The Apolitical Elephant

Assessing elephant ranging patterns across a political boundary in a human-dominated landscape, Eastern Ghats, India

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Project Update - Final

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Submitted to

The Rufford Foundation

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Acknowledgements

The study could not have been realized without the immense support and contribution of a portfolio of individuals, governmental and non-governmental organizations, including the generous funding and support of the Rufford Foundation, to all of whom we are indebted. We would also like to specially acknowledge the Karnataka and Tamil Nadu state Forest Departments for necessary permissions, logistic support and timely advise.

Very special thanks are due to the elephants that we have been studying, some of whom we have come to know as an 'individual' rather than 'an elephant'. We thank them for providing us with this incredible opportunity to chance a glimpse of their lives, for being kind enough in allowing us to observe and be with them for long hours, for showing the various facets of their behaviour, all of which has helped enrich our understanding of them and inform the world of their lives.

Background

Asian elephants have large home ranges of 14 to 3000 km^2. With drastically enhanced habitat loss, fragmentation and degradation, their homerange now often overlaps with human-use areas resulting in aggravated human–elephant conflict. While elephants appear to be increasingly adapting to these changes, such conflict creates enormous antagonism among local communities towards elephants. This has emerged as one of the greatest challenge to the survival of Asian elephants in the 21st century across its range.

In many habitat countries including India, where elephants range across state/administrative borders, each state department, forest or administration, is concerned in mitigating conflict only within their jurisdiction. With little inter-state consultation or cooperation to manage elephants at the landscape level, both, the local people and elephants, wedged between state politics and *ad hoc* mitigation strategies, suffer the brunt of conflict through loss of life and property. More implicitly, such improper management strategies alter the regular ranging pattern of elephants, often severely disrupting their social organisation, and leading to the spread of conflict to newer areas.

This project seeks to address the critical issues of elephant conservation and management in a human-dominated landscape along the inter-state boundary of two southern Indian states, Karnataka and Tamil Nadu that witness severe levels of human-elephant conflict. The collection of baseline information on spatio-temporal patterns of elephant distribution, the extent and range of human-elephant conflict and an assessment of the perception of local people towards elephants and mitigation measures used, at the landscape scale, would significantly add to our understanding of the dynamics of human-elephant interactions. Incorporation of such basic information in conflict mitigation plans should be the first step towards informed conservation of this increasingly endangered species.

This study also emphasises the need to manage elephants at the landscape level due to their large homerange and pervasive movements across administrative boundaries rather than the conventional territory-based approach. Linking local farming communities and state forest departments, who are both comparably affected by human-elephant conflict, through information linkages on daily and seasonal habitat usage by elephants can improve stakeholder coordination in elephant management, both within and across the affected states. Such cooperative action towards conflict mitigation in the long term may dissuade the local people from adopting *ad hoc* measures, such as elephant drives, which adversely impact both the people and the elephants in the region and instead facilitate the development of more sustainable, long-term management plans for both, the elephants and the affected people, in the landscape.

Methods

The patches regularly used by elephants across the landscape were mapped and the perception of local stakeholders towards elephant movement through these patches was assessed. Information on patch or habitat use by elephants was collected at seasonal scale. Such mapping exercises would help identify contiguous patches for elephant movement, with least stakeholder resistance which could then potentially become effective corridors over time. *Facilitating the movement of elephants across this human-dominated landscape by informing and receiving consent from the local stakeholders can significantly reduce conflict in the region.*

Local community members and forest department staff were trained in monitoring elephant movement and conflict in the region at the beat-level (5 to 10 km^2). Information on the presence of elephants in an area, group size and general directions of movement on a daily and seasonal basis were collected. *A regular sharing of this information with local stakeholders and its incorporation in conflict mitigation planning across the states would strongly aid in reducing conflict and relieve people from the daily stress of conflict.*

Members from Forest Divisions across two states and local community members were informed and educated regarding the need to manage human-elephant conflict in this landscape effectively through interactive meetings, workshops and talks. *This information can also be used by concerned agencies in their efforts to provide conservation education in conflict-affected areas, both in the region or elsewhere.*

Activities

The following activities were carried out during the project period:

1. Mapping the spatio-temporal patterns of elephant distribution and human-elephant conflict in areas along the state boundary between Karnataka and Tamil Nadu.

