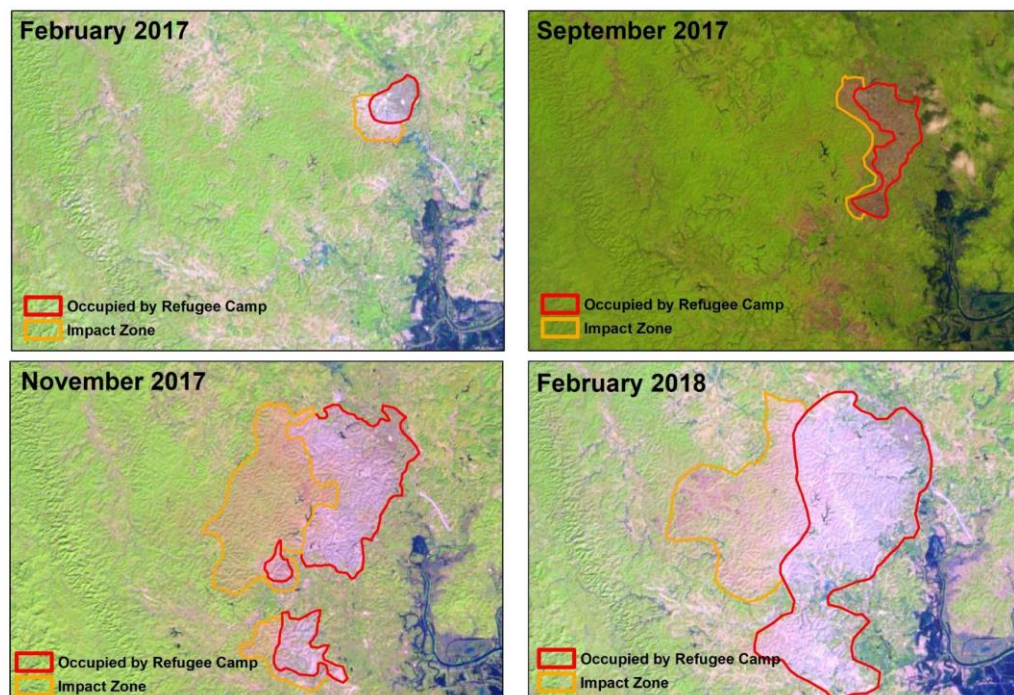
Figure 15: Land Cover Change between Feb'17 and Feb'18. Around the camp. Source: IUCN, Bangladesh.

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The study report concludes that there is a high risk of elephant encounter in the coming days and calls for immediate action to mitigate it and rather as suggested early in the report that long term measures are the requirement for this scenario to be planned and executed.

2.20.2 Community Securement Model: Siju-Rewak Elephant Corridor, Meghalaya

This corridor is located in the Garo Hills Elephant Reserve, which supports 1,000 elephants, man. This links the Siju Wildlife Sanctuary to the Rewak Reserve Forest, a very important link for elephants that helps to maintain Continuity of habitat between Balpakram-Siju-Rewak and Nokrek National Park. The corridor is 3.5 km long and 2 km wide. (Fernando et al., n.d.)

Elephants can cross the Simsang River only at three or four points where there are sandy stretches of the river; otherwise, the river is surrounded by steep limestone cliffs and large rock formations along both sides. Only part of the forest corridor is controlled by the Forest Department; the rest is managed by local tribal communities. The village of Aretika, which lies in the corridor region across the eastern side of the Simsang River and the southern end of Siju WLS, is a significant obstacle to the movement of elephants across the corridor. People in this village practice jhum or shifting cultivation, which is the common practice of tribal people in Meghalaya. (Fernando et al., n.d.).

WTI, with financial assistance from the World Land Trust (WLT) and partnering with the World Land Trust.

Nokma (Village Head), villagers, Garo Hills Autonomous District Council and Meghalaya Forestry Department, protected the corridor by notifying the corridor area as two Village Reserve Forests, namely the Siju-Aretika Village Reserve Forest and the Rewak-Kosigre Village Reserve Forest, spread over approximately 250 hectares in 2007-08. The corridor is being monitored for the assessment of pre-and post-securement animal use. Owing to the expanded usage of the elephant corridor, the human-elephant dispute in Aretika has risen. An electric fence was therefore erected around the village to prevent the entry of animals.

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2.21 Mitigation Measures

Several approaches have been applied to mitigate and prevent HWC at local and global levels. It is necessary to understand that this is an issue closely associated to society and hence, societal acceptations is crucial for effective implementation of the interventions and recommendations.

The wildlife corridor connecting (Ankua –Ambia Corridor) the Singhbhum population occupies about 2570 sq km of the available forest area of Dalma Wildlife Sanctuary and the forests of Saranda, Porhat, Kolhan, Saraikala (formerly North Chaibasa) and Dhalbhum Forest Divisions. About ten elephant corridors are located in this landscape.*(JH, 2017)* Mining is one of the most serious threats to the elephant habitats of this region, with Singhbhum being known for its large reserves of hematite iron ore, constituting 25% of the total known reserves in India. Mining activities in the Manoharpur mines and the transport of ore have severely affected the overall habitat and threatened the movement of elephants in these areas. Elephant movement between Dalma Wildlife Sanctuary and Saraikala Forest Division has been threatened by the heavy traffic on National Highway 33, the construction of the Subarnarekha canal, the Tatanagar-Chandil railway, various stone crushing units that have come up along the highway, and the expansion of human settlements and agriculture land almost till the foothills of Dalma Wildlife Sanctuary.*(Jauher, 2016b)* Habitat degradation has also threatened elephant movement between Dalma Wildlife Sanctuary and the Matha Range of Purulia Forest Division (West Bengal). The elephant habitats of the Mosabani Range of Dhalbhum Forest Division have also been severely affected by increased agricultural activities and anthropogenic pressure, impairing the movement of elephants from Mosabani Range to Rakhamines Range of Dhalbhum Forest Division. The degradation of elephant habitats in Jharkhand has also resulted in the migration of elephants to the adjoining areas of Chhattisgarh, leading to increased human-elephant conflict. *(Change, 2018; Jacobs et al., 2018; Jauher, 2016b)* To strengthen the conservation of the Singhbhum elephant habitats, which lack a Protected Area, Project Elephant has declared 4529 sq km of the elephant habitat as Elephant Reserve I. *(FSI, 2017)*

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a. Preliminary Suggestions

I. Policy decision by Jharkhand government for Elephants: If the government is willing to allocate resources for the management of these elephants then,

    a. Research & Scientific Study:

        i. Satellite Images – Delineate the available forest cover and corridors that are utilized by the migrant Elephant Population.

        ii. All the forest division maps should be converted to a digital format so that necessary information and variables for the wildlife management can be studied through computation.

        iii. Scientific mapping plan for the herd should be worked out in conjunction with the local state university and WTI.

    b. Elephant Conservation Action:

        i. All the concerned forest divisions should create flying squads so that they can keep proper records of elephant movements and other variables important for management of elephants.

        ii. In case of Emergency: The state government must procure darting equipment after providing necessary training to two veterinarians, who should be posted nearby center.

        iii. Awareness programmes for correspondents of local newspapers and for the general public, should be held so that a positive attitude towards elephants can be created.

        iv. Micro-level assessment of ongoing developmental projects is needed particularly in areas utilized by elephants.

II. Creation of Inter-state committee:

The Interstate Committee, consisting of representatives from Chhattisgarh, Jharkhand and Orissa, must be set up. The committee should decide on the collection of uniform information relevant to the management of elephants. The information collected should be shared directly between the DFOs concerned. This committee should involve individuals who have worked on elephant related issues in Jharkhand and Orissa in order to develop an effective management plan for elephant populations.

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2.22 Summary.

Human-Elephant Conflicts have different paradigms related and interweaved together. It affects human and wildlife psychologically and emotionally. The disturbances caused amongst species due to human elephant conflicts, makes it a grave concern. Several causes are associated with it which are discussed above. The case examples discussed here have peculiar and varied concerns and the measures adopted by them to cope up the dire situations have been studied to achieve a background knowledge about the working plan adopted to achieve the predicted results and the mitigation measures adopted to cater to the ultimate result. The relationship between the anthropogenic activities and the human-elephant conflict is incremental and that has been recorded by the literature review. From deforestation to depletion of the natural resources, fragmentation of the forests cover to increased anthropogenic activities has had a negative impact over the prehistoric elephant corridors present in the area and the forest resources in the region of reference. Human-Elephant Conflict has been an important global concern, international organizations have effectively been working upon it as IUCN, Conservation of Migratory Species (CMS) & World Wildlife Fund (WWF) have several policy and conservative schemes proposed and in act have been raised to mitigate these conflicts. These have made possible for the concerns to be looked upon as a global ecosystem level enabling the international and national policies and institutional prospects considering these aspects of Human-Elephant conflicts. This concerns the several global measures adopted to achieve my scope for the research.

