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Transportation System Design for Indian National Parks

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Transportation System Design for National Parks

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Table of Contents

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General Overview of the Project

The project aims to design transportation systems for Indian national parks, focusing on enhancing efficiency, sustainability, and ecological conservation. The project recognizes the need for intervention in various aspects of transportation within national parks and aims to address them through innovative and holistic approaches.

Key areas of focus include the introduction of electric and hybrid vehicles, promoting eco-friendly and sustainable means of transportation, incorporating technology interventions, and ensuring the safety of wildlife and visitors. The project also emphasizes the importance of specialized vehicles for researchers, wildlife conservation, and law enforcement.

Furthermore, the project highlights the significance of constructing animal corridors, facilitating animal transportation for rehabilitation and relocation, and implementing surveillance systems for enhanced monitoring and protection. It also considers the provision of specialized vehicles for medical transport, spreading awareness, and patrolling purposes.

The project envisions the integration of centralized booking systems, maintenance and servicing of transportation infrastructure, and upgrades to safari vehicles to enhance visitor experiences. Additionally, it emphasizes the need for fire department vehicles, satellite imaging, and thermal cameras for effective management and emergency response in national parks.

Overall, the project aims to create a comprehensive and sustainable transportation system that aligns with the unique needs of Indian national parks, while ensuring the conservation of wildlife, promoting visitor safety, and providing enjoyable and educational experiences for all.

Methodology

Our research methodology involved a systematic approach to gain insights into the topic. Firstly, our group conducted extensive desktop research to understand the concept of national parks and subsequently focused on exploring the total number of national parks in India. This was followed by an investigation into how these parks are distributed across the country. To comprehensively address the challenges faced by these national parks, our group conducted a detailed study, identifying and documenting various issues encountered by individual parks. By analyzing and synthesizing the collected information from these different sources, we were able to distill a set of common problems that are prevalent across the national parks in India.

To gain a comprehensive understanding of the system and the various actors involved, a thorough stakeholder study was conducted. This study encompassed stakeholder mapping and analysis to create a clear and detailed overview of all the individuals, organizations, and entities involved in the system. By analyzing the roles, interests, and interactions of these stakeholders, a holistic picture was obtained, shedding light on the dynamics and relationships within the system. This comprehensive approach allowed for a deeper insight into the stakeholders' perspectives, needs, and potential contributions to the overall functioning of the system.

After identifying the common set of problems, we proceeded to narrow down the focus specifically on issues related to transportation design. This selection process allowed us to formulate hypotheses for the existing problems. To gain valuable insights, we conducted two online interviews with senior conservation experts. However, realizing the need for on-site investigation, we conducted a field visit to Satpura National Park. During the visit, we meticulously documented our observations through audiovisual recordings and conducted comprehensive interviews. This hands-on approach enabled us to validate our initial hypotheses and uncover previously overlooked issues. Subsequently, we further refined our problem selection, leading to the creation of an assessment matrix. This matrix aided us in identifying the most suitable solution to address the identified issues effectively.

The final solution underwent a process of extensive ideation, taking into account various perspectives and considerations. Through a collaborative effort, multiple ideas were generated and thoroughly evaluated. Finally, after careful deliberation, the most suitable and effective solution emerged from this iterative ideation process.

Introduction

Protected Areas – IUCN

The **International Union for Conservation of Nature (IUCN)**[1] defines a protected area as:

A clearly defined geographical space, recognized, dedicated and managed, through legal or other effective means, to achieve the long-term conservation of nature with associated ecosystem services and cultural values.

The definition is expanded by six management categories (one with a sub-division), summarized below.

Ia Strict nature reserve: Strictly protected for biodiversity and possibly geological/ geomorphological features, where human visitation, use and impacts are controlled and limited to ensure protection of the conservation values.

Ib Wilderness area: Usually large unmodified or slightly modified areas, retaining their natural character and influence, without permanent or significant human habitation, protected and managed to preserve their natural condition.

II National Park: Large natural or near-natural areas protecting large-scale ecological processes with characteristic species and ecosystems, which also have environmentally and culturally compatible spiritual, scientific, educational, recreational and visitor opportunities.

III Natural monument or feature: Areas set aside to protect a specific natural monument, which can be a landform, sea mount, marine cavern, geological feature such as a cave, or a living feature such as an ancient grove.

IV Habitat/species management area**:** Areas to protect particular species or habitats, where management reflects this priority. Many will need regular, active interventions to meet the needs of particular species or habitats, but this is not a requirement of the category.

V Protected landscape or seascape: Where the interaction of people and nature over time has produced a distinct character with significant ecological, biological, cultural and scenic value: and where safeguarding the integrity of this interaction is vital to protecting and sustaining the area and its associated nature conservation and other values

VI Protected areas with sustainable use of natural resources: Areas which conserve ecosystems, together with associated cultural values and traditional natural resource management systems. Generally large, mainly in a natural condition, with a proportion under sustainable natural resource management and where low-level non-industrial natural resource use compatible with nature conservation is seen as one of the main aims.

National Park – IUCN Category II Protected Areas

In November 1969, 10th General Assembly of IUCN[2] meeting in New Delhi in November 1969 recommended that all governments agree to reserve the term "National Park" to areas answering the following characteristics and to ensure that their local authorities and private organizations wishing to set aside nature reserves do the same:

a National Park is a relatively large area
1) where one or several ecosystems are not materially altered by human exportation and occupation, where plant and animal species, geomorphological sites and habitats are of special scientific, educative and recreative interest or which contains a natural Landscape of great beauty and
2) where the highest competent authority of the country has taken steps to prevent or to eliminate as soon as possible exploitation or occupation in the whole area and to enforce effectively the respect of ecological, geomorphological or aesthetic features which have led to its establishment and
3) where visitors are allowed to enter, under special conditions, for inspirational, educative, cultural and recreative purposes.

Primary objective:

● To protect natural biodiversity along with its underlying ecological structure and supporting environmental processes, and to promote education and recreation.

Other objectives:

● To manage the area in order to perpetuate, in as natural a state as possible, representative examples of physiographic regions, biotic communities, genetic resources and unimpaired natural processes;

● To maintain viable and ecologically functional populations and assemblages of native species at densities sufficient to conserve ecosystem integrity and resilience in the long term;
● To contribute in particular to conservation of wide-ranging species, regional ecological processes and migration routes;

● To manage visitor use for inspirational, educational, cultural and recreational purposes at a level which will not cause significant biological or ecological degradation to the natural resources;

● To take into account the needs of indigenous people and local communities, including subsistence resource use, in so far as these will not adversely affect the primary management objective;

● To contribute to local economies through tourism.

Secondary Research

National Parks in India

India has been blessed with immense natural wealth. The country's wild landscapes encompass four of the world's 35 biodiversity hotspots, 26 of the world's most important wetlands as defined by the Ramsar Convention, and seven natural World Heritage Sites as defined by UNESCO. The total animal species in India has significant figures of 12% birds, 6% reptiles and 7% mammals which require national parks for proper conservation.
India has more than: 400 species of mammals, 1200 species of bird, 500 species of reptiles, 300 species of amphibians, 80000 species of invertebrates, 3000 species of fishes and more than 50000 species of trees.

There are total 109 National Parks in India which are maintained and governed by the MoEFCC.[3]

State/Union Territory	Total Parks	Name of National Park	Establishment Year
Andaman & Nicobar Islands	9	Campbell Bay National Park	1992
		Galathea Bay National Park	1992
		Mahatama Gandhi Marine (Wandoor) National Park	1982
		Middle Button Island National Park	1987
		Mount Harriett National Park	1987
		North Button Island National Park	1987
		Rani Jhansi Marine National Park	1996
		Saddle Peak National Park	1987
		South Button Island National Park	1987
Andhra Pradesh	3	Rajiv Gandhi (Rameswaram) National Park	2005

		Papikonda National Park	2008
		Sri Venkateswara National Park	1989
Arunachal Pradesh	2	Mouling National Park	1986
		Namdapha National Park	1983
Assam	5	Dibru-Saikhowa National Park	1999
		Kaziranga National Park	1974
		Manas National Park	1990
		Nameri National Park	1998
		Rajiv Gandhi Orang National Park	1999
Bihar	1	Valmiki National Park	1989
Chhattisgarh	3	Guru Ghasidas (Sanjay) National Park	1981
		Indravati (Kutru) National Park	1982
		Kanger Valley National Park	1982
Goa	1	Mollem National Park	1992
Gujarat	4	Vansda National Park	1979
		Blackbuck (Velavadar) National Park	1976
		Gir National Park	1975
		Marine (Gulf of Kachchh) National Park	1982
Haryana	2	Kalesar National Park	2003

		SultaNational Parkur National Park	1989
Himachal Pradesh	5	Great Himalayan National Park	1984
		Inderkilla National Park	2010
		Khirganga National Park	2010
		Pin Valley National Park	1987
		Simbalbara National Park	2010
Jammu and Kashmir	4	City Forest (Salim Ali) National Park	1992
		Dachigam National Park	1981
		Kishtwar National Park	1981
Jharkhand	1	Betla National Park	1986
Karnataka	5	Anshi National Park	1987
		Bandipur National Park	1974
		Bannerghatta National Park	1974
		Kudremukh National Park	1987
		Nagarahole (Rajiv Gandhi) National Park	1988
Kerala	6	Anamudi Shola National Park	2003
		Eravikulam National Park	1978
		Mathikettan Shola National Park	2003
		Pambadum Shola National Park	2003

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		Periyar National Park	1982
		Silent Valley National Park	1984
Madhya Pradesh	9	Bandhavgarh National Park	1968
		Fossil National Park	1983
		Indira Priyadarshini Pench National Park	1975
		Kanha National Park	1955
		Madhav National Park	1959
		Panna National Park	1981
		Sanjay National Park	1981
		Satpura National Park	1981
		Van Vihar National Park	1979
Maharashtra	6	Chandoli National Park	2004
		Gugamal National Park	1975
		Nawegaon National Park	1975
		Pench (Jawaharlal Nehru) National Park	1975
		Sanjay Gandhi (Borivali) National Park	1983
		Tadoba National Park	1955
Manipur	1	Keibul-Lamjao National Park	1977

Meghalaya	2	Balphakram National Park	1985
		Nokrek Ridge National Park	1986
Mizoram	2	Murlen National Park	1991
		Phawngpui Blue Mountain National Park	1992
Nagaland	1	Intanki National Park	1993
Odisha	2	Bhitarkanika National Park	1988
		Simlipal National Park	1980
Rajasthan	5	Mukundra Hills National Park	2006
		Desert National Park	1992
		Keoladeo Ghana National Park	1981
		Ranthambhore National Park	1980
		Sariska National Park	1992
Sikkim	1	Khangchendzonga National Park	1977
Tamil Nadu	5	Guindy National Park	1976
		Gulf of Mannar Marine National Park	1980
		Indira Gandhi (Annamalai) National Park	1989
		Mudumalai National Park	1990
		Mukurthi National Park	1990
Ladakh	1	Hemis National Park	1981

|			
Telangana	3	Kasu Brahmananda Reddy National Park	1994
		Mahaveer Harina Vanasthali National Park	1994
		Mrugavani National Park	1994
Tripura	2	Clouded Leopard National Park	2007
		Bison (Rajbari) National Park	2007
Uttar Pradesh	1	Dudhwa National Park	1977
Uttarakhand	6	Corbett National Park	1936
		Gangotri National Park	1989
		Govind National Park	1990
		Nanda Devi National Park	1982
		Rajaji National Park	1983
		Valley of Flowers National Park	1982
West Bengal	6	Buxa National Park	1992
		Gorumara National Park	1992
		Jaldapara National Park	2014
		Neora Valley National Park	1986
		Singalila National Park	1986
		Sunderban National Park	1984

- **Hemis National Park** is the largest National Park in India, located in Jammu and Kashmir. It stretches over nearly 4,400 km2.
- **Madhya Pradesh and Andaman and Nicobar Islands** have the maximum number of National Parks (9 each)
- **Largest National Park:** Hemis National Park, Jammu & Kashmir
- **Smallest National Park:** South Button Island National Park, Andaman and Nicobar Islands
- **Largest Wildlife Sanctuary:** Rann of Kutch, Gujarat
- **Smallest Wildlife Sanctuary:** Bor Tiger Reserve, Maharashtra

Ministry of Environment, Forest and Climate Change (MoEFCC)

The Ministry of Environment, Forest and Climate Change (MoEFCC)[4] is the nodal agency in the administrative structure of the Central Government for the planning, promotion, co-ordination and overseeing the implementation of India's environmental and forestry policies and programmes.

The Ministry also serves as the nodal agency in the country for the United Nations Environment Programme (UNEP), South Asia Co-operative Environment Programme (SACEP), International Centre for Integrated Mountain Development (ICIMOD) and for the follow-up of the United Nations Conference on Environment and Development (UNCED). The Ministry is also entrusted with issues relating to multilateral bodies such as the Commission on Sustainable Development (CSD), Global Environment Facility (GEF) and of regional bodies like Economic and Social Council for Asia and Pacific (ESCAP) and South Asian Association for Regional Co-operation (SAARC) on matters pertaining to the environment.