2. Assessing the perceptions of local stakeholders towards elephants with specific reference to elephant movement and conflict across human-dominated areas.

3. Identifying elephant movement patches in the landscape and sharing baseline information to facilitate inter-state, coordinated elephant management and conflict mitigation strategies.

Study Area

This study was conducted in the Bangalore-Hosur region of the Eastern Ghats landscape in southern India. The study site is a matrix of human habitations, croplands and elephant habitats, ~1000 km^2 in size, along an 80-km stretch of the boundary between the states of Karnataka and Tamil Nadu. It is comprised of elephant conservation areas such as the Bannerghatta National Park and Cauvery and Hosur Wildlife Sanctuaries. The region records an average annual conflict level of about 1450 cases of crop damage. On an average, about five people have been killed or injured by wild elephants, and five elephants killed in retaliation or poached annually over the last two decades in the region.

Chapter 1

The Land of Elephants and People

An assessment of land-use types and human activity across the state borders

The Land of elephants and people

A total of 75 forest department staff and an equal number of villagers from five most human-elephant conflict affected talukas were interviewed with the purpose of understanding the land of the elephants and people. In addition a total effort of more than 500 km was invested in traversing the 50 sampled beats (the smallest administrative unit of the forest department) mostly on foot and by using vehicle to document the land use types, various human activities including infrastructural activities within or close to the forest beats, status of elephant habitat, demography, and status of conflict and its mitigation. The results of the first five chapters in the report is largely based on these surveys and hence is a combination of quantitative data collected through interviews, coupled with quantitative assessment through direct observation of the above mentioned factors.

It is well know that fragmented habitats with hard boundaries between forests and human-dominated areas experience human-wildlife conflict and higher levels of human activities that are incompatible with the needs of the wildlife thus posing a serious challenge to the conservation and management of wildlife.

The natural and modified land use types

Data on the presence or absence of 8 different land use types within each beat in the study site (SS) was collected by speaking to the experienced forest staff and while carrying out ground truth surveys. The land use types was further classified into land use type natural (LUN) which included dry deciduous forest (DDF), scrub forest (SF), Riverine patches (R) and Rocky Outcrops (RO)and the modified land use types (LUUN), which included forest plantations (PL), crop fields (CF), human habitations (HH) and gomaal land (GL). The value for each category was estimated based on the presence (1) or absence (0) of the feature in that beat, calculated across all the beats for the particular division. For example, if DDF was mentioned to be present across the 50 beats, then the value for DDF would be 1. If it were mentioned to be present in only 25 of the 50 beats then its value would be 0.5. A cumulative score for LUN and LUUN would be a fair indication of the land use within each division (Table 1 and 2).

DDF	SF	R	RO
0.93	0.86	0.68	0.89

Table 1: Shows the cumulative beat score for each division for natural land use types

PL	CF	HH	GL
0.86	0.43	0.43	0.18

Table 1: Shows the cumulative beat score for each division for modified land use types