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3. STUDY AREA PROFILE & DATA COLLECTION

Jharkhand is the ancient name given as a whole to the wooded upland geographically known as the Chotanagpur plateau comprising the north-eastern portion of India's Peninsular Plateau. It is a region of great unevenness, consisting of a succession of plateaus, hills and valleys drained by several large rivers, including the Damodar, Subernarekha, Barakar, Brahmani and Baitarani. The plateau is a vast area from the western most part of Bihar to the eastern border of West Bengal and continues to West Bengal somewhat further.*(JH, 2017)* This plateau can be further sub-divided into the Ranchi and Hazaribag plateau based on physiographical consideration. Jharkhand is one of the richest regions in the world, rich in deposits of minerals and forests. The area has an enormous supply of coal, iron ore, mica, bauxite and calcareous and substantial copper, chromite, asbestos, kyanite, china clay, manganese, dolomite, uranium etc. *(Priyadarshi, 2008)*

The value of minerals mined in Jharkhand in 2004-2005 was Rs 5,760 crore-roughly 8% of the overall value of mineral production in India. Jharkhand receives the maximum royalty for mining among the coal-producing state in India. The government of Jharkhand has granted 524 leases for the mining of various major minerals-206 of which were granted only for coal. In addition, 2,717 leases were issued for the mining of minor minerals in the state covering an area of 8,426 ha.

A large portion of the Jharkhand population, 44 per cent, is below the poverty line and more than six per cent are still unable to get enough food. In the state the deprivation level is much higher than the country's.*(JH, 2017)* The present situations could worsen if the agricultural and forests land shrink further transforming landscapes to wastelands. Large population of Indigenous people will be forced to move out of their hearths and homes to brick kilns, stone quarries, etc. in search of livelihood. Their land which is their only wealth, will be forcibly taken away from them leaving behind heartbreak, destruction and degradation, rather than involving them an incorporating them as well in a planned approach.*(Singh, 2002)*

The West Singhbhum district of Jharkhand is considered to be one of the richest in terms of forest resources especially elephant biodiversity and minerals.

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Concerns have been raised about the effect of mining operations on biodiversity, environment and residents. Mining and its impact on forests, wildlife and the people around it have been one of the most recent topics discussed by policy makers and conservationists across the country. Minerals play an important role in the economic development of the country as minerals are the basic raw materials to promote the growth. However, indiscriminate and unplanned mining causes irreversible damage and deterioration of natural resources. Mining activities affect the surroundings i.e. Air, Water, Soil, Land, Biological diversity etc. (*IWMP, West Singhbhum*)

Increasing globalization of the mining industry has led to changing public attitudes regarding the costs and benefits of mineral extraction and an increase in public pressure to minimize the environmental and social costs associated with mineral development. *(In-Depth Forest Tales, DTE)*

Situated in the central Indian tribal zone and distributed over an area of 13,440 sq km, the Singhbhum district (in the eastern and western districts of Singhbhum in 1990) has one of Asia's finest sal forests-the Saranda forests. The Ho tribes, similar to the Mundas, but unique in preserving their traditional cultures, dominate the divisions of Saranda, Kolhan, Porahat and South Forest. The district is also very rich in iron ore, uranium, copper, asbestos, kainite, china clay and other minerals. This explains the emergence of 20 industrial mining towns in the region, including the industrial town of Jamshedpur. The Dhalbhum region of the district has many tanks and a second crop of vegetables is grown in many such pockets to meet the growing needs of the mining towns. The firewood and timber needs of these towns have exerted pressure over forests in these regions.

3.1 Administrative Setup

The West Singhbhum district in Jharkhand is considered to be one of the richest in terms of forest resources, biodiversity particularly elephant and also minerals. Concerns have been raised on the impact of mining activities on the wildlife, habitat and the people. Mining and its impact on forest, wildlife and the people around have been one of the recent topics discussed among the policy makers and conservationists all over the country. Minerals play an important role in the economic development of the country as minerals are the basic raw materials to

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promote the growth. However, indiscriminate and unplanned mining causes irreversible damage and deterioration of natural resources. Mining activities affect the surroundings i.e. Air, Water, Soil, Land, Biological diversity etc. (*IWMP, West Singhbhum, 2017*)

Increasing globalization of the mining industry has led to changing public attitudes regarding the costs and benefits of mineral extraction and an increase in public pressure to minimize the environmental and social costs associated with mineral development. *(In-Depth Forest Tales, DTE)*

The district of Singhbhum is located at the central Indian tribal area, spread over 13440 sq km and has one of the largest sal forest in Asia: the Saranda forests (1990 bifurcated to the east and west Singhbhum districts). Saranda, Kolhan, Porahat, and South Forest Divisions are the Ho tribes which resemblance to the Mundas but unique to preserve their traditional cultures. The district is also very rich with minerals such as iron ore, uranium, coal, asbestos, kainite and china clay. This is why 20 urban mining towns, including the industrial town of Jamshedpur, are developing in the area.*(State Government, 2011)* In addition to income from non-timber forest products, not-so-modem agricultural practices are followed in almost all of its 32 community development blocks. The district of Dhalbhum has many tanks and a second vegetable crop is grown in many of these pockets to meet the growing needs of mining towns. The firewood and timber demands of these towns have put strain on forests in these areas. *(Singhbhum & Harkhand, 2013)*

3.2   Geography

 The West Singhbhum district, part of the former Singhbhum district, came into existence when Singhbhum was forged in 1991 to form Pashchimi and Purbi Singhbhum. The largest district of the state lies in the division of South Chhotanagpur and is located in the south-eastern part of the state of Jharkhand, which lies beneath the eastern plateau and hills. It has a total area of 5351 km2 (2.066 sq mi). *(Mine Surveyor Institute, 2017)*

Saranda simply means seven hundred hills, which have a significant role in natural history as the finest and highest Salt Forest in the world. Saranda has been a training school for thousands of foresters for over a century and is now a prime

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elephant sanctuary. It forms the core of the Singhbhum Elephant Reserve with an estimated 150 elephants in about 820 sq km of the forest. *(FSI, 2017)*

a. Climate:

The year can be divided into three seasons, the November to February winter season, the March to May summer season and the June to October rainy season. The cold season is wonderful while in the summer season it is unpleasantly hot with prevailing dry westerly winds. The weather is usually dry due to the barrier of hills in the south. The Rainfall is the highest in the July and August months. In the second week of June Monsoon normally starts. The coldest months are December and January while the hottest are April and May. (State Government, 2011) The area receives about 1600 mm of annual rainfall, most of which is during the South West monsoon and is blessed with ten major rivers viz. Karo, Koyna, Koyal, Roro, Illigara, Kharkai, Konjaria , Sanjai, Roro-Gara, and Baitarnee. The winter is reasonably cold with temperature dipping to 30℃ – 40℃ and the average temperature remains at 16℃. The temperature goes up to 43℃ in summer. But the average temperature is recorded to be 33℃. *(DMP, 2011,* (State Government, 2011)

b. Natural Setting:

The district is of undulating terrain with hills alternating with valleys and steep mountains. Some stretches are comparatively flat in the river basins.*(Singhbhum & Harkhand, 2013).* In the north-west, the peaks have an altitude of more than 2,500 feet and in the southwest; there is a mass of hills, rising to a height of nearly 3,000 feet, around Saranda. West Singhbhum district has a vast area under forests harboring a variety of plants and animals.*(FSI, 2017)* Total forest area of the district is 2788.87 Sq. km (52% of total area of west singhbhum). There are four forest divisions in West Singhbhum, those are Saranda, Kolhan, Porhat and Chaibasa. There are 15 forest ranges in four divisions. The headquarters of all the Divisions are in Chaibasa. Saranda is the largest in terms of extent of forests. Singhbhum Elephant Reserve was the first elephant conservation reserve exclusively for the pachyderms in India, the Saranda Reserve Forest constitutes the major chunk of the dense and healthy habitat for the Biodiversity to thrive. *(IWMP, 2017)*

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The Range is fed by three prominent rivers that also act as the lifeline for the Saranda to survive are Koel, Karo and Koena rivers. In the north-west, the peaks have an altitude of more than 2,500 feet and in the southwest; there is a mass of hills, rising to a height of nearly 3,000 feet, around Saranda.