Components of a National Park
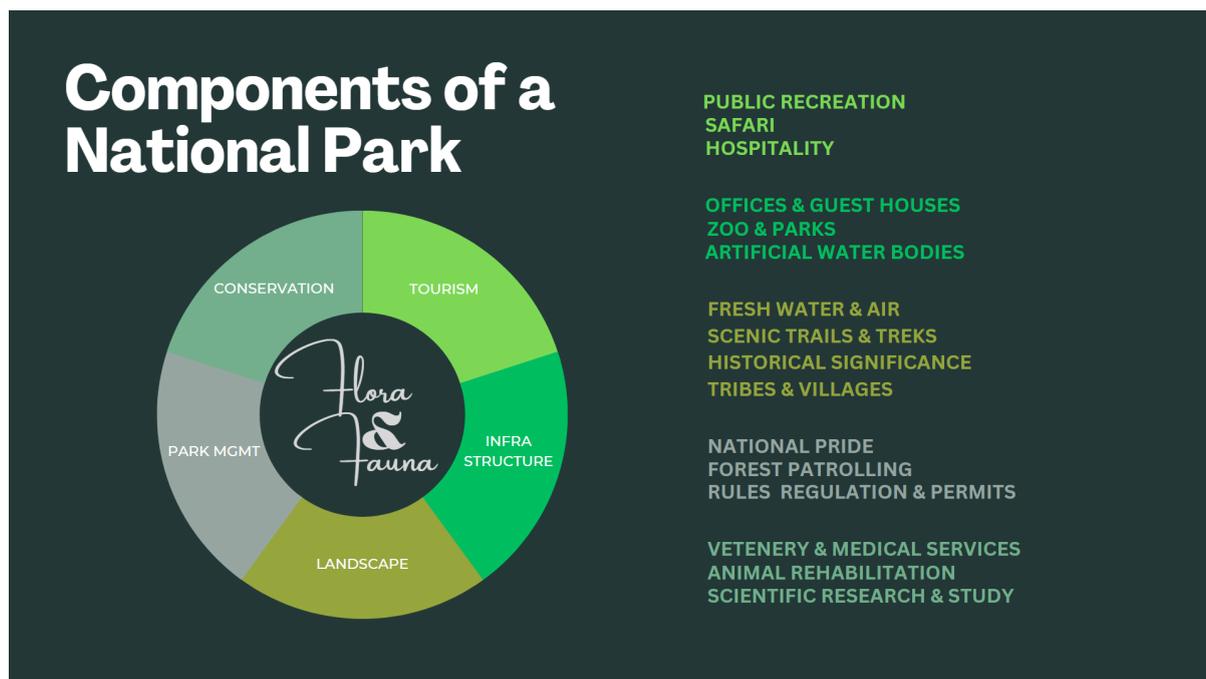
National parks typically consist of several key components that contribute to their preservation, protection, and visitor experience. While specific components may vary from park to park, here are some common elements found in national parks:

1. Core Area: This refers to the central or main part of the national park that is dedicated to the preservation of natural or cultural resources. It often includes unique landscapes, ecosystems, geological formations, or historically significant sites.

2. Buffer Zones: These are areas surrounding the core area that provide additional protection and help mitigate potential threats to the park. Buffer zones can include lands where certain activities may be regulated to minimize their impact on the core area.

3. Wildlife and Vegetation: National parks are home to diverse plant and animal species. The protection of wildlife and their habitats is a crucial component of national parks. Parks may have designated areas or corridors specifically set aside for the conservation of certain species.

4. Scenic Landscapes: National parks often encompass breathtaking landscapes, such as mountains, forests, deserts, canyons, rivers, lakes, or coastlines. These natural features contribute to the park's aesthetic value and recreational opportunities.

5. Cultural and Historical Sites: Some national parks are significant due to their historical or cultural importance. They may contain archaeological sites, traditional cultural resources, or landmarks associated with past human activities.

6. Visitor Facilities: National parks typically provide infrastructure to support visitor activities and services. These can include visitor centers, campgrounds, hiking trails, picnic areas, viewpoints, roads, and interpretive signage. These facilities aim to enhance visitor experience while minimizing impacts on the natural or cultural resources.

7. Interpretation and Education: National parks often offer interpretive programs, guided tours, and educational materials to help visitors understand and appreciate the park's natural and cultural values. Interpretation may involve ranger-led activities, exhibits, workshops, or audio-visual presentations.

8. Conservation and Research: National parks play a crucial role in scientific research, monitoring, and conservation initiatives. They often collaborate with scientists and institutions to study ecosystems, biodiversity, climate change, and other environmental factors. Conservation efforts may involve habitat restoration, species reintroduction, or invasive species management.

9. Regulations and Management: National parks are managed by government agencies or organizations responsible for enforcing regulations and guidelines. These measures ensure the protection of natural and cultural resources, while also addressing visitor safety and minimizing human impacts on the ecosystem.

These components work together to fulfil the goals of national parks, which include preserving natural and cultural heritage, promoting sustainable use and enjoyment, and providing opportunities for research, education, and recreation.

Research on National Parks

Through comprehensive desktop research focused on transportation system design in Indian national parks, it has been determined that the integration of wildlife corridors, the utilization of eco-friendly vehicles, and the implementation of stringent speed limits can effectively minimize adverse effects on wildlife populations, while simultaneously ensuring a secure and enjoyable transportation experience for park visitors. However, to gain a more comprehensive understanding of the feasibility and efficacy of these strategies, it is advisable to conduct further on-site research, which will provide invaluable insights into their practical implementation and overall impact.

During our desktop research it was found that threats on wildlife included 53% loss of habitat and fragmentation, 34% human population explosion and farmland encroachment, 9% developmental activities as well as 4% hunting.

Research Inferences:

The secondary research conducted has yielded valuable insights that shed light on crucial aspects. Firstly, it is evident that transportation infrastructure plays a pivotal role in wildlife conservation within these parks. Poorly designed or managed systems can have significant negative impacts on the natural environment. Secondly, there is a pressing need for enhanced data collection and analysis regarding the effects of transportation on wildlife. This knowledge is essential for informed decision-making and to enhance conservation outcomes. Thirdly, a diverse range of technologies and approaches can be employed to improve transportation systems in national parks. This includes better road design, the integration of alternative modes of transport, and the utilization of smart technology solutions. Lastly, it is vital to consider the broader social and economic impacts of transportation systems alongside their environmental effects. By prioritizing sustainability and long-term effectiveness, conservation efforts can be more comprehensive and successful.

The following are the inferences points:

- Lack of accidents assurances from occupation hazards.
- Misuse of funds provided by government
- Increasing organised crimes and hunting in forest reserve
- No transport of govenrment to move and regulated jungle wood
- No transportation system of reserve forest to counter forest fires.
- Poverty and lack of employment in locals.
- Poverty and lack of employment in locals.
- Displacement of local villagers
- Irrigation projects
- Land use for agriculture increased 26-31%
- No transportation system to counter forest fires
- Over construction of resorts and homestays
- Human settlements increasing YoY
- Reducing forest area due to infra projects
- Local intervention in national park policies very less
- Heavy daytime traffic on roads
- Safari vehicles on contract/permit basis
- Checking of every vehicle for plastic waste and garbage bins in vehicles
- EV intervention for quiter vehicles
- Unethical way of transport animals
- Lack of transport system for patrolling and survelliance
- Scope for more transparency in wildlife survey
- Lack of technology for tracking and tracing animal movement
- Booking systems can be streamlined

- Eco-tourism opp. but acc to animals
- Lack of proper infra to cater to needs of migratory species
- Commercialization and infra devpt disturbs wildlife
- No proper animal corridors in reserve forests
- No proper planning of safari route systems
- Rail accidents as cause of death
- lack of proper awareness amongst villagers
- Increased organised wildlife crimes and hunting in forest reserves
- Poisoning of prey
- Human-Animal conflict is increasing
- Captive breeding is working
- Under equipped staff to deal with poachers
- Intercepting poachers and smugglers as quickly as possible
- Lack of training and equipment for forest guard/ watcher and officials
- Illegal acts in Safari booking
- No proper planning for safari route system
- Local intervention in national park policies very less
- Influencers play a huge role in spreading awareness
- Litter, noises and disruption by tourists
- Lack of ownership amongst tourists and villagers towards wildlife
- Poachers use religion to lure villagers
- Transport routes distrubing wildlife
- Lack of proper transportation system for wildlife SOS to report illegal activities
- Lack of transport for moving vehicles
- Vehicles face issues in monsoon
- Upgradation of safari vehicles
- No transport to chase wild animals away from farm lands
- Diesel vehicles create noise
- intercepting poachers and smugglers as quickly as possible
- Lack of transport system for patrolling and surveillance

Stakeholder Analysis
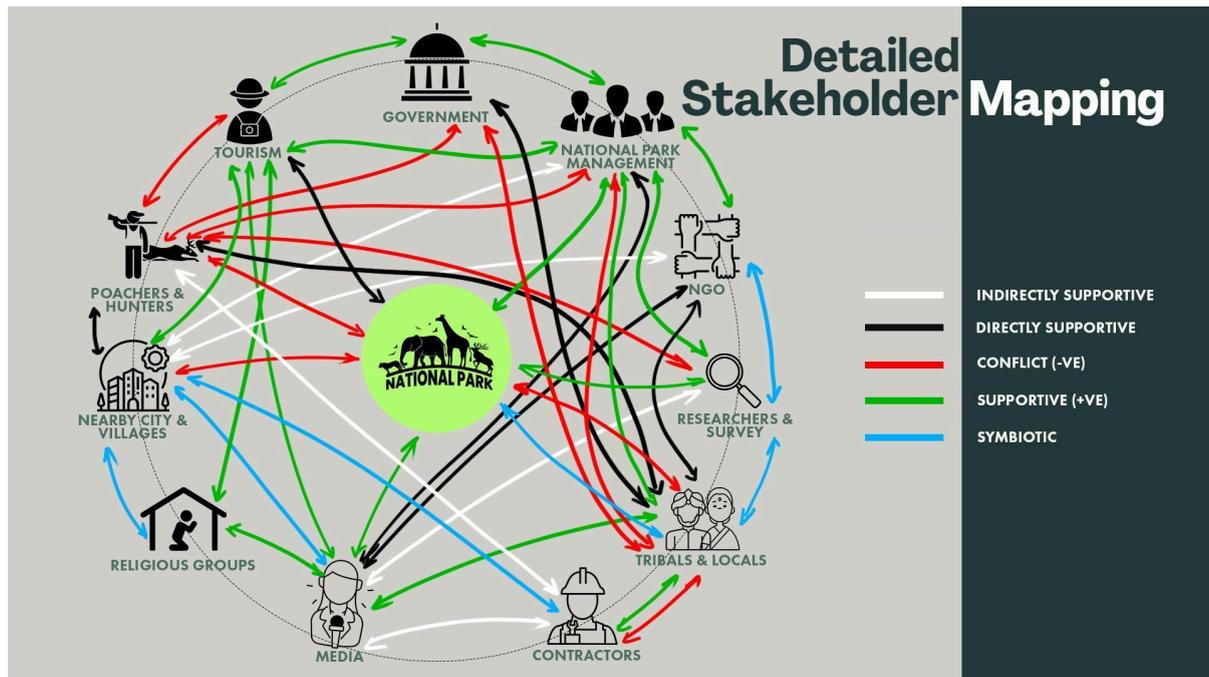
The following stakeholders were mapped out and their roles in the transportation system design project for Indian national parks are as follows:

1. Park Management: The park management oversees the overall operations and decision-making related to the transportation system. They collaborate with various stakeholders to ensure the system aligns with the park's goals of conservation, visitor experience, and sustainability.

2. Visitors: Visitors utilize the transportation system to explore the national park. Their needs, safety, and experience are important considerations in designing the system. Feedback from visitors can inform improvements and help shape future developments.

3. Researchers: Researchers have specific requirements for transportation within the park to conduct studies, surveys, and research activities. Designing vehicles or transportation solutions that cater to their needs can enhance their efficiency and effectiveness in studying the park's ecosystem.

4. Local Communities: Local communities residing near or around the national park may have a stake in the transportation system. Collaborating with them can ensure that their perspectives, concerns, and livelihoods are taken into account. Their

knowledge of the local area can also provide valuable insights for designing appropriate transportation solutions.

5. Conservation Organizations: Conservation organizations play a crucial role in protecting the wildlife and ecosystem of the national park. Collaborating with them can help identify areas where the transportation system may impact conservation efforts and find ways to mitigate any negative effects.

6. Technology Providers: Technology providers offer solutions like drones, satellite imaging, thermal cameras, and communication devices. Collaborating with them enables the integration of advanced technologies into the transportation system for improved wildlife monitoring, visitor safety, and efficient management.

7. Government Agencies: Government agencies, such as wildlife departments and transportation authorities, have regulatory roles and can provide guidelines and support for designing and implementing transportation systems in national parks. Collaboration with these agencies ensures compliance with regulations and access to necessary permits.

8. NGOs and Education Institutions: Non-governmental organizations (NGOs) and education institutions can contribute to raising awareness, conducting educational campaigns, and promoting sustainable transportation practices. Collaborating with them can help spread awareness and educate visitors and local communities about the importance of sustainable transportation in national parks.

These stakeholders have interconnected roles and interests in the transportation system, and collaboration between them is essential for designing an effective and sustainable system that benefits the park, its wildlife, and its visitors.

Scope of Transportation Design Intervention

Identifying the common set of problems, we proceeded to narrow down the focus specifically on issues related to transportation design. This selection process allowed us to formulate hypotheses for the existing problems.

● Drone tech intervention for wildlife conservation

● Special vehicles for SOS law enforcement -intercepting poachers human-animal conflict

● Centralized portal for safari booking system (pan India)

● Safari vehicle upgradation

● Interception of speed limit defaulters (rail & road)

● Special purpose vehicles for heavy animal transport

● Special purpose vehicle for medical transport & rescue

● Technology interventions - Surveillance requirement -satellite imaging -thermal cameras - communication devices

● Changing & planning -safari routes-

● Special patrolling vehicles - 4x4 -2w

● How to avoid rail accidents?