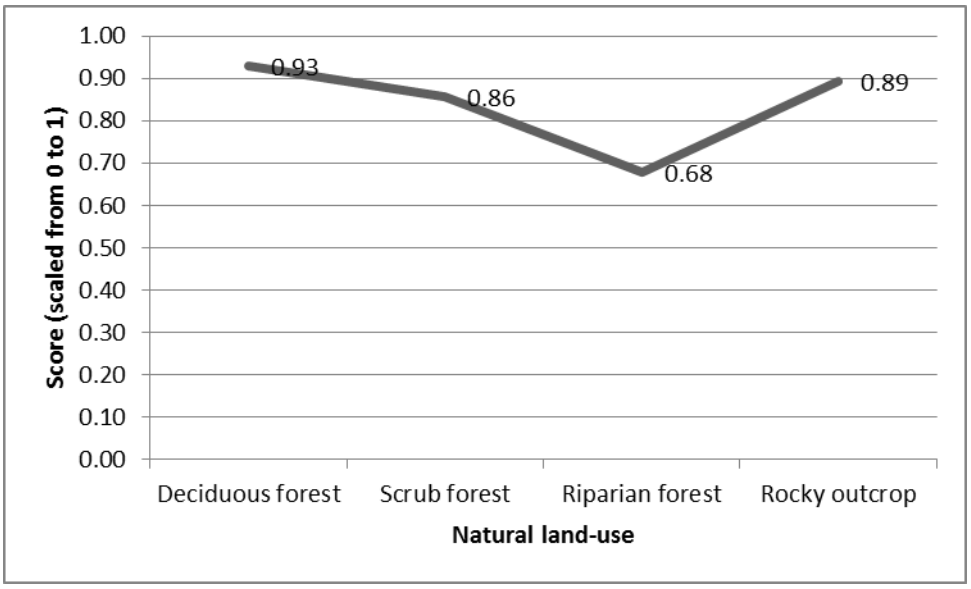


Figure 1: Natural landuse types and intensity in the study region

The results show that all four LUN types occur almost to an equal extent and have forest plantations of mostly Acacia sp. and Eucalyptus sp. well represented across the beats. But these regions also have crop-fields and human habitations interspersed with the forested habitats at fairly high levels of 0.43.

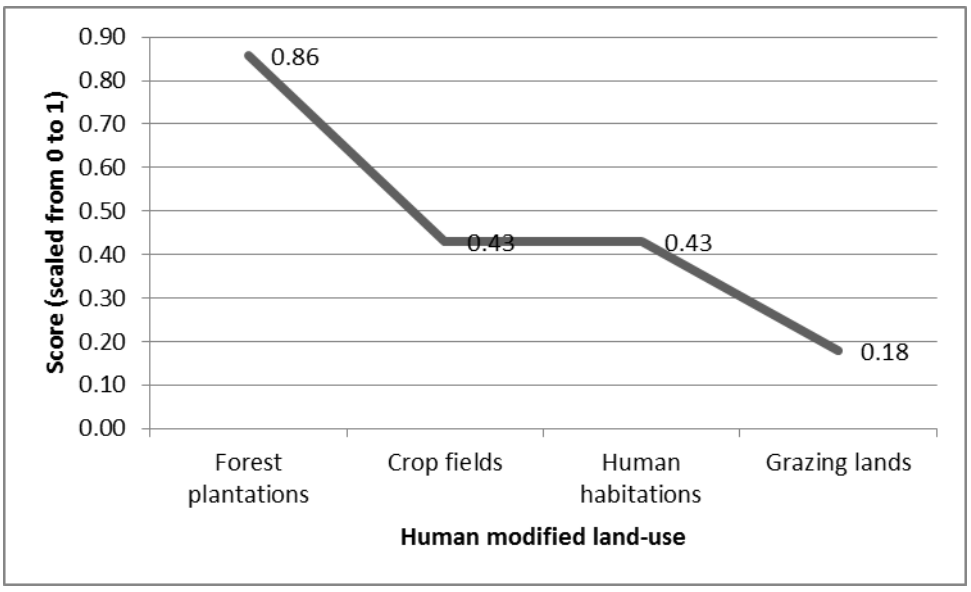


Figure 2: Human-modified landuse types and intensity in study site

The human activity types within the forested beats

Data on the presence or absence of 8 different human activity types within each beat was collected by speaking to the experienced forest staff and while carrying out ground truth surveys. The different human activity types (HUA) within each beat included, livestock grazing (LG), firewood collection (FC), non-timber forest produce collection (NTFP), poaching or smuggling (P/S), fire (F), stone quarrying (Q), sand mining (SM) and tourism related activities (T). The value for each category was estimated based on the presence (1) or absence (0) of the feature in that beat, calculated across all the beats for the particular division. For example, if LG was mentioned to be present across all the 50 beats, then the value for LG would be 1 and if it were mentioned to be present in only 25 of the 50 beats then its value would be 0.5. Note that activities such as Q and SM were scored as presence for a beat even when the quarry or sand mining site was adjacent to the beat and not necessarily within, as the impact of such activities is expected to be on a larger area.