c. Land-Use Pattern:

Agricultural conditions in different parts of the district vary considerably. The district can be divided into three tracts, first comparatively flat plains, then contrasting hills with open valleys and, lastly, steep mountains clad in trees. The district's people have almost changed their nomadic ways, and have more permanently taken up cultivation. There's been a tremendous shift in people's mindset and now there's an understanding of the more advanced agricultural practices and irrigation needs. *(Author)*

d. Livelihood Scenario:

Agriculture is the major livelihood activity in the district predominantly with paddy which is mostly depending on the rain fed water.*(Singhbhum & Harkhand, 2013)* The district is also rich in various produces such as Amla, Chironji, Mahua and Sawai Grass. Other than these, Sawai grass, Tasar silk and Lac are cultivated in different blocks. In some blocks, fruits such as papaya, mango, lemon, tomato, jack fruit, custard apple and guava are grown. There are three crop seasons viz. Kharif, Rabi and summer. Major Kharif crops are paddy, jowar, bajra and maize. Major Rabi crops are wheat, jowar, barley, gram, linseed, rapeseed and mustard. Rice and maize are grown in summer also.*(JH, 2017)*

The West Singhbhum district is very rich in mineral resources mainly iron ore and limestone. The other Minerals found are Chromite, Magnetite, Manganese, Kainite, Asbestos, Soapstone, and Heavy Atomic mineral.*(Change, 2018)*

The West Singhbhum district in Jharkhand is reported to have extensive deposits of high grade hematite ores. Almost the entire present day production of iron ore and its products comes from hematite reserves, magnetite reserves are not being exploited as these are mostly in eco-fragile areas of the Western Ghats. *(Change, 2018).* Around 96% of hematite resources are confined in the states of Orissa, Jharkhand, Chattishgarh, Karnataka and Goa. The remaining resources are spread in the states of Maharastra, M.P., U.P., Rajasthan, Assam etc. There are

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all together 63 mining and allied activities/surface right leases in West Singhbhum district of Jharkhand. Out of 63 leases 43 leases are in Saranda forest division, 19 leases are in Chaibasa forest division and 01 lease in Kolhan forest division of West Singhbhum district of Jharkhand. Further, out of 63 leases 10 nos. are operating lease, 32 nos. are non- operating, 04 nos. are surface right lease for infrastructure 0- allied activities of mining, 14 nos. are mining leases which are in advance stage of operation and 03nos. are under prospecting license. *(Change, 2018; Priyadarshi, n.d.)*

So the basic livelihood of the residents in the adjoining settlements in majorly agriculture and some of the villages that have been adopted by the leased out companies provide petty jobs at the mines as labour or at the employee resource centres established there to cater the technical and managerial staff members appointed there on site. As Chiria and Ankua are adopted by SAIL ltd. They assist in infrastructure and resources keep up of both the villages. *(Author)*

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3.3 About the Elephant Corridor: Ankua-Ambia

The identified corridor Ankua-Ambia runs through the bottleneck connection between the Ankua Reserve Forest Range of Saranda Forest Division and Ambia Reserve Forest Range of Kolhan Forest Division. *(Menon et al., 2017)* The cluster of 4 Villages sparsely populated village settlements are identified as the study region for the data collection, surveys, interviews and focus group discussions. Following, Table 3 Compiled Fact Chart: Ankua-Ambia Elephant Corridor. Source: Forest Survey of India (FSI), 2017. Describes a brief factual description of the Elephant corridor.

State	Jharkhand
Connectivity	Ankua Reserve Forest (Saranda Forest Division) with Ambia Reserve Forest (Kolhan Forest Division)
Length & Width	Spread through three Mining Clusters- Chiria – 12 km Gua – 32 km Noamundi – 38 km (topographical distance)
Geographic Co-ordinates	22°20'50" -22°22'19" N 85°15'1"-85°17'26" E
Legal Status	Reserve Forest
Major Landuse	Forests, Agriculture Fields
Foresr Type	Tropical dry deciduous sal forest
Frequency of Usage by Elephants	Regular; throughout te year (Oct-Feb & Apr-June)
Ecological Priority[1]	High
Conservation Feasibility[1]	Medium

Table 3 Compiled Fact Chart: Ankua-Ambia Elephant Corridor. Source: Forest Survey of India (FSI), 2017.

.Corridor falls in remote location in the reserve forest areas, a rural setup and the settlements sprawled around just because of the mining potential zones and the forest villages[2], set-up in the forest trade times to have a caretaker to assist and support at the times of felling and trade. The villages sprawled through time and grew to be notified as villages. The villages that are around the identified corridor are **Ambia, Lebenta, Balia, Rela** in the **Gamharia** Panchayat and **Ankua, Chiria,**

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[1] As Ranked by the WTI & ANCF in Right of Passage: Elephant Corridors of India.
[2] Forest Villages: 'forest villages' means the settlements which have been established inside the forests. By the forest department of any State Government for forestry operations.

Lo, Binuan in the **Chiria** Panchayat, and these are the villages which were identified for the study.

The tribal world view of the fact that human beings can, but cannot, restore trees should overcome challenges and deficiencies that hinder government land management policies. The Tribal also specifically differentiate tree production from natural forests. The variety of Sal forests and the diversity of animal and plant species they support has defined people's livelihoods in this area. Studies shows that out of 214 wild plant species found for fuel, fruit, meat, medicine, household articles, product and religious purposes, the Tribe used 155 fuel and household articles in adjacent Sal forests of Midnapore district.*(FSI, 2017; JH, 2017)*
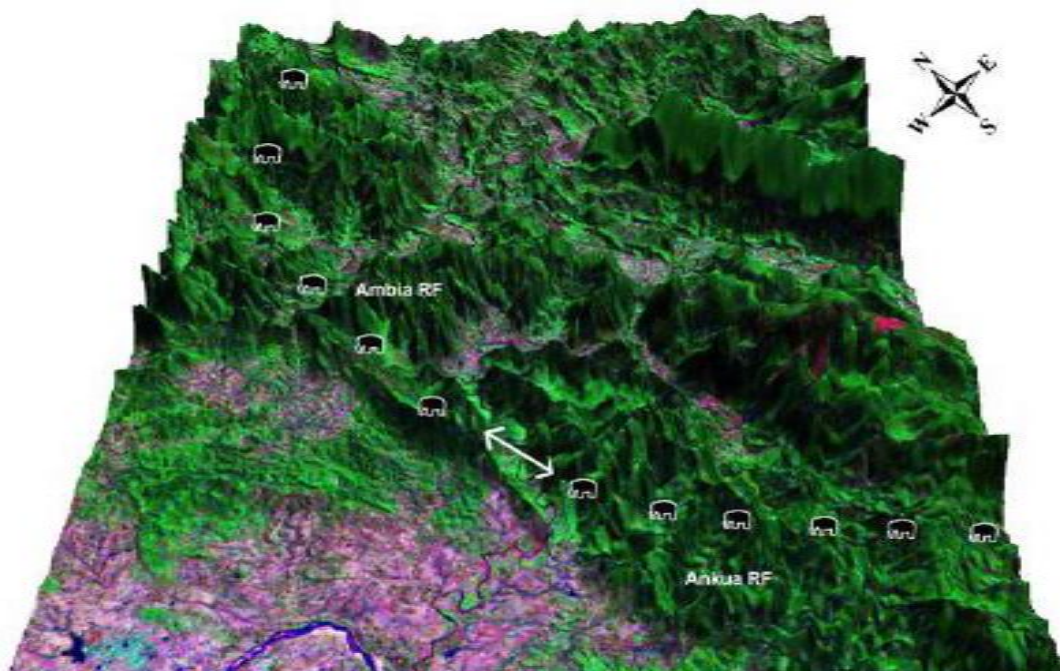
Figure 16: 3D Map of the Corridor. Source: Right of Passage.

The village cluster selected for the study is based on the past elephant sightings and the recurrence of the Human-Elephant confrontations that have been taking place recently due to the fragmentation of the settlements and the degradation in the nutritive value of the forest ranges, as conveyed by the forest and biodiversity experts, over my visit and the interactions with various of them.(Redpath et al., 2015)

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Elephant Demography

The elephant is without doubt the flagship animal in Jharkhand's West Singbhum. The elephant population migrates from one forest patch to another particularly for particular seasons, i.e. allowing for the regeneration of fodder stocks in one region and allowing for the continuous transfer of genetic material between different populations. So forest cover status, diversity of tree species, distribution and abundance of fodder species, availability of shed, water and ecological parameters were considered to finally arrive at a reasonable assessment of the status of the flora and fauna resources of the region.