● Construction of animal corridors in & around national parks & reserve forests

- Vehicles for spreading awareness - education -campaigns -camps.
- Eco friendly & sustainable means of transportation
- Special vehicles for researchers with their specific requirement Loaded features.
- Vehicles for monsoon safaris
- Fire department vehicle in wildlife reserves & forests
- Servicing & maintenance of existing/new transportation system
- Vehicle for transporting jungle wood & other exotic woods/timber
- Introduction of EV/ hybrid vehicles

Online Interviews with Conservationists and Wildlife Experts

We were privileged to engage in enlightening conversations with Dr. Ullas Karanth, a prominent conservationist, and Dr. YashVeer Bhatnagar, a seasoned wildlife researcher. Their invaluable perspectives guided us in ensuring our solutions prioritize the well-being of wildlife and avoid unintended negative impacts. Here are some insights from the online meeting we had with both of them.

Dr. Ullas Karanth

"Recreational tourism efforts in indian national parks inspired by other countries will affect the conservation efforts."

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One of the world's foremost authorities on tigers, Dr. Ullas Karanth[5] is a senior conservation scientist and Director of the US-based Wildlife Conservation Societys India Programme. Originally trained as an engineer, he even tried farming before finally homing in on wildlife science as his profession. The central thesis of his work has been the connection between prey and predator numbers and the arena of most of his field work has been Karnataka, particularly Nagarahole, though he has, of course, studied tigers across India. Besides dozens of scientific papers, Karanth's popular books 'A view from the Machan and 'The way of the tiger have been acclaimed widely.

Excerpts from his interview:

- A lot of vegetation is cleared while constructing roads in National park & reserves affecting conservation.

- Not to get fixated

- Only on 4-wheeler as transportation solutions for wildlife conservation

- Increase in tourism 15 affecting wildlife reserves/park negatively.

- Road construction has become an economic activity for governments.

- Artificial waterbodies are not good.

- No sustainable means of travelling in national parks/reserves.

- Avoiding construction of roads going through national parks & forest reserves

- Very old vehicles are being used for safari, rescue, patrolling & other conservation efforts.

- Lack of empathy on wildlife & ecology while planning infrastructure in & round national parks wildlife reserves

- Need for only required road system & not unplanned excess road in & around national park.

- In order to increase employment opportunities under MGNREGA (National Rural Employment Guarantee Act, 2005) excess infrastructure development projects are being created.

- Officials are not aware about animals & their behaviour

- No proper planning of road system in & around national parks & reserve forests

- Lack of new & innovative ideas & plans for wildlife conservation

- Ineffective usage of funds to construct roads in national parks in spite having need for investment for other conservation effort.

- No riot vehicles to control & protect during rescue operations in sensitive areas.

- Requirement based vehicle to use for conservation efforts are not present.

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- Recreational tourism efforts in Indian national parks will affect the conservation efforts.

- Artificial moonscapes are being created with the use of earthmovers in infrastructure development resulting in losing the natural beauty of the national park & wildlife reserve.

Dr. YashVeer Bhatnagar
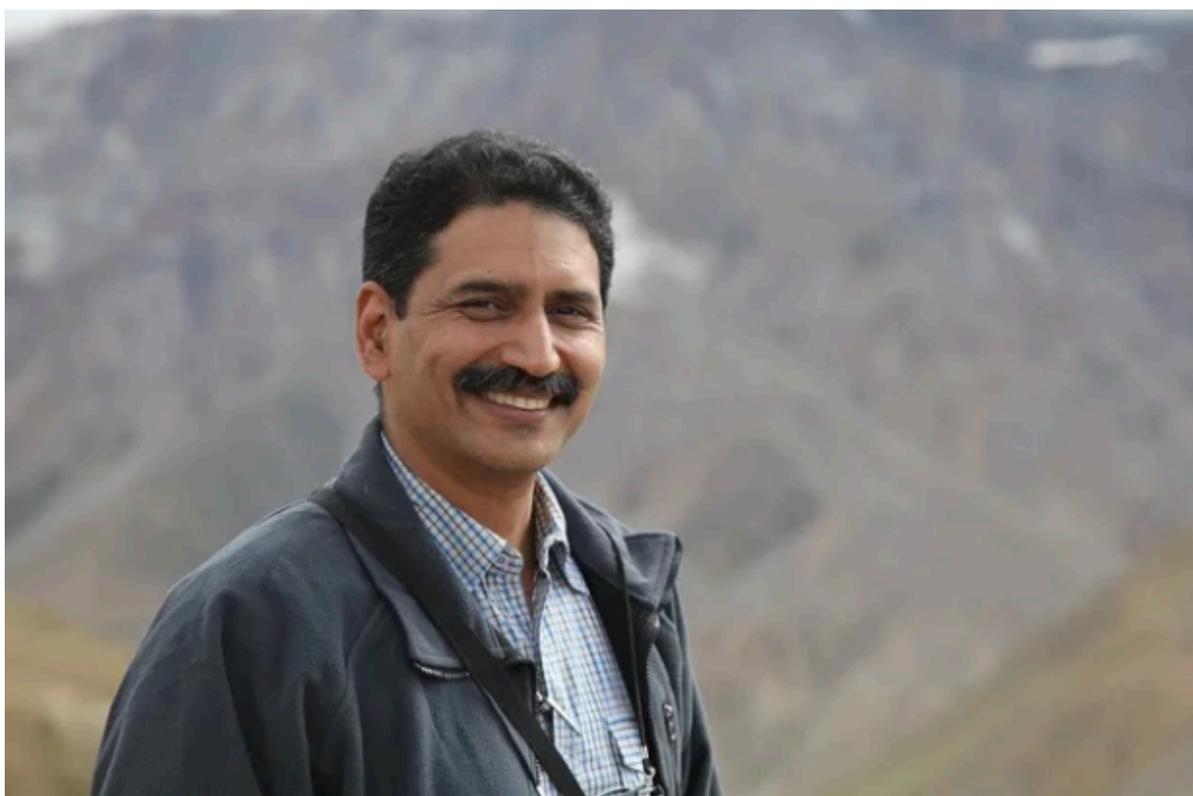
"There is a need for including the conservationists while planning infrastructure development in & around national parks."

Dr. Yashveer Bhatnagar's[6] primary interests lie in the cold-arid landscapes of the Trans-Himalaya. With a liking for the Himalaya since childhood, Dr. Bhatnagar developed a definitive interest in wildlife during his graduate days at the G.B. Pant University of Agriculture & Technology. He completed a Master's degree in Agricultural Entomology in 1989, followed by another Master's in wildlife science at the Wildlife Institute of India (WII), Dehradun. For his PhD, he worked on ranging and habitat use by Himalayan ibex under the guidance of Drs. G.S. Rawat, Michael Stüwe, and A.J.T. John Singh and was awarded the degree in 1997. Dr. Bhatnagar has conducted research and conservation activities as a faculty at the Wildlife Institute of India and later joined the Nature Conservation Foundation (NCF) in July 2003, where he has been co-directing the High-Altitude Program. He has focused on studying ungulate-habitat relationships, livestock interactions, people-wildlife conflict

resolution, and alternative models for conservation, among other research and conservation interests. Additionally, Dr. Bhatnagar has contributed to the field by participating in expeditions, including the 15th Indian Antarctic Expedition, where he studied penguins and seals in Antarctica.

Excerpts from his interview:

- Increase in private vehicle traffic due to increase in road infrastructure around national parks

- Simple modified busses & trucks are being used by the forest department.

- Large category of vehicles entering the forest are for tourism & other purposes.

- No existing vehicles in the Indian market qualifies to the needs of serving as a surveillance vehicle

- Existing vehicles in the forest dept are to not fast & strong enough. No sophisticated equipment are present in them

- Vehicle connectivity to a network is very important.

- Communication is not a luxury now. It's a necessity for management of wildlife/ national park reserves.

- Satellite phones can be used for communication purposes.

- No padded cages, capturing equipment & first aid facilities in the rescue vehicles.

- Quality of modification of vehicles are very unsatisfactory. Unstable vehicles

- Rescue vehicles are utilized to rescue animal in distress.

- Lack of understanding the animal & its behaviour

- Lack of awareness amongst locals tribals to reduce the stress of the captured animal.

- In Jim Corbett, 4-member beat team was attacked by a tiger. One was killed & one was injured & the other two couldn't communicate SOS for help & evacuation.

- Forest guards have to talk/keep in touch with their family for their mental wellbeing.

- Ability to use firearm by forest guards in the forest is highly restricted.

- Conservationists can be involved right from the conceptual phase of planning related to wildlife.

- Lack of dedicated ambulance service for wild animals

- Without any bodily injuries, rescued animals have died due to negligence in handling the rescued animal.

- Many rescued animals have died during transportation (due to shock)

- Lack of stretcher for carrying animals of different sizes

- Need for linear infrastructure, railway track, power line & canals that doesn't affect wildlife.

- Behaviour of locals towards captured animals also results in the death of the animal.

Primary Research
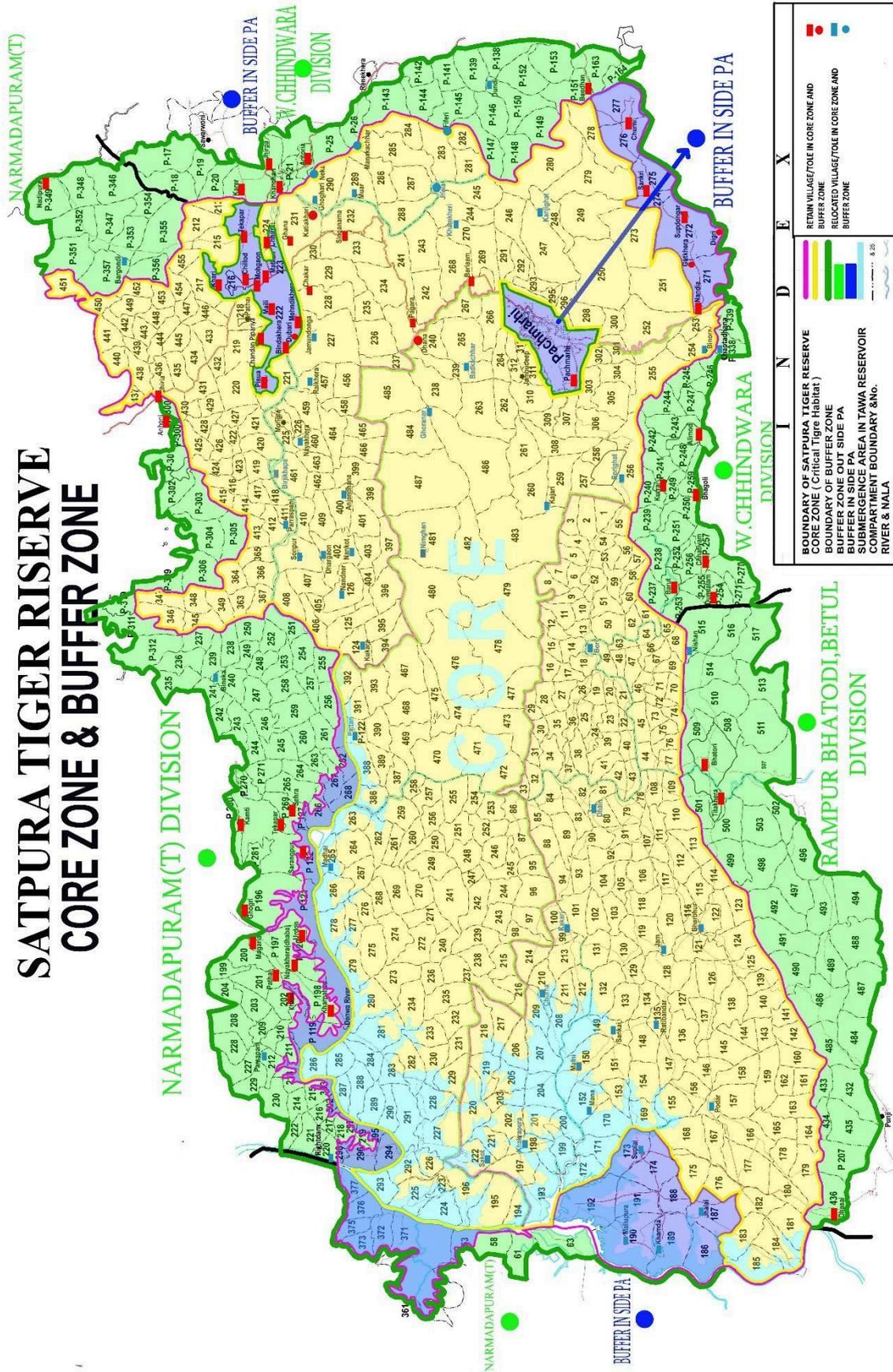
Satpura Tiger Reserve

Satpura Tiger Reserve is a habitat of 52 species of Mammals, 31 of Reptiles and 300 species of birds, out of which 14 are endangered. STR also a habitat of arboreal mammals like Flying Squirrel, Indian Giant Squirrel and Leaf nosed bats. Eurasian Otter and Smooth coated Otter are also found here. It is a unique park of M.P where pollution-free activities like cycling, canoeing and trekking are allowed.