Figure 3 shows that activities such as LG and F are known to occur in most beats across the regimes, only its intensity is known to vary. As expected, poaching cases were largely unreported or under-reported during the survey and hence we decided to use data on historical poaching instead to assess the senstitivity of the region with respect to poaching. Quarrying (Q) and Sand mining (SM) was reported to the highest extent of 0.14 and 0.25 respectively.

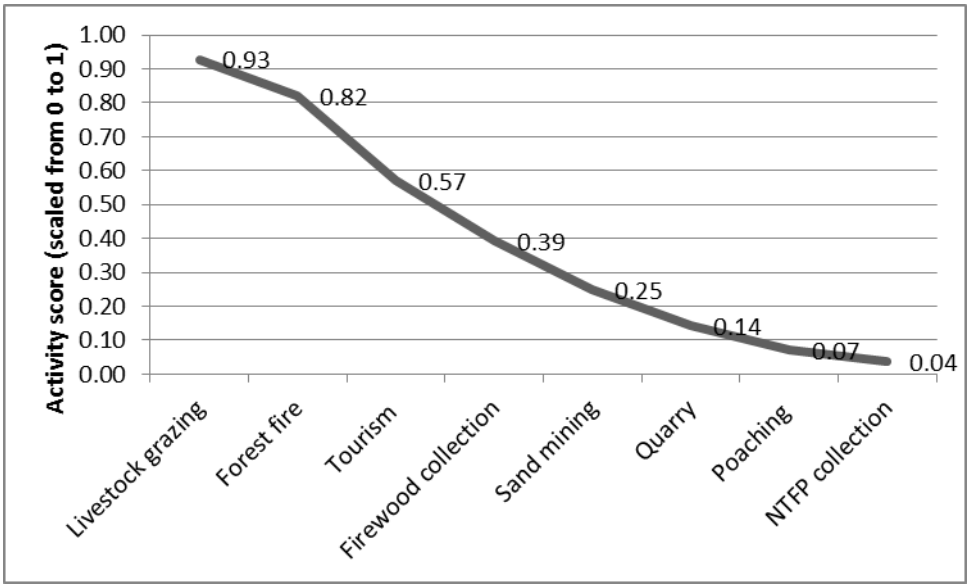


Figure 3: Human activity types and intensity in the study region

Mega projects in elephant land

Although human activities such as the ones discussed in the above paragraph tend to change behavioural reposnses in elephants, such as alteration in their time-activity budget, becoming mostly nocturnal in highly disturbed areas and vacating the area for short to long durations in the case of poaching. Most of the activities listed above are reverslible through increased protection and planning. However, large scale infrastrucutre projects such as dams, railway lines and mining have a long-term and mostly irreversible impact on the habitat use and behaviour of the elephants. This may include displacement of elephants from a portion of their home range, fragmenting the habitat and increasing the risk of accidental deaths, and sustained pressure from increased human traffic and reduction in available habitat.

Data on the presence or absence of 6 different infrastructure types within each beat was collected by speaking to the experienced forest staff and while carrying out ground truth surveys. The different infrastructural activities (IA) within each beat included, dams (D), hydro-electric power station (HPS), metalled roads (MR), high-tension electric power lines (EPL), canals (C) and railway lines (RL). The value for each category was estimated based on the presence (1) or absence (0) of the feature in that beat, calculated across all the beats for the particular division. For example, if HPS was mentioned to be present across all the 50 beats, then the value for HPS would be 1 and if it were mentioned to be present in only 25 of the 50 beats then its value would be 0.5. The result of this activity is shown below.

The most prevalent IA type was the presence of metalled roads, these include highways, major district roads and other metalled roads. Metalled roads passing through all the beats were reported to an extent of 0.71.