The study of forest division census figures from 2007-12, which are performed in the summer, suggests the existence of restricted distribution to some pockets of the forests. Such areas form the permanent home ranges, where elephants can be found all year round. The primary home range includes RFs in and around Tholkobad, covering three divisional ranges Samta, Sasangda and Koina. The population present in the ranges are distributed approximately as 65% in Samta, 25% in Sasangda and 10% in Koina Ranges.

2007 – 124; 2010 – 139; 2012 – 154 Elephants (out of total population of nearly **200-253** in these years.) (*Wildlife census 2007-12*)

The congregation of Elephants swell up in the area with the on-set of winters, by the incoming herds from Saraikela - Kharsawan, Porahat, Chaibasa and Saranda. (*IWMP, West Singhbhum*). Elephants cannot be conserved only by Jharkhand's initiatives hence it requires the support from the neighboring states as well, all anti depredation measures are to ward off the elephants, which are temporary.

3.4   Data Collection

Primary and Secondary surveys was conducted to collect data on Human-Elephant Conflicts and related trends and events. The Secondary data collection included Wildlife Managements Plans, District Development Plans, Sustainable Mining Plans, Project Elephant 1992, Forest Management Plan, Forest Survey of India Documentation, MOEFCC surveys and data archives, etc. For Primary surveys Focus Group Discussions and Household Surveys were conducted. Also, interviews of officials, NGO's, Activists and relate personnel's were conducted. The Sample of questionnaire sheet of the surveys has been attached in Annexure I.

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3.4.1 Village Selection

The selection of villages for primary survey is done on the basis of incidents of conflicts that occurred till January 2020. 1700 and more is the number of human, and 370 plus elephant causalities in just past half a decade, *(Jauher, 2016b; Singh, 2002; WWF, 2015)* human elephant conflicts are on a rise, and this fact is evident with the numbers. The incidents that have been confirmed over these selected villages have been spurring as just because of the degradation in the nutrient value base of these Forest Reserves and fragmentation of this important corridor which is the major transit node for the Elephants to the 3 identified habitat locations. *(IUCN, 2018; Singhbhum & Harkhand, 2013)*

3.4.2 Focus Group Discussions

The Focus Group discussions were conducted in all four Villages. It was ensured that maximum people are part of these discussions and that the group characteristics are heterogeneous. People of different age groups, gender and social stature were part of the focus group discussions in the villages so that a discreet responses can be recorded and the charter and their perceptions as a community can be brought forward.

The Checklist for the Focus Group Discussion is shown in Annexure II.

3.4.3 Public Perception through Household Surveys

For conducting this a sample size of taking confidence level of 95% was kept as a major guiding factor and was equally distributed among the four villages.

Sample Size	
No. of Households	1265
Confidence Level	95%
Confidence Interval	8%
Sample Size (approx.)	125

,Source: Author

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4. DATA ANALYSIS: HUMAN ELEPHANT CONFLICT AND CONSERVATION OF ELEPHANT CORRIDOR

Elephant in West Singhbhun is the part of Central Indian population referred in the old text as "Mayurbhanji" having the home range of old Singhbhum (Jharkhand) and old Mayurbhanj of Odisha. Elephant population in West Singhbhum has always been debated mostly due to the changes in the seasonal distribution, movement within and to adjacent states beyond the forest boundary. Elephant movement seems to have been affected due to habitat fragmentation, disturbance in the natural features, degradation of the natural forest, Transportation routes dividing their paths and several other factors. The analysis of the records from forest department and other direct and indirect evidences gives a picture of distribution and the factors for the frequent confrontation with the pachyderms. Most of the villages are either enclosures or in fringes close to reserve forests. Majority of the villages reported conflict with wildlife mostly in the form of crop damage.*(Priyadarshi, n.d.)* About 84% in clusters reported crop damage and was mentioned as serious. *(Official Records)* Interactions with the villagers indicate elephants and wild boar as the major crop raiding animals. Attitude of the people towards mining was also of interest during the survey. About 75% of the people consider mining good and this was very high in Ankua & Chiria village. An attempt is made to estimate the poverty level of the people in the area at multidimensional point of view for an idea about the status of people in terms of poverty, which is estimated based on several criteria.*(Priyadarshi, n.d.)* The Documented evidences show that the factors that are considered here lead to the degradation of the natural setting of the pristine Saranda forest and in turn leads the Elephant herds to wander out to the villages at the fringe or those which are enclosed. The mega mammals require their nutritive intake to be met and if the Forest doesn't meet it, it is observed in various cases that they move out to the easier and approachable ways to achieve it, they being a highly intellectual species sense the time for an optimal ambush and carry out raids to the farms and grain storage spaces. This Ankua-Ambia corridor from Saranda to Kolhan Forest Division is used by Elephants. *(Mine Surveyor Institute, 2017).* This range occupy the most fragmented elephant habitat

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of the country that has been degraded due to mining, shifting cultivation & development activities. *(Change, 2018; Jauher, 2016a)*

Household surveys done by Cluster sampling survey method, classifying the villagers and qualitative responses for the structured and framed questions were giving out similar responses. The transcription of the AV recording were done which made the framework of the methodology as they specified the factors and the indicators that majorly affect the villagers in the time of the onset of the migration and transit of elephants through the village premises.

So the qualitative responses were recorded as evidences, showing the simplicity and the cooperative response to the human elephant issues present there and the analysis over these facts were reached have more clarity over the matters in consideration. As the literature study was done to guide the proceeding for the work to be done. The ground realty that the indigenous people who have been there for centuries intricately understand the changes that have happened and the way it is carried out that will truly destroy the serene Saranda forest. It's one of the major responses from one age old village munda. Most of the residences that visited for survey had the old members of the family residing back there and the adult kids had moved out to the cities all around India to earn their living. They blamed the SAIL Chiria Mines *(Singhbhum & Harkhand, 2013)* being out of services had brought these changes as they would have had livelihood if the mines were working.

The analysis of the factors and support documents associated with the HEC in the selected region, as depicted in the Data Collection, trend should be analyzed of the conflict and thus it will enable us to further project out the possible planning recommendations.

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4.1 Documented Evidences: How Anthropogenic Activities and other allied activities causing Environmental Impacts.

Mining effects include soil erosion, creation of sinkholes, depletion of habitat, and pollution of land, groundwater, and surface water by mining chemicals. All mining companies use forest land more than the approved diverted area of the MoEFCC. A committee should be set up to restrict mining and allied activities within the approved diverted area, and the penalty should be levied or mine should be closed for those who do not comply with its recommendations. The Central or State Govt. agencies like MoEFCC, IBM (Indian Bureau of Mining), Mining Dept., Pollution Control Board and Development Authority, are inspecting the mine, but not inspecting in details for survival of the ecological balance.

4.1.1 Degradation in quality of landscape and land resources:

The landscape can be severely modified by mining. It damages the soil, disrupts the soil water and the surface water by dumping and washes away the ores and minerals. It is vital that the natural eco system I s conserved through systematic and scientific planning, air pollution control measures were installed and maintained, and that energy and water use processes were optimized for sustainable and eco-friendly mining and processing.

Below this pristine forest of Sal lies one of the richest iron ore deposits in the country. However, in the Saranda division of 85,000 hectares (ha), existing mines have already damaged swathes. Around 16 iron ore mines operated within a leasing area of 6526,369 ha, 12 mines in a rental area of 2892,344 hectares have been closed due to pending the proposal of the FC at MoEFCC and approximately 11 proposed mining leases were applied by companies including Tata steel, Mittal, Jindal, Essar, Adhunik, Electric Steel, Rung, Karampada, Ghatkuri and Saranda, covering an area of about 6505.50 hectares. Total mining lease (existing + close + proposed) area is 15924.013 ha for iron ore mining. After all, the future of the Saranda Forest is a burning problem left of the forest. Mining has increased over the last six years. Unlawful mining is rife in and around the area.

About 16 iron ore mines are working in the 6526.369 ha of lease area, 12 mines in 2892.344 ha of lease area are closed due to pending of FC proposal at MoEFCC, and around 11 proposed mining leases have been applied for 6505.50 ha of area

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in Kodlibad, Karampada, Ghatkuri, and Ankua compartment in Saranda by different companies, such as Tata steel, Mittal, Jindal, Essar, Adhunik, Electro Steel, Rungta Group, etc.