General information:

- Total: 2133.30 Sq Km
- Core: 1339.26 Sq Km
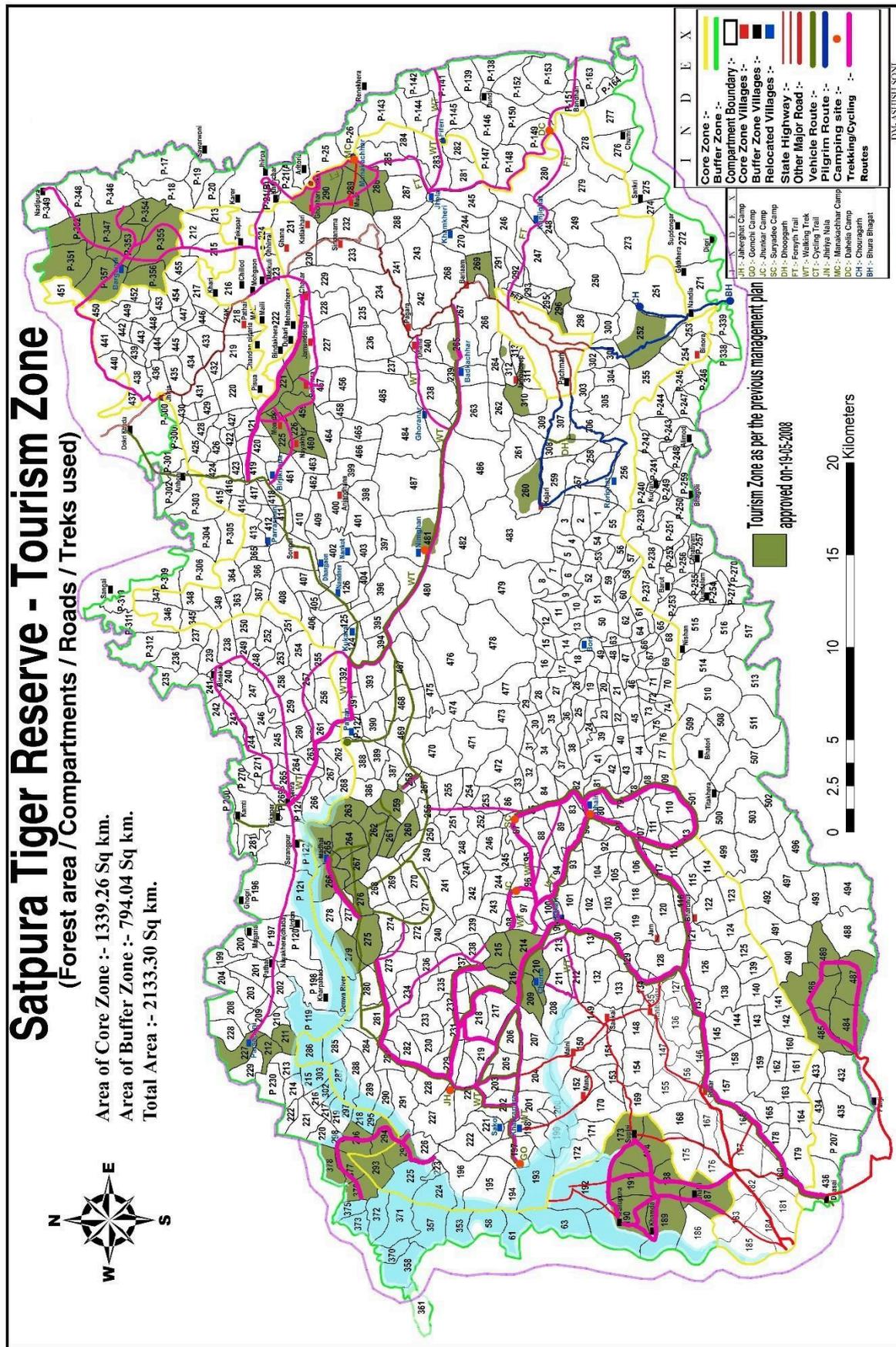- Buffer: 794.04 Sq Km
- Flora & Fauna

Satpura Tiger Reserve Located in the south of the river Narmada. The forest of the Satpura ranges are rich in biodiversity and are inhabited by many endangered species. Keeping this specialty in mind, Satpura Tiger Reserve was declared as the first biosphere reserve of Madhya Pradesh in the year 1999. The high ranges of the Pachmarhi plateau are covered by Sal forests, whereas dense teak forests are spread over its lower hill ranges. Here, 26 species of Himalayan region and 42 species of Nilgiri areas are found. due to which Satpura Tiger Reserve also known as the northern extremity of Western Ghats.

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SATPURA TIGER RISERVE CORE ZONE & BUFFER ZONE

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Satpura Tiger Reserve – Tourism Map

Satpura Tiger Reserve - Tourism Zone
(Forest area / Compartments / Roads / Treks used)

Area of Core Zone :- 1339.26 Sq km.
Area of Buffer Zone :- 794.04 Sq km.
Total Area :- 2133.30 Sq km.

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Satpura Tiger Reserve – Satpura Pench Corridor
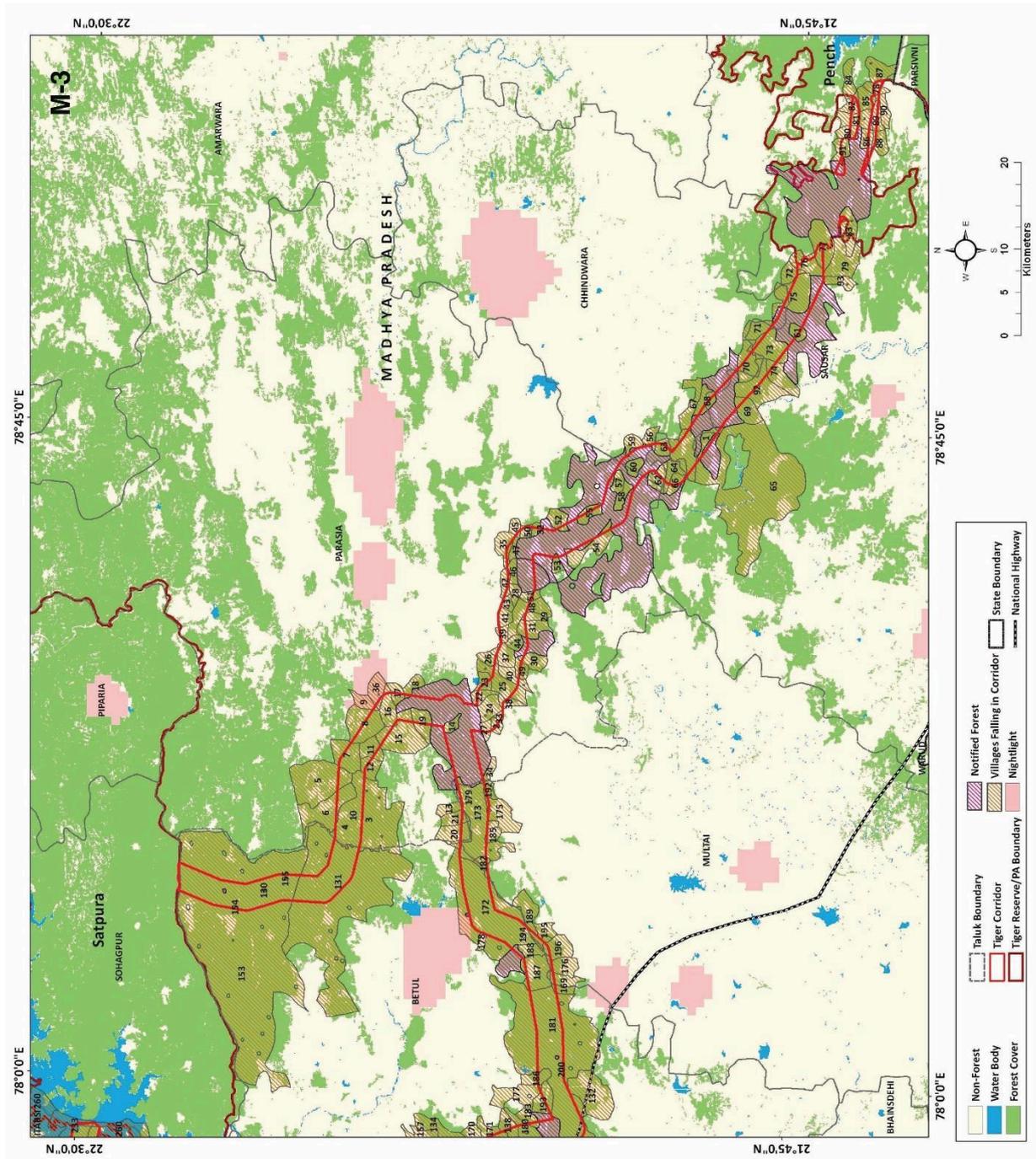
Satpura Tiger Reserve – Satpura Melghat Corridor

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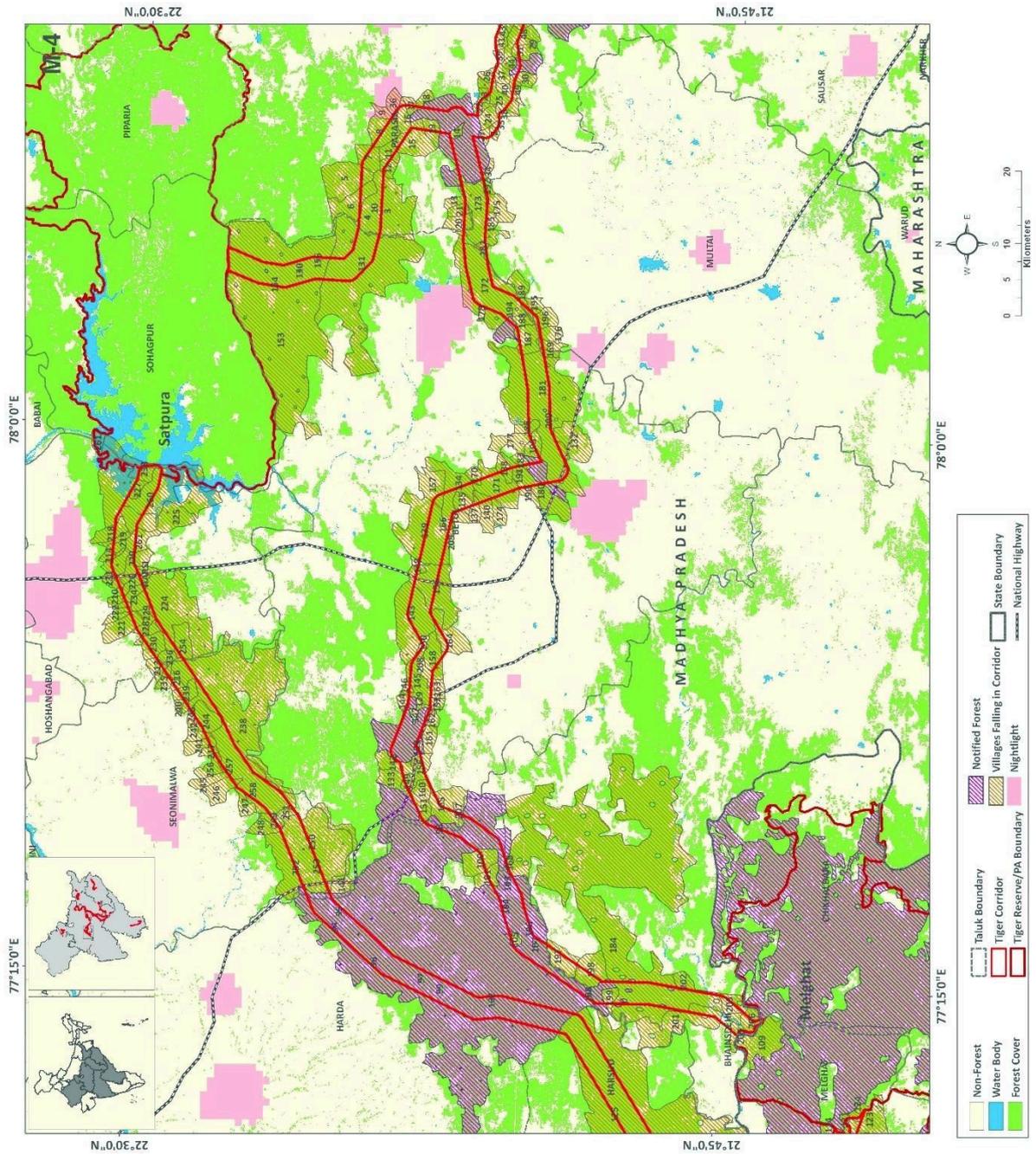
This large land is an important habitat for the protection of tiger. This area is home to almost 14 endangered species, among which Giant Squirrel, Indian Skimmer, Black Bellied Tern, Leaf-nosed Bat, etc. are the specialty of area. More than 300 species of birds found here, including Malabar Pied Hornbill, Malabar Whistling Thrush and Madhya Pradesh's state bird Paradise Flycatcher (Doodhraj). Apart from this, migratory birds such as Bar-headed Geese,

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Pintails, Spot-bills, spoonbills, etc. also appear in large groups during the autumn. Eurasian otter has also been seen here in the past.

Tourism zone & carrying capacity

- Madhai- Only 30 vehicles are permitted to enter this core zone per day, including the morning and late-afternoon drives. Ecotourism activities except vehicle safari include elephant ride, boat ride, canoeing and trekking.

- Churna- In Churna zone, tourists can take their own pollution free, four-wheeled vehicle capable of going through the rough forest terrain.

- Jamanidev, Parsapani- These buffer zones (near Madhai) of the tiger reserve can be visited through safaris by private vehicles. 14 vehicles in the morning and 14 in the afternoon are permitted to enter these zones.

- Pachmarhi- This is a hill station containing waterfalls and some beautiful viewpoints, all of which can be reached by privately owned vehicles.

Satpura's Needs

Our field research in Satpura National Park focused on designing a transportation system that could cater to the diverse requirements of Wildlife Rescue operations, Surveillance & Patrolling, and Safari & Tourism. We observed that the rugged terrain and dense forest cover of the park demand a transportation system that is rugged, durable, and efficient. Our research highlighted the importance of equipping vehicles with advanced technologies such as GPS tracking, thermal imaging, and communication systems to enable effective monitoring and enforcement of park rules. Overall, our research showed that a well-designed transportation system is crucial for the smooth functioning of Satpura National Park's various operations.