Thousands of trucks jam the roads from Chaibasa to the forest past Noamundi, which are disruptive and harmful to the environment. Now illegal mining needs to be controlled which the government is trying hard to achieve, but the damage done needs to be managed and restoration activities with considering all the dimension of ecological services needs to be carried out efficiently to bring back the disrupted balance

Figure 17 Degradation by haul road & mining.

4.1.2 Polluted of Natural Water Sources:

Pollution of the perennial water sources are one of the major challenges that are being poised by the resource extraction drives that have been blindly being taken forward. Karo and Koina are the two perennial rivers playing an important part in the drainage system of the area. Karo River is the source of water for mining and allied activities (including water supply for colony) in the leasehold. Mining in Saranda has led to extensive silting and pollution of river Koina, which feeds the villages downstream.*(Priyadarshi, 2008)* It is also an essential water source for elephants during the summer. But as the river (and forest) dry and wither, the elephants are pushed into the neighboring Chhattisgarh causing severe conflict and loss of life and livelihood. This is only going to worsen as we ravage and fragment the forests further.

The Koina, which carries degraded fine particulate matter from an active mining area, overburden dumps, Kutcha roads and unbroken natural forest land, is filled with excess rainfall from the leasehold at the Monsoon. During that time, no mine is located. In this monsoon season it is essential to manage excess water in natural

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sources (river Koina), which is a source of drinking water in downstream residents. This means maintaining the quality of water in natural sources is essential.

Figure 18 Siltation & Blockage due to washing of Ore

4.1.3 Forest Land to new villages.

In the forest region nearby mines, many new villages have emerged as a result of employment in mines. For cultivating crops and hutting, the trees next to Nala and the river are cut down. Around 1000 acres of Saranda Forest Land has been allocated by the Jan-Kalyan State Department to most of the villages.

4.1.4 Insurgent forces have inflicted violence in Forest area.

Insurgent forces the Maoist have been in violence in the Saranda forest areas in West Singhbhum district to stall the development activities in the forest. Many development services, such as roads, employment, housing, and enhancement of productive activities started by Central and State Government in the rural area of Saranda are hindered by this Naxal violence. The contractors and labourers engaged in the construction work are tortured, harassed, and killed by the Naxals at Saranda forest in recent times the activities are scarce as due to steady deployments of security forces, counter insurgency techniques and surrender schemes have reduced the violence.

4.1.5 Smuggling of wood.

Sal trees in Saranda are being cut down by local inhabitants of the surrounding mining settlement for firewood. Sagwan, Bijja, and Gamahar are expensive trees and very useful for making furniture. These expensive trees are being cut in the night by the Jungle Mafia, which has a size of more than 40 cm. It is overlooked by the forest staff, as at the beginning the problem was confined to fuel wood, but later it took on a worse shape as the smuggling of poles, timber, sleepers began not

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only in passenger trains but also in goods trains. Ingenious ways of hiding wood in the toilets, sides, undersides of the cargo train, and even hiding inside the loaded car were devised by the smugglers for their shipment to the industrial towns of Jamshedpur and Rourkela.

4.2   Documented Evidence: Drive to achieve balance to co-exist.

The livelihood of major population who are still in the village and have not migrated partially or wholly to different parts of the country, rely on agriculture and forest resources for their livelihood. Hence making them vulnerable to fall in the midst of the Elephant crossing/ transit paths, putting their life in fatal scenario, and in some cases unfortunately prey to them.

The increase in the population is evident through the past decadal growth trend in these villages. This will in turn cause the conflicts to increase as well as the encounters. The resource collection from the forests and the agricultural practises cannot be averted as it's a day to day need for them, nor shifting from the conflict zones to the safer localities away from their land parcel will be sustainable as the attachment and the psychological connection that a human has with his home and in this case his provider the farm. So, knowing this is unavoidable and the vulnerability through being in the midst of the corridor. So evolving about this as there have been evidences through the primary surveys that the indigenous people who have been living in these parts of Saranda Forest have been accustomed to the thoroughfare of the mega herbivores, the most vulnerable are those who are migrated from different part and the pseudo. It has been observed from way past that tribal that reside in the interiors and the forests have been asked for assistance as they understand the forest and as well as known to perceive the conditions better than a learned expert as they are accustomed to it. Here is where it guides to be accommodative over their choices and not force changes on the villagers. Same as to be done for the control measures for the Wild, as educating and elaborating the public as not all are of the same calibre to wade off the intrusion with the same intensity.

Hence, being more adaptive and evolving around their coexistence and being accommodative to it. As the mammals have evolved over time and the intensity of the raids have been increasing as identified earlier. In these events there should

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be a simple but an accommodative change of responsive respect and the privilege to coexist, giving an opportunity to correct that has been done so wrong for all these years. This is not an easy task to take on as for the target which has to be achieved the path has to be something that has a risk to life but worth the change. Rescue and relief cases enable us to mark and notify the locations of conflicts and the paths treaded and favoured by the pachyderms and this gives a tread of events and the locations that need to be the hotspot zones and the sensitive areas as per the recent events and compare it to the old and previous conflicts, which would shows the spatial and landscape factors similar to the cases which would render the public to be prepared and ready in a better way so that they avoid fatal outcomes. The community participation over the social fabric to help and empower the victim and the family who have been recently involved in a mishap (Crop Raiding, Damage to Property, Injury/Death) would raise a communal outreach to everyone in the village but also promote a sense of belongingness for everyone and a better mental and psychological frame would help in better decisions and outcomes.

4.3   Lacunae Identified

The major factors that have held back the community inclusiveness towards a well thought and understood fact is that, at the end of the day have you had earned anything to sustain yourself and your family. This is where the indigenous even being knowledgeable enough to understand the natural features better tend to not cater be involved and invest time in these drives. So as to incentivise these activities their needs an encouragement for the administrative bodies involved to chalk out some give and take activities to keep the crowd responsive and active over the conservation and protection as they are the owners and keepers as it feeds them and protects them. It was one of the social aspect that really needs a rework and feeling of respect and responsibility should also be affirmed by the major utilisers and actors as the mining and the other development drives that have been destroying the natural form of the place. *(Author)*

The study thus oriented towards more of the public perceptions and the local setup and the people involvements in the activities that are proposed to happen in those places. The activities proposed and initiated at these locations are merely for the

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profit of the resource gathering stakeholders, as the mining and other related activities are only directed to the uni-directional motive of extraction as much and as quick as possible. The data shows that the Saranda forest that is the largest Sal forest in Asia. The prime habitat of the elephants and this constitutes the Singhbhum Elephant Reserve, which is an expansive 800 sq.km forest. Official data shows that the one-eighth of its area, a patch of 100sq.km is leased out for mining iron ore, even just 10-25 sq.km of this area is being currently mined, it has caused sufficient damage to the elephant habitat.(Jauher, 2016b; Singh, 2002). This Saranda Forest Division Being identified as the Zone (B2)

4.3.1 Administrative & Institutional Setup

The ecosystem approach requires all Ecosystem Services to be catered in a responsible and advocated manner so as to achieve that the collaborative efforts of the relevant institutions that fall in the working and overlap the collective system needs to be well balanced and coordination needs to be set up. As their needs an adoption of a special task force which particularly addresses the needs and adaptations required in various facets as the traditional knowledge to be maintained and sustained the Tribal Affairs Ministry, to cater to the livelihood needs and infrastructure development the Village Development Authority, the new mining leases being giving out and analysing the previous leases held in these sensitive natural habits, needs to be assessed with the involvement of the technical support in these fields, the natural features and the natural systems being assessed by the MoEFCC & Agriculture and Irrigation Departments, assisted by the Mining Agecies like

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4.4 Land Use | Land Cover: Mapping (1994; 2004; 2014; 2019)