The research was divided into three main points:
wildlife rescue, safari and tourism, and **surveillance and patrolling**, for ease of study.

In the **wildlife rescue category**, the focus was on transportation needs related to rescuing and rehabilitating wildlife. Our research highlighted the need for a transportation system that could rapidly access remote areas of the park and transport rescued animals to safety, equipped with specialized gear and medical facilities.

In the **safari and tourism aspect**, the aim was to enhance the safari and tourism experience within national parks. Vehicles were studied for comfort, safety, and optimal wildlife viewing opportunities for visitors. Our research highlighted the significance of designing eco-friendly and comfortable transportation options for tourists, while minimizing the impact on the park's ecosystem. The transportation system should provide a safe, enjoyable and informative experience for visitors.

The **surveillance and patrolling focus** involved developing transportation systems to support effective surveillance and patrolling activities within national parks. Integration of satellite imaging, thermal cameras, and communication devices was explored to monitor and protect wildlife. Specialized vehicles were considered for law enforcement personnel involved in combating poaching and addressing human-animal conflicts. The need for patrolling vehicles capable of navigating various terrains and providing quick response in emergency situations was addressed. We identified the importance of advanced monitoring and communication equipment, such as GPS tracking and thermal imaging, in ensuring effective enforcement of park regulations by park rangers.

By dividing the research into these three points, a deeper understanding was gained of the specific transportation requirements and challenges associated with wildlife rescue, safari and tourism, and surveillance and patrolling. This approach allowed for a more focused and comprehensive analysis of the project.

Wildlife Rescue Operations

left to right - Pradeep Sharma, Vasanth Pandey, Bhagwandas Sagar, Dr. Gurudutt Sharma

Wildlife rescue operations play a crucial role in India, where the country's rich biodiversity faces numerous threats, including habitat loss, poaching, and human-wildlife conflict. Effective wildlife rescue operations not only help in saving endangered and threatened species but also ensure the survival of the entire ecosystem. The rescue and rehabilitation of wildlife require a coordinated effort between various stakeholders, including government agencies, NGOs, and local communities.

Inspection and Evaluation of Rapid Response Unit:

Bolero Camper 2008:

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- 14 years in service improper maintenance
- Under-equipped
- No mechanism to load the cage
- Noisy vehicle
- Lack of inter-vehicular communication lack of basic amenities (torch, water bottle, first-aid etc.)
- No air conditioning
- Difficult ingress & egress.
- Restricted movement / no movement of search lights (beacon).
- No straps & grapple hooks to secure cargo/stowage
- No GPS systems/physical maps
- Lack of electronic systems (power windows, ADAS etc.)
- No wrench
- No fuel cans
- No safety systems (air bags)

Swaraj T3500 4x4 truck:

- Improper maintenance.
- 15 years in service.
- Glitchy hydraulic system.
- Improper seating space.
- Lack of ergonomically defined space.

- Lack of surveillance in the bay area.

- No humidifier for animals.
- Noisy systems.
- Lack of proper ventilation.
- Good ground clearance.
- Lack of satellite & navigation systems.
- Lack of electronic systems.
- lack of basic amenities.
- Difficult ingress & egress.
- No proper lighting system (in & out).
- Lack of communicating device systems.
- No wrench.
- No off-roading tires. And no Airbags

Bolero Camper S:

- No humidifier for animals.

- Small cage.

- No automatic mechanism to bring the cage down/up.

- No GPS/Satellite Navigation systems.

- No camera surveillance in bay area.

- No search light systems customized bumper to increase approach angle.

- No off-roading tires/all terrain tires.

- No proper space for rescue equipment.

- Lack of electronic systems (power windows, ADAS etc.)

- Good ground clearance.

- Less capacity to accommodate rescue personnel.

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Interviews:

During the inspection, parallel interviews were conducted to gain deeper insights into the finer nuances and address any existing issues. Here are selected excerpts from the interview:

Dr. Gurudutt Sharma – Veterinary Officer Wildlife

With over 10 years of experience as the Chief Veterinary Officer for STR, Dr. Sharma's expertise and valuable insights not only provided us with direction but also validated several of our findings.

- 12 wheel trucks are currently being used to transport elephants (hired Vehicle).
- Current modifications are not satisfactory.
- Proper spacing of animal corridors & need for mitigation measures.
- Elephants are used to rescue/catch Tigers.
- Earthmovers are also used in rescue operations.
- Lot of manpower & time is required to set up traps during mass capture of wild animals.

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- Captured/rescued animals are released to buffer/core/non conflicting zones using vehicles.

- New technique & experience for every capture/rescue operations

- Captured animals are monitored for 6 months using radio collar.

- Shooters are hired to kill notorious Animals (maneaters etc.) international poaching links to China.

- Superstition motivated poaching of Animals.

- Uneducated tribals & locals are motivated to kill tigers/other exotic animals for very low prices.

- Sagwan & Saal forest are pre-dominant in this region.

- Local tribals & villagers are recruited for mahouts, guards & other such posts.

- FFMS (forest are management system) is used to send alert through satellite surveillance.

- No proper vehicle/equipment to exterminate forest fires.

- Carelessness of villagers entering the core zone also causes forest fires.

- Controlled forest fire is conducted between December to latest by 15 January.

- Confidence building & awareness amongst villagers is done with the help of local animal grazers. 28 villages are relocated from core zones (चरवाहा सम्मेलन).

- Festivals also disturb wildlife in core zones (Panchmadi).

- NGO's play a vital role in giving funds & vehicles as they are quicker than government in response.

- WTI, WWF, WCT, & ICCI & other trusts/NGO's conduct survey & development infrastructure.

- On field medical treatment is given to animals.

- For emergency/severe medical treatment, animals are taken to Vanvihar national park/zoo at Bhopal (MP)

- Requirement of ambulance (4x4) for both animals & humans is required.

- Force Toofan (9 seater) 2 vehicles are introduced in safari. They have no proper service duration & also have low ground clearance.

- 19 vehicles are there for safari (15 vehicles were present for safari in reality).

- K9 units have been used in Pench & Satpura for tracking pangolin burrows, scat & feeding locations.

- Fully modified vehicle (as per requirement) is preferred than the base model being provided which take a lot of time & paper work to get it modified.

- As per govt regulation, the vehicle width cannot be increased even after required modification.

- Pending fogger installation in rescue vehicles to maintain cooling inside the vehicle.

Vasanth Pandey and Bhagwandas Sagar – Drone Operator and Rescuers

- Difficult to control crowd during rescue operations.

- Often locals turn to violence when a mishap happens before or during rescue operation.

- Lack of awareness among villagers regarding wild animals.

- New technique & experience for every capture & rescue operations (new challenges).

- Feeding of wild animals (including monkey) by villagers & tourists causes further conflict & harm.

- During rescue operations, efforts are made for minimal engagement with wild animals for safe passage into the wild.

- Drone is helpful to navigate in dense tough terrain.

- Drone is used to capture images, to check water level & in surveillance.

- Drone helps in collecting video evidence of animal intervening in farmlands.

- Only one drone is in operation for the whole National Park.

- Drone footages & images are shown to villagers to instil fear to not interfere with core zone.

- Olympian Gagan Narang has trained the drone team in using the drone & it's application.

- Predefined schedule already exists to conduct drone surveillance in the national park. Drones are used to map & plan water infrastructure in the national park.

- Grazing grounds are created for grazing inside the national park.

Surveillance and Patrolling Operations

Wildlife surveillance and patrolling operations are essential in India to protect its diverse wildlife and ecosystems from illegal activities such as poaching, wildlife trafficking, and habitat destruction. The use of advanced technologies such as GPS tracking, thermal imaging, and communication systems can help authorities monitor and detect such activities, leading to more effective enforcement of wildlife protection laws.

Drone Surveillance Unit

The drone surveillance unit played a crucial role in monitoring and capturing aerial data for enhanced situational awareness in the national park. It facilitated efficient surveillance, data collection, and informed decision-making. The drone which they currently use is the DJI Mavic 3. Following are the points from the inspection:

- Very small team (only 2 members).

- Cinematic drone used for surveillance.
- Infrequent surveillance & patrolling.
- Smartphone being used as display.
- Glare & small size of screen.
- No rotor guards.
- No weather protection.
- Very less flight time (15mins).
- Decent range coverage of drone (8 kms).
- No AI based animal tracking (laser based).
- No thermal imaging (for profiling).
- No long distance focal-point camera.
- No proper data management.
- No payload area for additional equipment.
- No Li-DAR system.

- Helpful in monitoring forest fires.
- Helpful in tracking human interference.
- Monitoring water bodies in forests.

Vehicle Patrolling Unit

The vehicle patrolling unit was instrumental in ensuring effective monitoring and enforcement across the national park. It provided swift mobility, increased coverage, and enhanced response capabilities for ensuring park safety and security. The models used for vehicle patrolling are Bolero Camper S

- Under equipped for patrolling.
- Delay in modification process.
- No air conditioning system.
- Lack of Satellite & navigation system.
- Lack of electronic systems (ADAS etc.)
- Non customized vehicle still being used.
- No safety systems

- No offroading tires..
- Lack of stowage space for basic ammenities.
- No beacon lights/search lights
- Absence of roll cages
- No personnel protection gear/equipment's.
- No first aid kit /training

Boat Patrolling Unit

The boat patrolling unit played a vital role in monitoring and safeguarding the water bodies within the national park. It enabled efficient coverage, quick response, and effective enforcement in aquatic and inaccessible areas.

- Old boats being used for patrolling

- Noisy engine

- No proper seating

- Underequipped boat

- No safety systems & measures

- No communication system

- No canopy overhead

- No GPS systems

- Staff are under equipped

- No proper seating for navigator.

- No automated driving/steering system

- No utilitarian uniform for patrolling staff

- No first aid kit/training

- No light system/search light

- No night vision (IR lighting)

- Boat patrolling covers larger area in less time

- Frequent foray of fisher man into national park waters

- Campaigns & awareness camps are conducted to maintain relationships with villagers

- Political influences affect the national park Management negatively.

- Migratory birds can also be seen in & around national park.

Foot Patrolling Units

The foot patrolling unit served as the frontline defense in ensuring the security and integrity of the national park. Every day, they travel 5-10kms trips on foot deep in the forests to look out for something that doesn't happen naturally. We interacted with a foot-patrolling chowkidar to understand what really happens and what the issues are.

- Covers 05-20 kms/day for patrolling
- Uses M-stripes for patrolling data logs
- No proper living conditions
- Just one uniform provided per year
- Lack of communication between chowkidar & checkpost officers
- No transport system to take chowki-dars from entrance of national park to the assigned check post
- No proper safety equipment
- Underequipped for patrolling
- Vulnerable to animal attacks
- Required to notify every kill/death, natural/unnatural to officials
- No transportation to carry monthly ration to the check post (on-foot)
- No EMS & first aid facilities
- No proper sanitation system for when multiple stay at the checkpost.
- No fridge/electric appliances to cook.
- Invertor facility for lights & water pump.

Elephant Patrolling Units

Elephants play a significant role in patrolling and rescue operations in India, especially in forested areas where vehicles cannot access easily. These gentle giants are intelligent, agile, and have an acute sense of hearing and smell, making them ideal for navigating through dense forests and tracking down poachers. Elephants are also used for rescuing animals in distress, such as those trapped in water bodies or those injured due to human-wildlife conflict. In addition, elephants are an integral part of Indian culture and have been used for transportation and other purposes for centuries. Therefore, protecting elephants and their habitats is essential to ensure effective patrolling and rescue operations and preserve the country's cultural heritage.

We interacted with mahouts and chara-cutter of 4 elephants: Anjugam, Ismita, Vikram and Periya.

- Elephants are being used for patrolling areas where vehicle doesn't cover.
- Teams patrol in different routes (overing 12 km/day) at same time.
- No communication system b/w teams & check posts.
- Wild animal attack mahouts while they take back the elephants after grazing in forest.
- No transport from government to take the mahouts from national park gates to the check post.
- Local tribals & villagers are hired as mahouts.
- No proper training on personnel safety & first aid.
- No medical facilities & EMS.
- No onsite veterinarian & doctor.
- No specific government vehicle to transport elephants.
- Shift wise working.
- Tough to handle elephants during mating time.
- No safety gear for mahouts.
- No properly defined retirement plan for elephants.
- No shelter for elephants.
- No kitchen for food preparation for elephants.
- Breeding of elephants.

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- Just one uniform provided by government per year.

Safari and Tourism

Safari and tourism in Indian national parks play a crucial role in studying the transportation system design for these parks. The need to provide efficient and sustainable transportation while ensuring visitor safety and minimal impact on the environment is critical. Understanding the requirements of both tourists and the ecosystem is essential to design transportation systems that promote a harmonious coexistence.

The model they use is Maruti Gypsy.

- 23 year old vehicles are being used for safari.

- No offroad tires

- No proper stowage area for first aid & other basic amenities

- No navigation/GPS system in the vehicle.

- No communication system in & between safari vehicles only in during emergencies.

- No vehicle tracking systems to monitor/observe during distress & emergency situations

- Not equipped with binoculars.

- Not equipped with safety equipment.

- No utilitarian uniform is provided to both drivers & the guides.

- No retractable canopy for both driver & passengers on board the safari vehicle.

- Lack of electronic systems such as ADAS (hill terrain assist), power windows, wiper system etc.

- No camera mounts in the safari vehicles.

- No ergonomic grab handles in the vehicle.