The supervised classification method is applied to classify the land use and land cover categories. For this classification, data are collected from the field survey as well as local knowledge of the area also helped. Six training classes are defined to classify the images.*(Hoare, 1999; Kayet et al., 2016; Yadav et al., 2018)* The parallelepiped classification algorithm is applied for the study. The results obtained shows a good fit with the local data. This area was classified into six classes: dense forest, open forest, agricultural land, water body wetland and built-up (mining area) using supervised classification method and maximum likelihood algorithm. The accuracy of a classification process is usually assessed by comparing the results of classification with mention data from field visits, high spatial resolution images, or top sheet.*(Kayet et al., 2016; Yadav et al., 2018)*
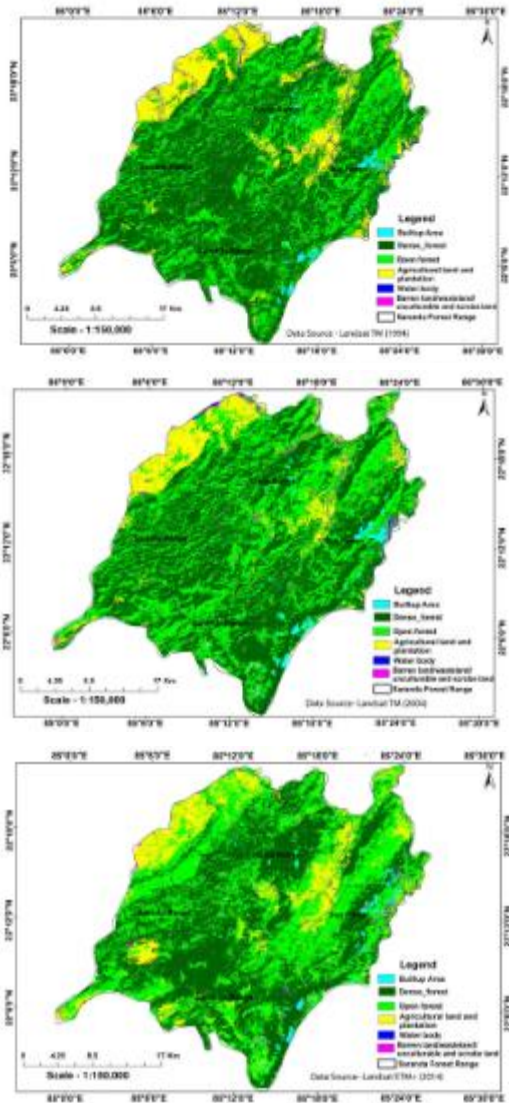
Figure 19 LULC 1994-2004-2014 (from Top)

Acceding to the result observed the land surface temperature changed over time depending on the different activities of different land cover and land-use categories of the study area. It can be seen accuracy assessment statistics for multiple time spans of LULC categories. It is found that the minimum and maximum temperature for built-up area year wise increases gradually.*(Kayet et al., 2016; Yadav et al., 2018)* The increasing trend of built-up area of Saranda forest has been clearly visible through the illustration and thus makes it clear to say that the anthropogenic activities have been degrading the serene and pristine Saranda forest, collaterally damaging and fragmenting the primitive Elephant Corridor through it.

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4.2 LST Mapping (1994; 2004; 2014)

This study is carried out to identify the environmentally critical areas based on land surface temperature (LST) distribution in Saranda Forest, Jharkhand. It is observed that the land surface temperature has increased over the years in the area where there is more anthropogenic activities occur and for the build-up areas.*(Kayet et al., 2016)* The study reveals that the north and northwest part exhibits high temperature mainly due to built-up (mining area) and wetland. Some of the high-temperature zones are also seen in the central part of the image mainly due to anthropogenic land use. The impact of vegetation is clearly perceived as low-temperature values are observed over agricultural cropland, dense vegetation (forest), and sparse vegetation (grass/park) land use categories.*(Kayet et al., 2016; Yadav et al., 2018)*. It is noted that the land surface temperature has shown a significant increase over the Saranda forest.
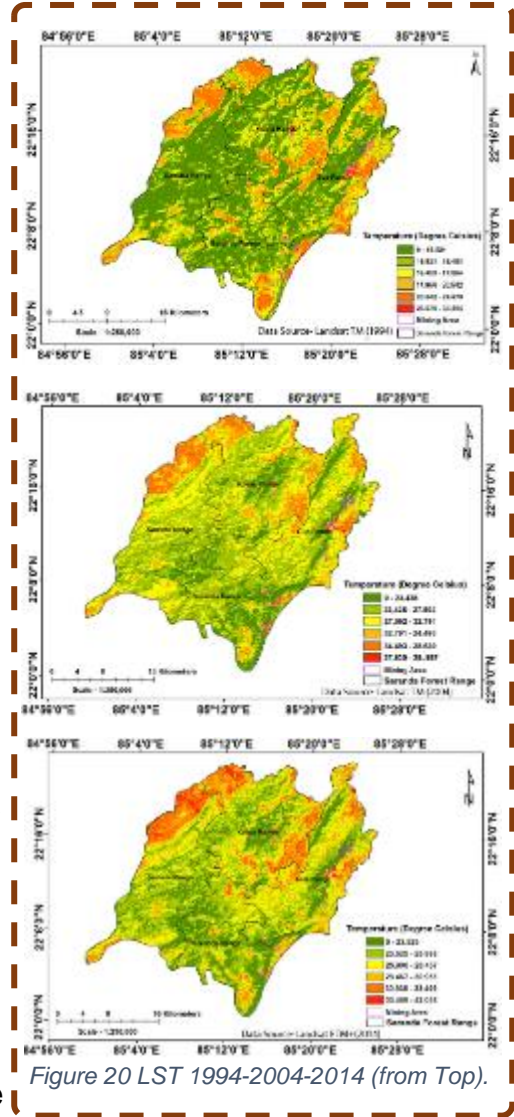
Figure 20 LST 1994-2004-2014 (from Top).
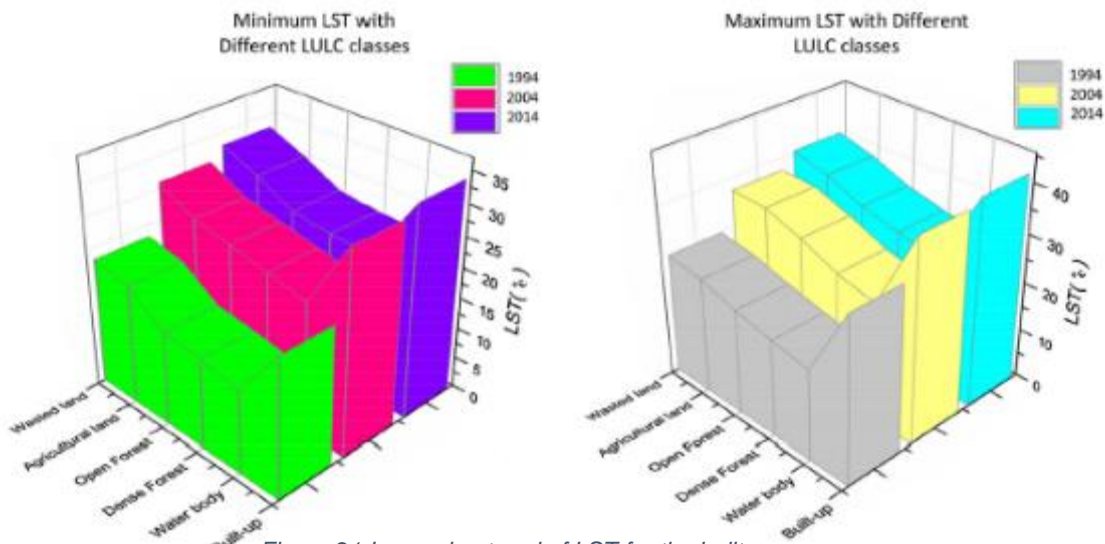
Figure 21 Increasing trend of LST for the built up areas.

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It is noted that the land surface temperature has shown a significant increase over the Saranda forest. Assessment of LST provides valuable input for ecological restoration initiatives.