- Lack of comfort in seats

- No rear view vision for the driver.

- No drinking water in the safari vehicle.

- No shallow water fording.

- No do's & don'ts instruction manual for tourists in safari vehicle.
- No sentry mode to monitor tourists & driver during the safari (ingress, Egress during the safari except for Viewpoints).
- No wrench system in the safari vehicle.
- No system to safeguard tourists during mid safari vehicle breakdown.
- No repair shop/service station. Nearest service station is 60kms from the park.

We also asked a few tourists who came to see the safari to understand their point of view and understand the problems that they face when they visit the place. There were also new vehicles, Force Toofan, modified into a 9 seater vehicle.

Force Toofan

- No mode of transportation to take the break-down vehicle from the national park to the service station.
- Too much suspension noise.
- No seat belt system for passengers in the rear.
- 8 seater capacity.
- The clearance of the vehicle is very less.
- No 4x4 in the new safari vehicle.
- Length of the vehicle is more, which affects narrow cuts during offroad.
- Too much noise will affect wildlife
- Good seating comfort.
- Has good power.
- Many issues & problems observed in old safari vehicles aren't solved in the new safari vehicles.
- Long bonnet hinders visibility during offroading in hilly areas.
- 9-seater capacity.

- No insurance for vehicles

- No prescribed dress code for tourists.

- Tourists are very demanding and forces drivers to take detours.

- No safaris during rainy season. Hence no employment for drivers during this time.

This was followed by a review of the uniforms which were given to private safari guides and drivers.

- Certification and Training: Government safari guides and drivers undergo rigorous training and certification programs to ensure they have in-depth knowledge of the park, its wildlife, and responsible tourism practices. Private safari guides and drivers may not have the same level of certification or training.

- Cost: Private safari guides and drivers may charge more than government safari guides and drivers, as they offer personalized services and may have exclusive access to certain areas of the park.

- Flexibility: Private safari guides and drivers offer more flexibility in terms of scheduling and itinerary, as they cater to the specific needs and interests of their clients. Government safari guides and drivers follow a fixed schedule and route.

- Equipment: Private safari guides and drivers may provide their own equipment, such as binoculars and cameras, while government safari guides and drivers provide basic equipment but may not offer more advanced equipment.

- Language: Private safari guides and drivers may be multilingual and able to communicate with visitors in their preferred language, while government safari guides and drivers may only speak the local language or English.

- Environmental impact: Private safari guides and drivers may not always follow environmentally responsible practices, while government safari guides and drivers are required to follow strict guidelines to minimize their impact on the environment.

Interaction with Piper McKay

During our discussions, we had the privilege of engaging with Piper Mckay, a renowned wildlife photographer with extensive experience operating in Kenyan National Parks. Having visited Bandhavgarh, Ranthambore, and Corbett Tiger Reserves, her perspective as an international tourist offered intriguing insights into the comparison of national parks worldwide.

- No proper promotion of indian national parks/reserve forests in international communities and tourism.
- Lack of direct connectivity between national parks for international tourists.
- Suggestion : charted flights between national parks in india.
- Scope of airport infrastructure develoment in & around national parks.
- International tourists spend a lot of money in travel & stay enroute national park visits.
- No government transportation system to entertain foreign tourists & guests who wants to visit major national parks & reserve forests of India.

General Evaluation of SATPURA NATIONAL PARK TOURISM

- No connectivity of buses & other public transport to & from the Satpura national park.
- No Wi-Fi or phone connectivity in & around the government Guest house.

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- Private hotels & lodges are more profitable than the govt owned guesthouse/lodges.

- No proper basic facilities & amenities such as fans, mosquito nets, charging points, hot water etc.

- Kitchen hygiene was not up to the standard requirement.

- No government safari conducted in buffer zone.

- No hospitality services during safaris for tourists.

- No binoculars for tourists.

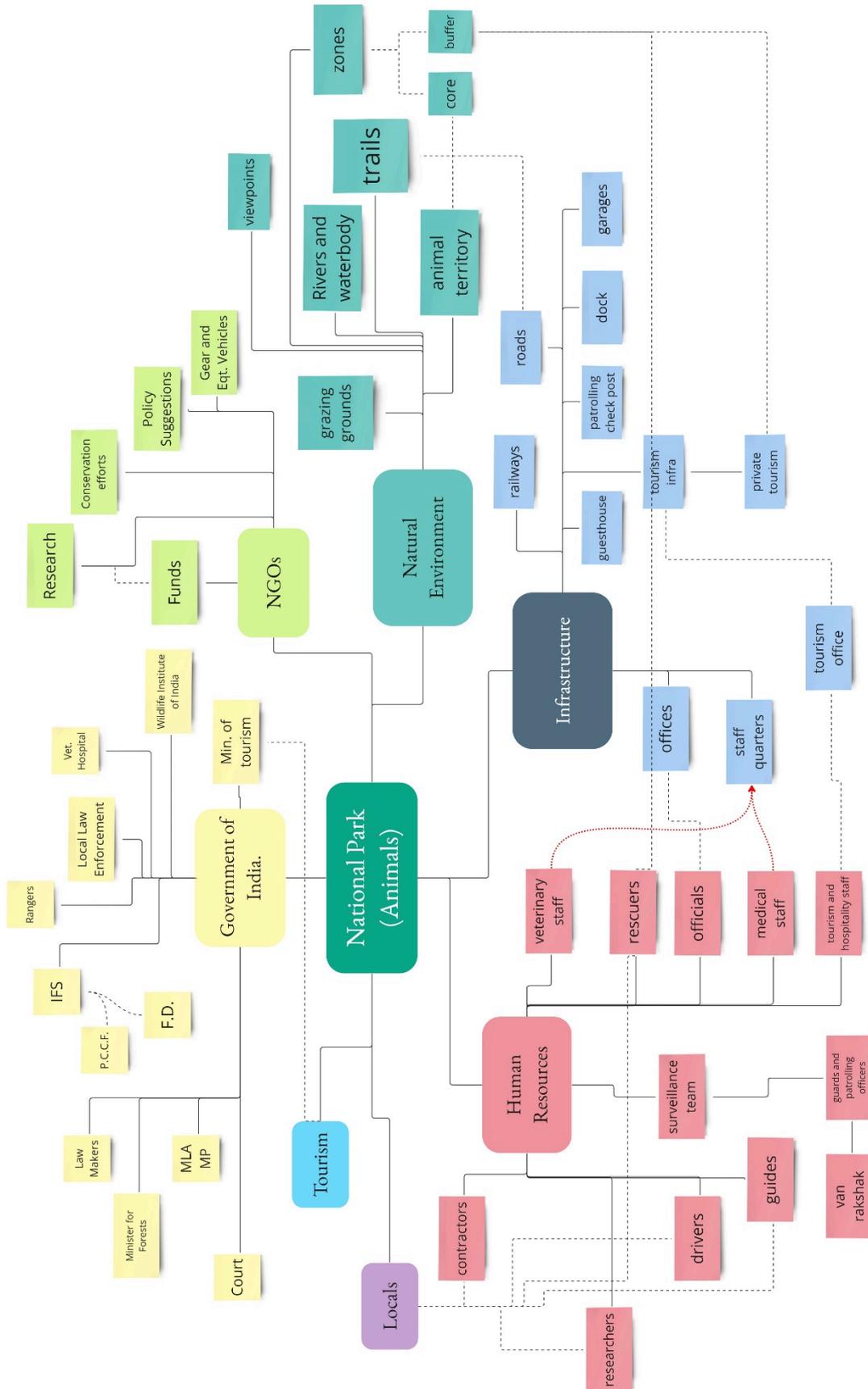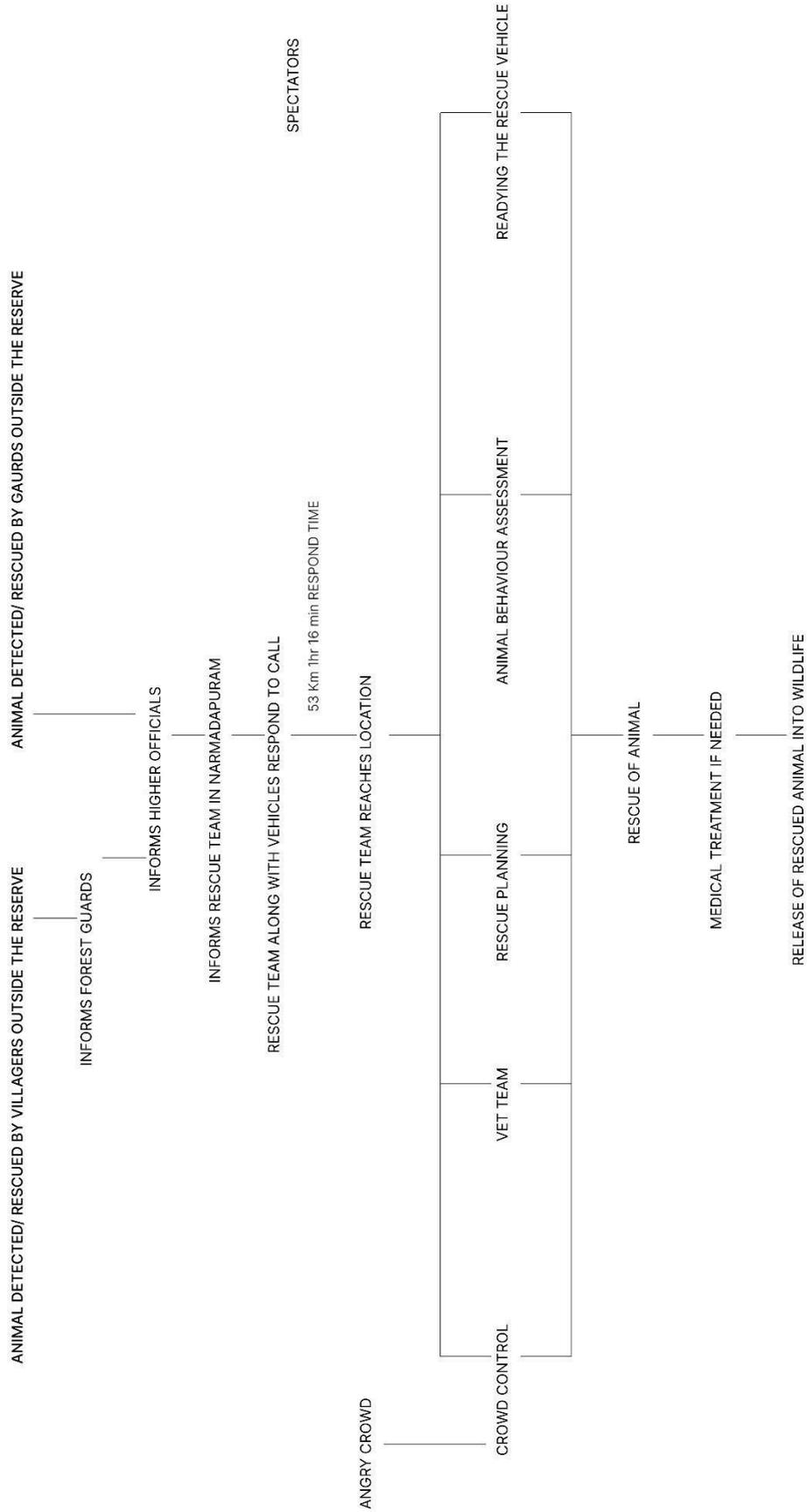- Private homestays/lodges has no regulation on sound & lighting during night.

Interaction with VILLAGERS OF SEHRA

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We interacted with two villagers from the neighbouring village of West Sehra who were affected by wild animals attacking their cattle. We also talked to a guard, Mr. Kaliram posted in the West Sehra Forest Outpost.

- Tiger attacks livestock

- Leopard attack for street dogs & other small animals

- Deer incursions for food & grazing in farmlands.

- Villagers gather in number to create noise in order to scare the predator away.

- Active tiger movement in & around the village.

- Forest guards use personal vehicle for patrolling & tiger allowance is given (which is less for the fuel).

- Incase of damage by wildlife, villagers/victims get equivalent renumeration. But they are not given to villagers on time. And no basic First-aid training

- They have makeshift system to create noise to scare away wild animals.

- No watch tower infrastructure at the forest guard check post to oversee incursions.

- Forest guards are under- equipped to protect villagers & animals & also to defend themselves.

- Lack of awareness amongst villager on how to confront wild animals.

- Local villagers are hired as guards as they are aware of the area & to increase awareness & employment opportunities.
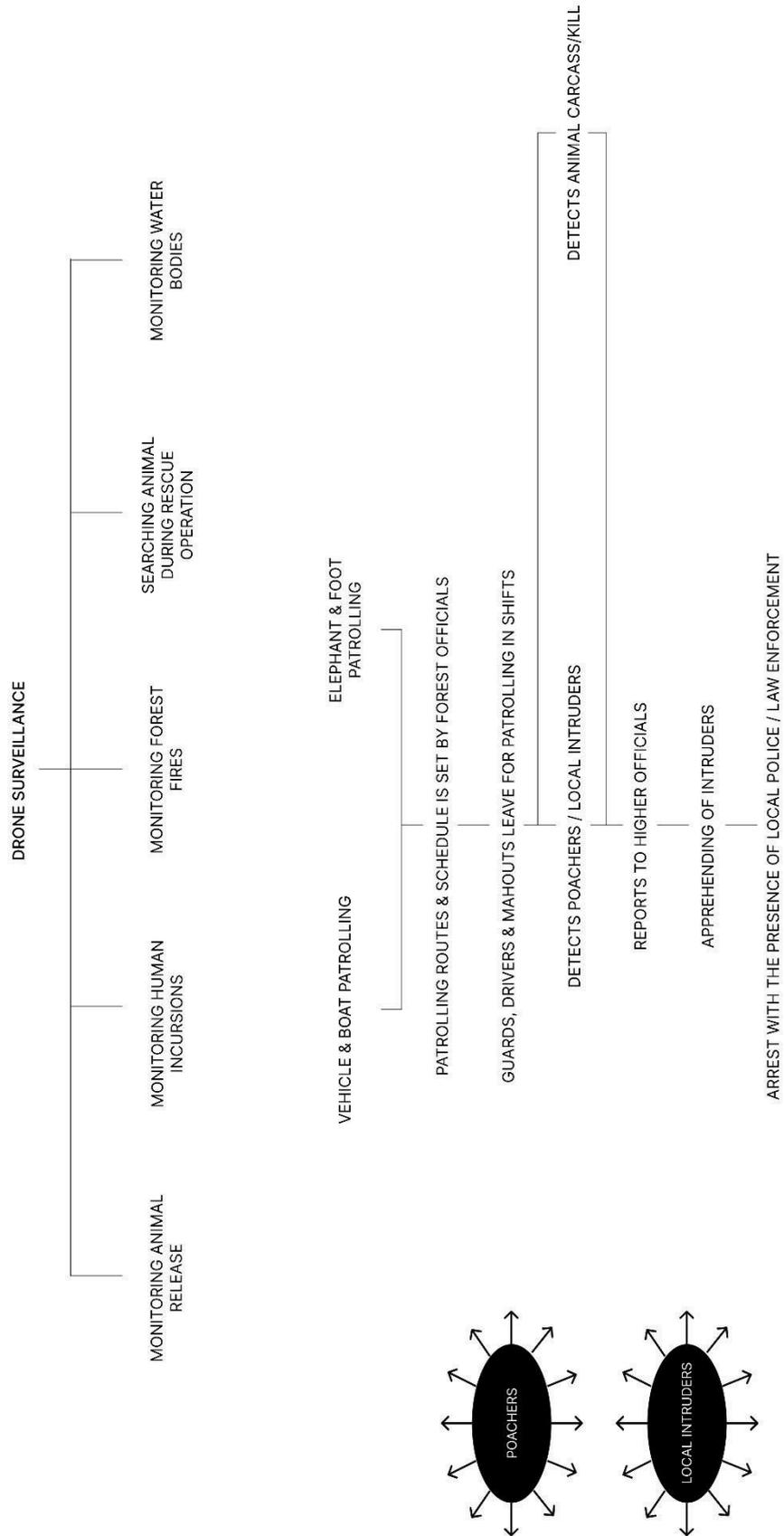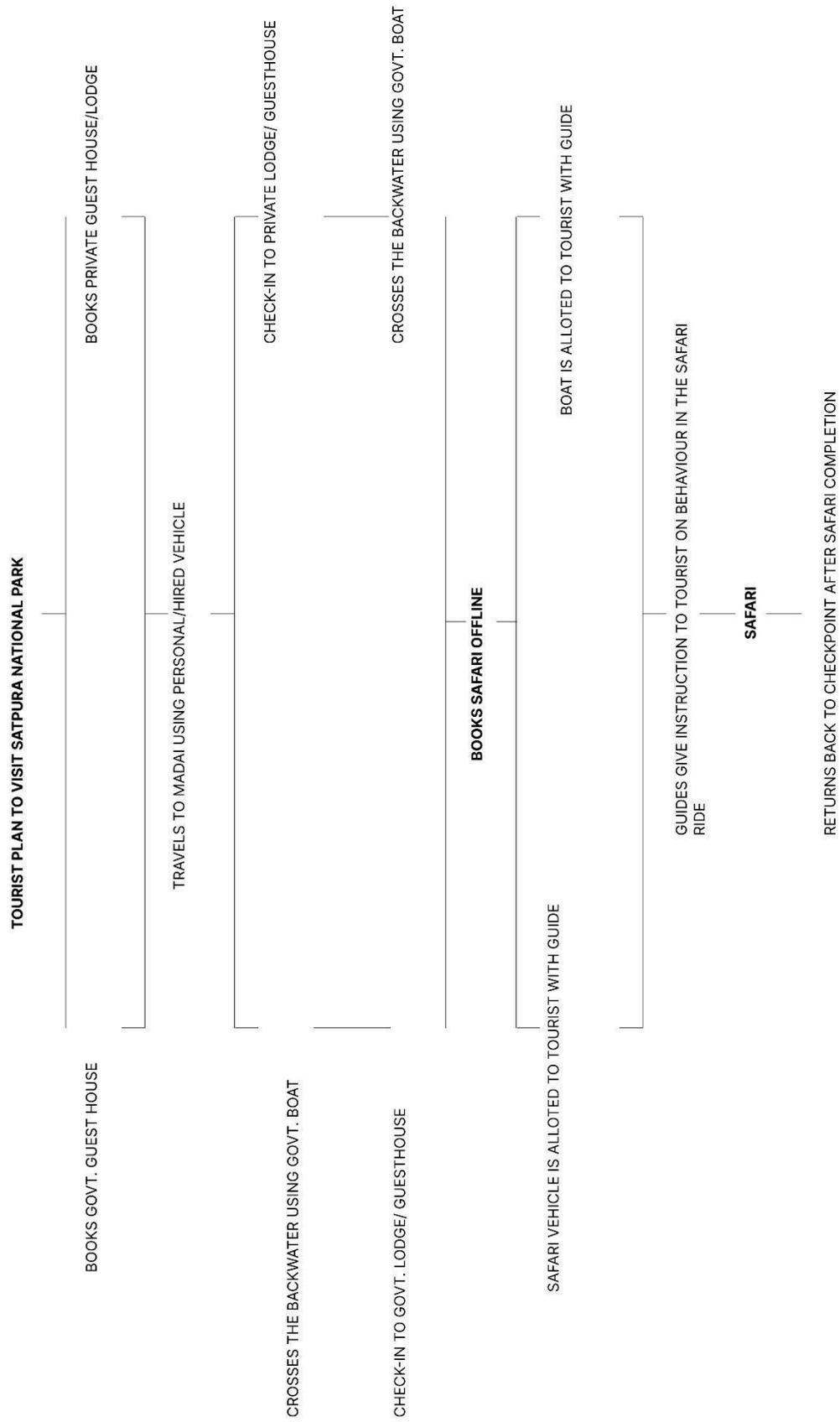
Satpura National Park – Existing System Map

Wildlife Rescue System Map

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ANIMAL DETECTED/ RESCUED BY VILLAGERS OUTSIDE THE RESERVE

ANIMAL DETECTED/ RESCUED BY GAURDS OUTSIDE THE RESERVE

SPECTATORS

INFORMS FOREST GUARDS

INFORMS HIGHER OFFICIALS

INFORMS RESCUE TEAM IN NARMADAPURAM

RESCUE TEAM ALONG WITH VEHICLES RESPOND TO CALL

53 Km 1hr 16 min RESPOND TIME

RESCUE TEAM REACHES LOCATION

ANIMAL BEHAVIOUR ASSESSMENT

READYING THE RESCUE VEHICLE

RESCUE PLANNING

RESCUE OF ANIMAL

MEDICAL TREATMENT IF NEEDED

VET TEAM

RELEASE OF RESCUED ANIMAL INTO WILDLIFE

ANGRY CROWD

CROWD CONTROL

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Surveillance and Patrolling System Map

DRONE SURVEILLANCE

MONITORING ANIMAL RELEASE

MONITORING HUMAN INCURSIONS

MONITORING FOREST FIRES

SEARCHING ANIMAL DURING RESCUE OPERATION

MONITORING WATER BODIES

VEHICLE & BOAT PATROLLING

ELEPHANT & FOOT PATROLLING

PATROLLING ROUTES & SCHEDULE IS SET BY FOREST OFFICIALS

GUARDS, DRIVERS & MAHOUTS LEAVE FOR PATROLLING IN SHIFTS

DETECTS POACHERS / LOCAL INTRUDERS

DETECTS ANIMAL CARCASS/KILL

REPORTS TO HIGHER OFFICIALS

APPREHENDING OF INTRUDERS

ARREST WITH THE PRESENCE OF LOCAL POLICE / LAW ENFORCEMENT

POACHERS

LOCAL INTRUDERS

Safari and Tourism System Map

TOURIST PLAN TO VISIT SATPURA NATIONAL PARK

BOOKS PRIVATE GUEST HOUSE/LODGE

BOOKS GOVT. GUEST HOUSE

TRAVELS TO MADAI USING PERSONAL/HIRED VEHICLE

CHECK-IN TO PRIVATE LODGE/ GUESTHOUSE

CROSSES THE BACKWATER USING GOVT. BOAT

CROSSES THE BACKWATER USING GOVT. BOAT

CHECK-IN TO GOVT. LODGE/ GUESTHOUSE

BOOKS SAFARI OFFLINE

BOAT IS ALLOTED TO TOURIST WITH GUIDE

SAFARI VEHICLE IS ALLOTED TO TOURIST WITH GUIDE

GUIDES GIVE INSTRUCTION TO TOURIST ON BEHAVIOUR IN THE SAFARI RIDE

SAFARI

RETURNS BACK TO CHECKPOINT AFTER SAFARI COMPLETION

Design Interventions

We conducted a comprehensive analysis of the issues across all sectors of our study. We cross-validated these findings with our secondary research to identify key focal points for further attention and action.

Following are the points:

- Very crude animal transfer cages (no padding etc))
- Better weather protection for staff while on duty (vehicle canopy, etc))
- Old vehicles still in use hence lack modern tech and equipment
- Opportunity for better safety systems for field staff
- Need of a good quality 4x4 replacement of gypsy
- No centralized system to track vehicles and staff in forest area.
- No satellite/navigation systems across the national park area
- Lack of basic amenities, first aid kit in all vehicles, timely audit, maintenance
- Need for frequent awareness campaigns on confronting animals.
- Solution to make vehicles less noisy.
- Opportunity for better quality cages & emergency medical services for animals
- No provision for equipment storage in rescue & surveillance vehicles
- 4*4 ambulance for forest area
- Requirement of good quality, modular stretcher
- Lack of inter-vehicular communication systems
- Do we need more roads?
- Lack of electronic and safety systems
- Lack of standard uniform set which are on-par with private lodges.
- Lack of docs and camera mounts in safari vehicles
- No proper lighting solution, in and out of the vehicles
- No on-ground medical staff or services.
- No standardized hospitals for animals and humans.
- Nearest is 60 km away.
- Direct modified vehicle still not available. (Too much time delay in modification process)
- Using technology to avoid human intervention into the national park for conservation activities.

These were further bifurcated into broad groups:

- Inclusion of Ecologists and Wildlife experts in all infrastructure planning around national parks and protected areas
- Medical Systems

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- Awareness Campaigns
- Vehicular Interventions
- Centralized System for Monitoring Staff and Vehicles
- Policy Suggestion for gear and equipment
- Communication and tracking Framework proposals
- Surveillance and Technology

Impact Assessment of Solutions

Upon discussing and finding out key points, we did an impact assessment of all the possible solutions to figure out which solutions can be worked on.

HIGH EFFORT

HIGH IMPACT

LOW IMPACT

LOW EFFORT

No centralized system to track vehicles and Staff in forest area

need of a good quality 4x4 replacement of Gypsy

Using technology to avoid human intervention into the national park for conservation activites.

4*4 ambulance for forest area

old vehicles still in use hence lack of modern tech and equipment

No on-ground medical staff or services. No standardized hospitals for animals and humans. Nearest is 60 km away.

opportunity for better safety systems for field staff

Lack of electronic and safety systems

Direct modified vehicle still not available. (Too much time delay in modification process)

better weather protection for staff while on duty (vehicle canopy, etc)

No proper lighting solution, in and out of the vehicles

Requirement of good quality, modular stretcher

NO SATELLITE/NAVIGATION SYSTEMS ACROSS THE NATIONAL PARK AREA

NO PROVISION FOR EQUIPMENT STORAGE IN RESCUE & SURVEILLANCE VEHICLES

SOLUTION TO MAKE VEHICLES LESS NOISY

OPPORTUNITY FOR BETTER QUALITY CAGES & EMERGENCY MEDICAL SERVICES FOR ANIMALS

LACK OF BASIC AMENITIES, FIRST AID KIT IN ALL VEHICLES, TIMELY AUDIT, MAINTENANCE

NEED FOR FREQUENT AWARENESS CAMPAIGNS ON CONFRONTING ANIMALS

Ideations for each problem statement:

This was followed by putting out ideations for each of the above briefs to get the widest spectrum of solutions possible for each brief.