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4.3 Conservation Priorities

Suitable habitat can be achieved by considering following parameter in mind: Surface Water, Vegetation Indices, Land cover, Forest Disturbances, Landscape Integrity, Landscape Connectivity, etc. (yet to be generated)(Brogi et al., 2020)
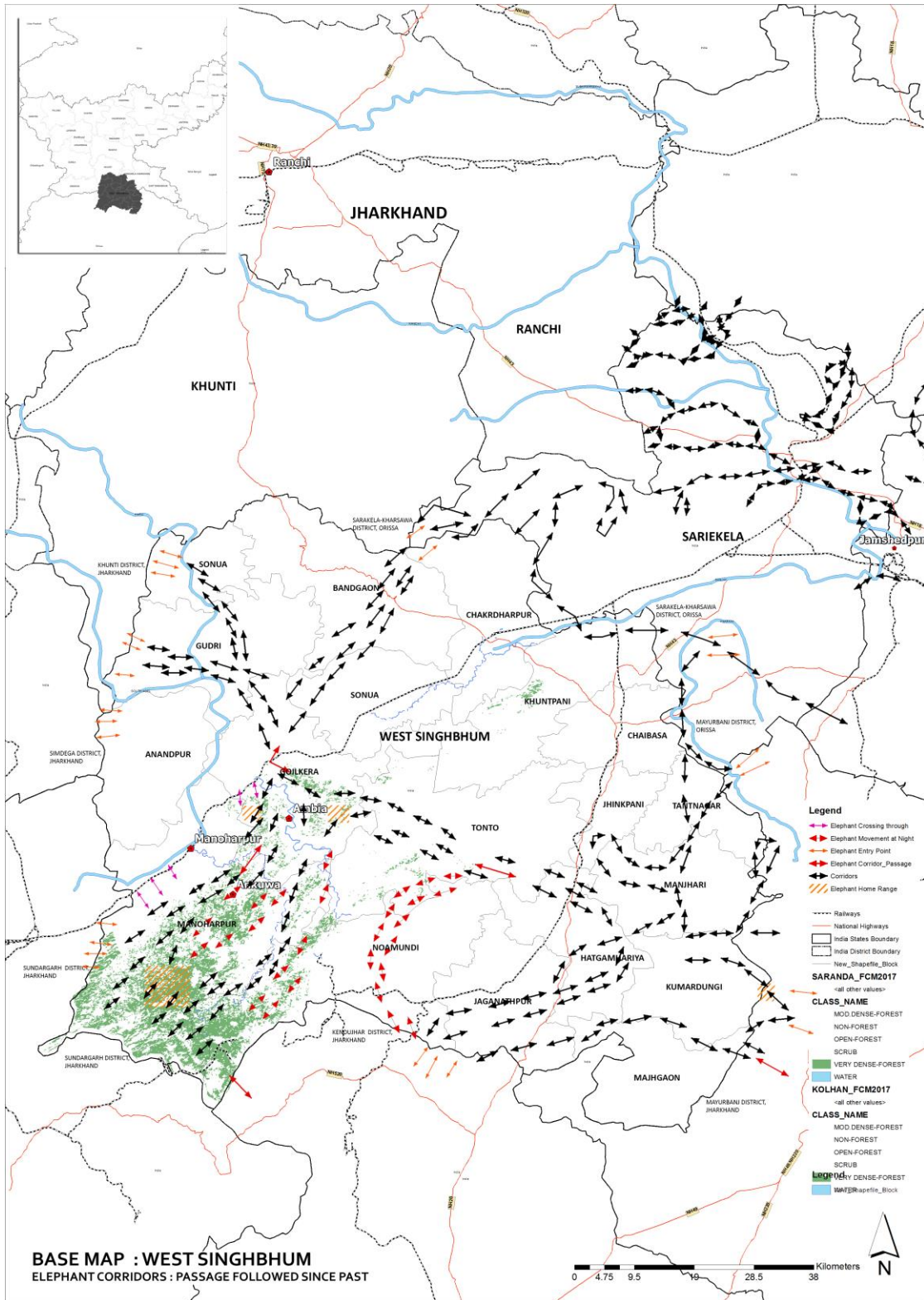
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4.4 Wildlife Suitability Map
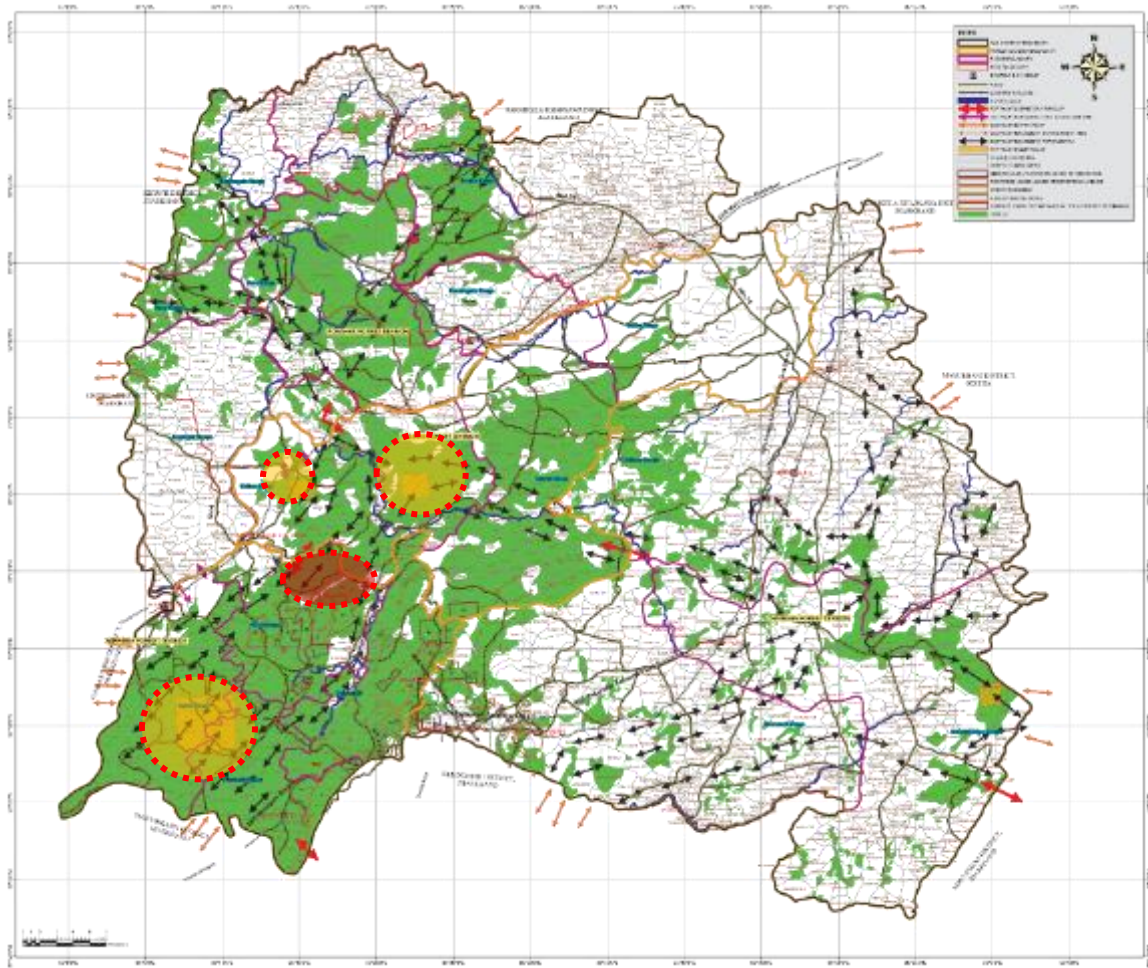
Year	Area of forest and vegetation cover in sq.km.			Area of Forest Vegetation cover in %
	Total	Manoharpur	Goelkera	Total %
1994	5079.723	976.918	548.888	65.58
2019	3062.686	779.581	400.528	40.41
Net change in forest & Vegetation cover.	2017.037	197.337	148.36	26.17

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5 SUGGESTIONS & RECOMMENDATIONS

This chapter details out the conclusive addressal to the adopted suggestions and recommendations to minimize Human-Elephant Conflicts.

5.1 Institutional Interventions

The scenario at the implementation and directive head which is managed back at Ranchi Headquarters, it's a maze for the simple ecological disruptions. The realignment of the working planning Dept. and a planned schematic approach to deal with the projects in hand and the Departments involved should make it streamlined for the transaction of the information. The Human Elephant Conflicts are a shadow of the mismanagement in the different sectors of the development drives. The conflicts are directly reflected to the fragmentation of the vegetative cover and the pristine Sal (Shorea Robusta) forest takes the wrath of degradation. The collaborative and a systematized chain of actions, beginning from the root focus of the issues and the concerned development initiatives would have a streamlined and a clear approach to lead the way to conservation. Approach towards reaching it should evolve from the incorporation of the different institutions that are involved, in bringing about a developmental change in the case scenarios. The suggestion for further formulating the tradeoff between the several Dept. involved, the formulation an expert committee that would make up a special task force to deal with the development drives in these eco-sensitive zones. This Task Force would be consisting the senior heads of various departments and stakeholders to report to situations that would need the overall approvals and analyzing the several outputs through the approaches taken. Clearing out the possible outcomes and then finalizing over the most sustainable option. The committee should be out of the time bounds that is limited to a fiscal year.

5.2 Physical Interventions

Cameras can be installed in the fringe areas of the forests and possible locations of transit to track elephant movement and the early warning SMS notification through cellular services and through SOS alerts can also be initiated to let the people in the sensitive locations can easily notify and alert the other villagers nearby and also the authority. Reflective Sign-Boards and Warning signs should

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be installed near Highways and critical locations to make the people aware of the surroundings. Watch towers have been the best traditional and indigenous way to be prepared and alert the villagers to evade a fatal encounter. Villagers should be made aware of the steps to be taken in the event of an encounter so as to not panic and act with courage and presence of mind.