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problem	solutions no.1	solutions no. 2	Solution 3	solution 4	solution 5	solution 6	solution 7	solution 8	solution 9
OPPORTUNITY FOR BETTER QUALITY CAGES & EMERGENCY MEDICAL SERVICES FOR ANIMALS	Padded cages	modular cages	Humidifiers	Water for animals inside cages					
Requirement of good quality, modular stretcher	COLLAPSIBLE STRECHER FOR EASY STOWAGE	electric assisted stretchers for easy movement and less man power needed	stretcher to be odour resistant since many animals to be transported		stretcher as a extended version of the ambulance itself				
LACK OF BASIC AMENITIES, FIRST AID KIT IN ALL VEHICLES, TIMELY AUDIT, MAINTENANCE	FOREST DEPARTMENT GEAR SET DESIGN	MEDICAL TRAINING FOR THE STAFF	AUDIT BOARD TO MONITOR & REGULATE						
NEED FOR FREQUENT AWARENESS CAMPAIGNS ON CONFRONTING ANIMALS	Introduction of Games related to wildlife preservation		AUDIOVISUAL CAMPAIGNS IN RURAL AREAS	SUMMER CAMPS FOR CHILDREN TO ENCOURAGE CONSERVATION		Ads related to the conservation of wildlife			implementation of an app that can accommodate all the features from survilieance, tags, latest information, updates, rules and regulations, ease communication.
NO PROVISION FOR EQUIPMENT STORAGE IN RESCUE & SURVEILLANCE VEHICLES	mesh covered storage	grapple hooks	EASY ACCESSIBLE EQUIPMENT STORAGE	PREDEFINED STANDARD EQUIVENT SET FOR A RESCUE VEHICLE					implementation/ development a new vehicle to counter al the vehicle related issues and technological interventions for the benefitting of the national parks.
No proper lighting solution, in and out of the vehicles	better quality lighting, using dots and projector lamps		IR LIGHTING IN ORDER FOR DISCRETE SEARCHING & PATROLLING						
better weather protection for staff while on duty (vehicle canopy, etc)	GPS tracking on suits	fire resistant, durable clothing	DURABLE UTILITARIAN UNIFORM FOR ALL WEATHER CONDITION	TENTS & SLEEPING BAGS TO CAMP AT NIGHT				gumboots can be provide to the foot-patroliers in the period of heavy rain to ease their work.	
opportunity for better safety systems for field staff					EV cycles can be used for the for patrolling, adding sustainability in the perspective.				
Ambulance for forest area	4*4 vehicle with standard forest eqp		EV ambulances can be used to reduce park for animals.		ambulances to also work as rescue and patrol units	small, portable medical units that can be shifted to different vehicles in case of emergency	crawling features to be introduced in the vehicles to counter tough terrains and better grip in slippery surfaces.		
No centralized system to track vehicles and Staff in forest area	control centre (concern) to be established in buffer zone					Application to monitor all the vehicles entering the national park to monitor the activity.			
old vehicles still in use hence lack of modern tech and equipment	replacement vehicle for Gypsy	jeep like modularity for vehicles	EV introduction	vehicle fited with continuous track for off-road heavy duty work					
Using technology to avoid human intervention into the national park for conservation activities.	drone patrolling instead of foot patroling	LIDAR scanning of forests to monitor geographic changes and wildlife mgmt	motion sensors to detect the direction of the movement of humans in the national park	satellite provided data collection and surveillance	thermal imaging to monitor wildlife activity at night	Automated fire detection Use sensors and cameras to detect fires in the park, and automatically notify park authorities.	Smart fences: Install smart fences that are equipped with sensors and cameras to track animal movement and prevent illegal entry into the park	Mobile emergency alert on the person who just entered the national park unknowingly	

A glimpse of all the 90 something ideations for each problem statements.

For final step, we distributed the solutions into three basic headings: awareness, product and system level solutions.

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Awareness Level solutions:

- Introduction of ideathon & competitions to get new ideas for conservation efforts.
- Medical training for the staff.
- Audio/visual campaigns in rural areas.
- Summer camps for children to encourage conservation.
- Requirement of repair shop inside the national park.
- Use virtual reality technology to create immersive educational experiences.

Product Level Solutions:

- An app that does surveillance, tags, latest information, regulations and ease communication
- 4*4 vehicle with standard forest equipment.
- Fire resistant, durable clothing with GPS Trackers fitted in the suits.
- portable vehicular medical units.
- Padded Modular Cages with provision to install humidifiers.
- tents & sleeping bags to camp at night.
- Water for animals inside cages.
- Electric assisted stretchers with Odour-resistant materials.
- EV ambulances can be used to reduce noise which makes the animals panic.
- Replacement for Maruti Gypsy.

System Level Solutions:

- Drone patrolling System.
- Implementation of a vehicle replacement program: on a scheduled basis.
- LIDAR scanning of forests.
- Satellite-based tracking system for data collection and surveillance.
- Motion sensors to collect data.
- Control Centre (ConCen) to be established in buffer zone.
- Thermal imaging to monitor wildlife activity at night.
- Field staff to be equipped with a tracker and walkie-talkie when on field.
- Automated fire detection: Use sensors and cameras to detect fires in the park, and automatically notify park authorities.

Policy Level Suggestions

We prepared few points which, if implemented into the policies by the government, might help strengthen the conservation efforts.

Policy Level Suggestions for Indian Government:

1. Implementation of a timely audit system to ensure the quality and efficiency of all services provided in national parks.

2. Involvement of wildlife experts, conservationists, and research institutes from the concept phase of infrastructure development projects near national parks to mitigate harm to wildlife.

3. Prioritizing allocation of funds towards the welfare of wildlife over developmental projects.

4. Restriction on land allotment and development activities within national parks and their buffer zones, considering that only 4% of land in India is designated as national parks.

5. Introduction of Ideathon competitions to encourage the creative community to contribute novel conservation ideas.

6. Prohibition of activities such as providing meals inside the core zones of national parks to minimize disturbance to wildlife.

Proposed System Map
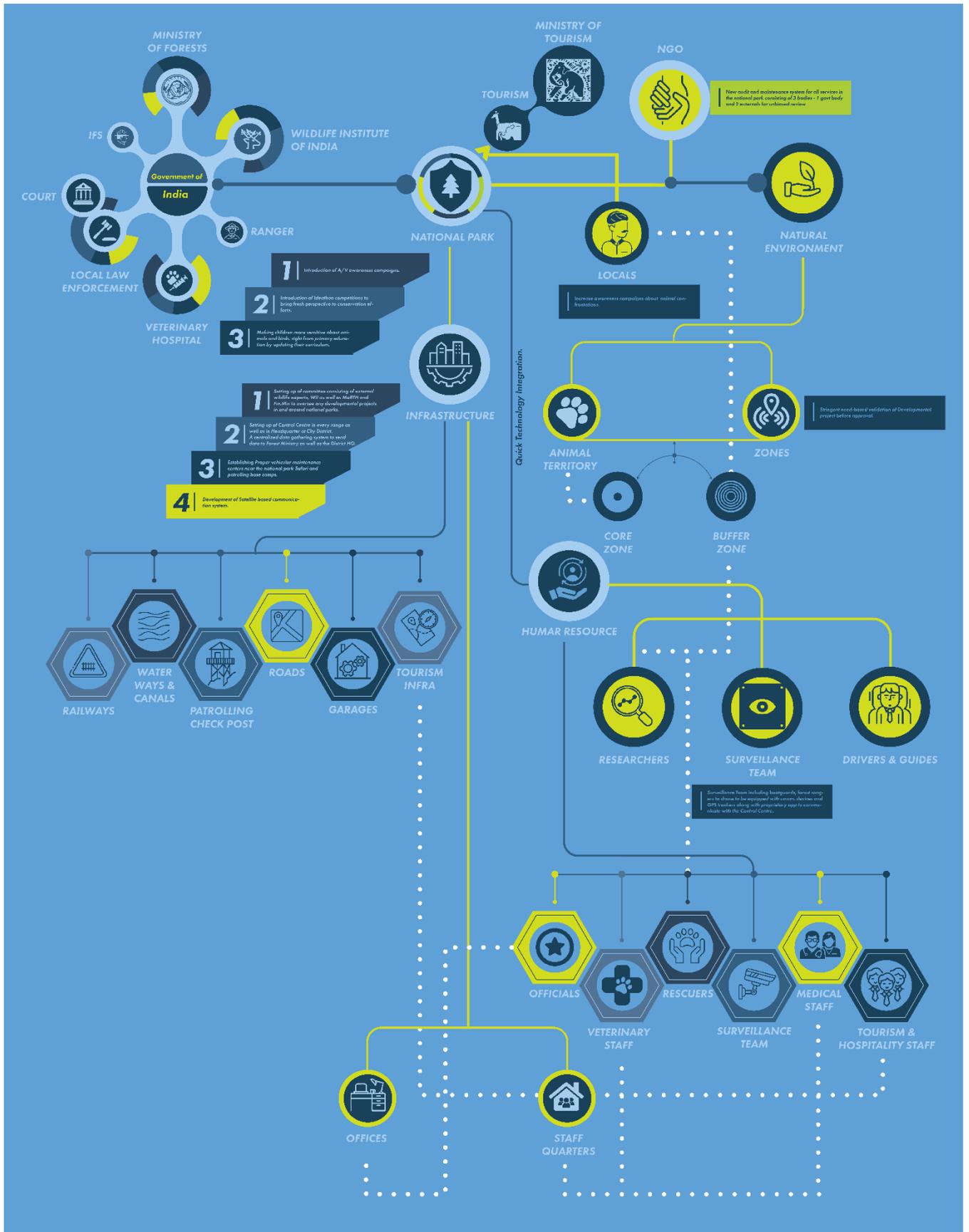
Design Proposals

We prepared two design proposals under the timeline of this coursework. First one was a communication system which would help connect all the stakeholders which are actively involved in the day-to-day tasks in the national park. Second being introduction of a vehicle platform which can be used as patrolling vehicle as well as safari and ambulances.

Communication System:

The inadequate communication infrastructure emerged as a prominent challenge within the national parks, leading to cumbersome processes and delays in conveying essential information. For instance, during safaris, vehicle breakdowns necessitated guides or drivers to trek to the nearest outpost, use walkie-talkies to contact the center, and request dispatch of a replacement vehicle. This approach posed risks, as individuals had to traverse the forest, vulnerable to potential animal encounters. Recognizing this, we identified an opportunity to establish a comprehensive communication system linking various stakeholders, including beat guards conducting deep forest foot patrols and the field director stationed at the district headquarters, often located several kilometers away. This unified communication system would enhance transparency, facilitate seamless data collection, and enable direct transmission to the Ministry of Forest's data bank. Implementation would involve equipping field officials with walkie-talkies or satellite-based communication devices, alongside provisions for such devices in nearby offices and the district headquarters.
Apart from data being transferred, communication was also important for forest officials, especially those on foot patrolling for months, to communicate with their families. This would help them keep themselves mentally satisfied as well as aid for their mental wellbeing.

Vehicles:

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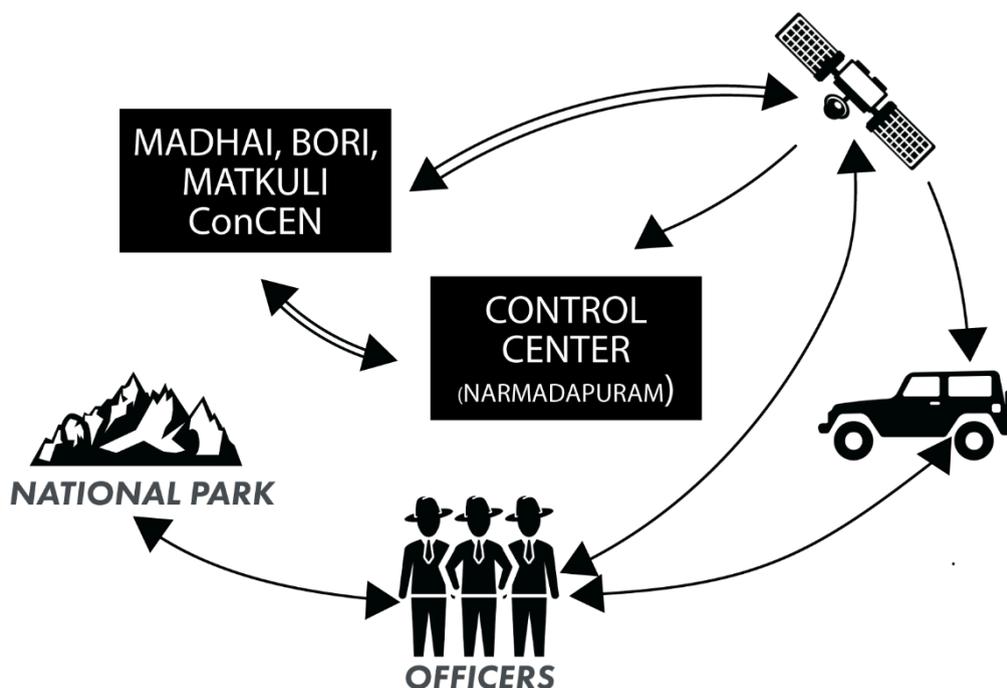
The current vehicles used were more than 20 years old Maruti Gypsy cars, which were lightweight, quiet and capable to go any terrain. All qualities required in a national park when on safari. But a worthy replacement is still not found. We take this opportunity to propose a design for a vehicle that would have a common chassis and front cabin. The rear bed will have replaceable modules for safari, ambulance, patrolling as well as surveillance vehicles as shown in the renders below. The reason for proposing a modular, replaceable vehicle is that the requirement of ambulances and rescue vehicles is comparatively very less as compared to safari and patrolling vehicles and this would help in reducing the overall maintenance cost of such vehicles. Electric Powertrain would help it remain quiet.

Safari Vehicle:

Ambulance Vehicle:

Wildlife Rescue Vehicle:

Surveillance Vehicle:

References

1. *Page 4* - IUCN - [pag-021.pdf (iucn.org)](pag-021.pdf)

2. *Page 5* – IUCN Indian National Parks - [10.1.doc (iucn.org)](10.1.doc)

3. *Page 6* – List of Indian National Parks [National Parks in India 2023- Total State Wise List PDF (adda247.com)](adda247.com)

4. *Page 12* – MoEFCC - [Official Website of Ministry of Environment, Forest and Climate Change, Government of India (moef.gov.in)](moef.gov.in)

5. *Page 19* – Dr. Ullas Karanth - [Meet Dr. Ullas Karanth (sanctuarynaturefoundation.org)](sanctuarynaturefoundation.org)

6. *Page 21* – Dr. YashVeer Bhatnagar - [Yash Veer Bhatnagar (ncf-india.org)](ncf-india.org)

Thank you.

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