5.3   Community Participation

Community participation and the awareness drives to bring about their involvements in to frontline and bringing it would really promote the views and their commitment towards the safeguarding the Nature. There are several Eco-Samitis and Joint Forest Management drives, but there collaborations and intent to work together for a common derivative should be promoted, this will in turn bring about a positive result. Formulation of Village Eco-Development Committees (EDC's), these bodies will help spread and brainstorm the villagers to be aware of the situations, and be prepared not physically but also mentally to withstand grave scenarios, and recover better if involved. Ownership and belongingness being the drivers for the community development successes as observed, so the committee should be concerned with vocational trainings; Capacity Building programs 'Atmanirbhar' as the new economic relief package also states. To be self-sustainable. Preparation of Micro Plans: Rain Water Harvesting: Sustainable Energy Use, etc.

5.4   Decade on Ecosystem Restoration

As observed in the recent times during the lockdown times the whole of the Earth came to a stand-still and all the human lead activities that have been causing degradation of the ecosystem in a way or the other took a hard port. The results of it were out in just a matter of weeks, this clearly shows and supports the will of the humans to survive and meager changes in the lifestyle of our survival can bring about a clear and drastic transformation. Taking the testing times as a healthy example to set out and evolve as a prime specie and contribute towards bringing balance to the Ecosystems. The last decade was dedicated for the conservation of Biodiversity, as it marked the "*United Nations Decade on Biodiversity to promote the implementation of a strategic plan on biodiversity and its overall vision of living in harmony with nature.*" and hence the following decade is dedicated to,

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"The United Nations Decade on Ecosystem Restoration 2021–2030 was conceived as a way of emphasizing the need for much greater global collaboration to restore damaged and ruined ecosystems, leading to efforts to counter climate change and safeguard biodiversity, food security and water supply." – UN, 2020.
The following Figure 22: United Nations Decade on Eco-Restoration 2021-2030. Shows the existing trend of management drives that we are practicing and how we should be transforming around to achieve the above said Declaration for Ecosystem Restorations.

Figure 22: United Nations Decade on Eco-Restoration 2021-2030.
Source: https://ecosystemrestorationcamps.org/

The above said declaration empowers the institutional facilitators to act over it and come up with a conservation initiatives for local ecosystems, hence in this case the recommendations are to facilitate and conserve the Elephant habitat and the activities to enrich the existing conditions. The initiative to propose particular zones as per the Biodiversity and the sensitivity of the natural resources as DND Zones. (DO NOT DISTURB- no human activities, no transport by road, no mining). This will also ensure the Elephant passage, the Right of Passage.

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6 CONCLUSION

Dogma of the mainstream has set the examples for the livelihood goals in such a manipulative way that the strive for that achievement has made the local the indigenous to go out and achieve the living standards as per 'city-life' the capitalist world forgetting the potential of their own surroundings, and be slaves of the mainstream. Human-wildlife; Human-elephant conflicts have been surfaced in various parts of the globe since decades. Interference between the two have caused issues ever since.

Considering the facts and evidences the documented analysis, developmental trends and policies studied and documented it suffices the call for conservation and restoration of these identified habitats. The public perception and the social fabric of the inhabitants in these conflict corridors. The stakeholders and the officials who have a hand on experience of the current scenarios and their involvement in mitigating the impacts of these conflicts, compensation and the losses involved both human and elephants perspective.

The indigenous people and their livelihood practices in these remotely populated areas, but still encroached by mining, its infrastructure intrusions and the resource extraction from these resource rich zones have been employed form long and the impacts of these have been existing and the impact has transformed the largest Sal forest ecosystem. Which is fighting to sustain the flora and fauna relying on it to achieve balance and sustenance.

The planning proposals as any spatial incorporations could not be established as the villages are mere a point of existence but the impact that the activities of these are even more than to be just the conflict areas. The planning interventions could be possible but there are even major concerns that need to be addressed before suggesting a spatial update. The serene Sal forest that dates to ancient times have been a natural habitat which has been degrading due to uncontrolled and unassessed, as to what impact it would have in the natural setting of the region and the need for that houses even more intricacies of survival of the habitat.

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ANNEXURE

ANNEXURE I: QUESTIONNAIRE SHEET : SURVEY QUESTIONNAIRE

Village Name: _____   **DATE:**

1. Age   : _____ Gender :_____ Household Size
   :_____

2. Occupation: Cultivator☐   Agricultural Labor☐   Mining Labor ☐

   Household Worker☐   Shop Owner☐   Other☐

3. Education: Uneducated☐   Middle School☐   Senior School☐

   UG☐

4. Type of House: Kuchha☐   Pucca☐

If Agriculture Field is prone to Conflict:-

5. No. of livestock _____   Purpose of keeping livestock: Self☐ Commercial☐

6. Do you accompany your livestock when they go for grazing?

   If Yes, How far?

   _____

   If No, Why?

   _____

   If the reason is conflict, what type?

   _____

7. Ownership of agricultural land.

   _____

   If owned previously, reason for shift from agriculture?

   _____

   If the reason is conflict, what type?

   _____

8. Size of land holding.

   _____

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9. Frequency of Visiting field per Day.
_____

10. Distance travelled.
_____

11. Animals involved in Conflict _____ Sightings per week
_____

12. If not Agriculture, what would you prefer to do?
_____

If dependent on forest resources:-

13. Purpose:
_____

If purpose is commercial, what do you do with the forest produce?
_____

If not, What is the Use?
_____

Do you wish to shift to other occupation? Yes☐ No☐ Why?
_____

If purpose is firewood, why don't you use LPG?
_____

What other fuels do you use?
_____

14. Frequency of visiting forest.
_____

15. Precautions taken while visiting forest (alone or in groups)_____

16. Time to Visit forest: Morning☐   Afternoon☐   Evening☐   Night☐

17. Duration of Visit:

_____

18. Distance Travelled in a Trip.

_____

19. Resources Gathered in a Visit.

_____

20. Alternatives if available is accessible?

_____

21. Any idea about the Laws & Regulations?

_____

22. How do you think the HEC(Human Elephant Conflict be Controlled)

_____

_____

_____

_____

23. Do you get support of the authority to manage it? Yes☐   No☐

Questions	Yes	No	DNC	Reason
Do wild animals have an important role in ecosystem?				
Should wildlife species be protected?				
Should use of forest resources be minimized?				
Should the conflict animals be killed				
Should the authority provide them with alternatives to develop better elsewhere?				

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Does the decrease in the habitat for them has lead to this?				
What do you think are you in there path or they want to harm you?				
Does these activities of the city culture made a difference?				
Do the young believe in the resources and the importance of the forest?				
Does the increase in the city developments increase the conflicts?				

24. How conflicts can be prevented?

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ANNEXURE II: FOCUS GROUP DISCUSSION

FOCUS GROUP DISCUSSION – CHECKLIST

1. History of settlements (year, trend of growth)
2. Frequency of conflict/animal sightings.
3. Animals involved in Conflicts.
4. Type of conflicts (Defensive, Provoked, Predation, Accidental)
5. Causes of Conflict

Use of Forest Resources		Habitat Fragmentation	
Food/Water Availability		Road/Railway Accidents	
Livestock Movement		Wildlife Movement Patterns	
Management Issues		Disturbance in Forests	
Tourism Activity		Grasslands for herbivores	
Cropping Patterns		Increasing wild animals	
Edge Habitats		Forest Fires.	
Others. (			

6. Months/Seasons/Time of the day when conflicts occur.
7. Type of losses (economic, social, property)
8. Immediate response to sightings (Any community groups formed for immediate response?)
9. Which group is majorly affected? (Females, Males, Children, Elderly)
10. Do you feel forest cover has decreased over years? (Reasons)
11. What is the major occupation in the Village?
12. What are the other alternatives?

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13. Is there a risk while working on the agricultural fields? (To any specific group-daytime workers, Seasonal Workers?)
14. Type of Crops grown(Subsistence farming, commercial purpose, name of the crop)
15. Provision of grazing lands (distance from abadi area, other alternatives)
16. Average size of landholdings in the village
17. What are the alternatives to use of forest resources?
18. Is there any help from government or NGO's for resolving conflicts? (Response Time)
19. What are your views on conservation of Wildlife? (Positive or Negative-reasons)
20. How conflicts can be prevented?
21. Compensation Mechanisms

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