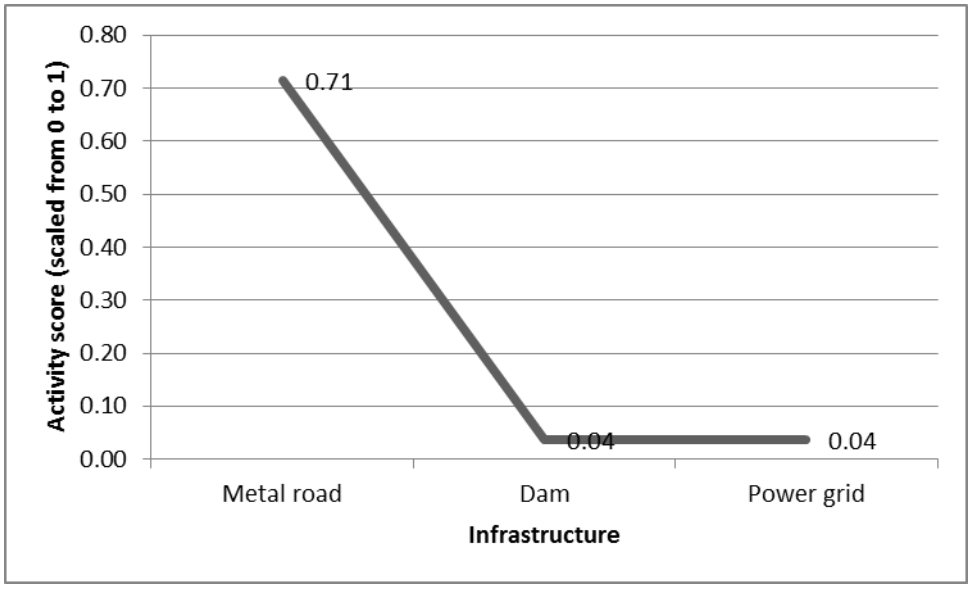


Figure 4: Major infrastructure activities within the study region

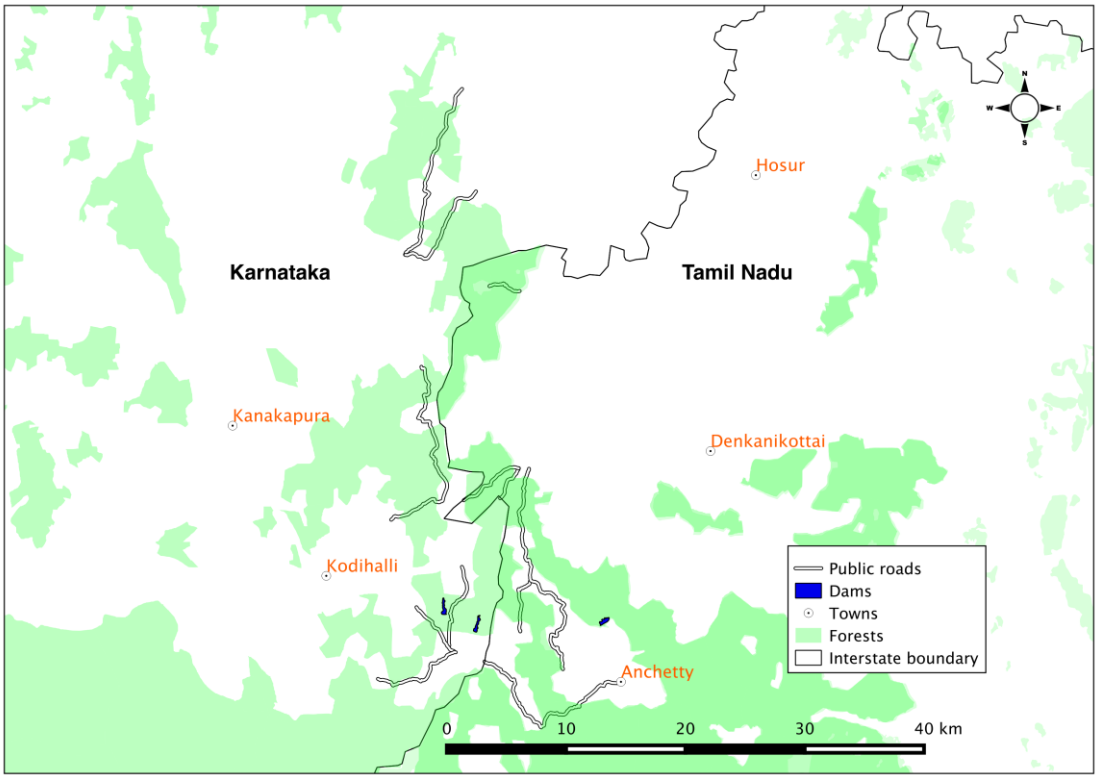


Figure 5: Map of the infrastructure activity within the study region

Chapter 2

The Elephants in Space and Time

A spatio-temporal assessment of occurrence and use of habitat

Elephants in Space and Time

Data on the presence or absence of elephants, duration of stay, place of stay and movement pattern in each beat was collected in an area spread across nearly 500 km^2. The spatio-temporal aspects of elephant occurrence in an area was documented by interviewing the forest personnel and villagers and through direct sighting by investing an effort of 2000 km across the beats, traversed on foot and in vehicle. As expected, all the beats showed the presence of elephants.

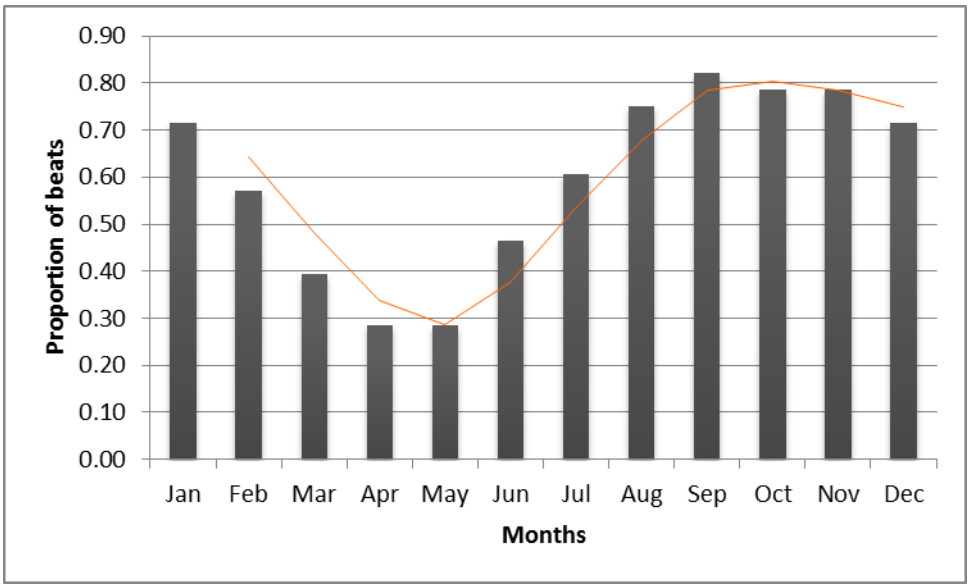


Figure 1: Seasonality in elephant occurrence in the study region

The occurrence of elephants in a beat was arrived at by asking the beat watchers if the elephant visitation and sighting within their beat was on a daily, weekly, monthly or yearly basis. The value for each category was estimated based on the presence (1) or absence (0) of the elephant in that beat under the four categories, calculated across all the beats for the particular division. For example, if elephants were encountered in the beat on a daily basis (D) across the 50 beats then the value for D would be 1 and if it were in only 25 of the 50 beats then its value would be 0.5. The elephants showed a high degree of seasonality in their occurrence across most of the surveyed beats. Most beats report elephant sightings on a weekly or monthly basis.

In order to further understand the temporality in elephant occurrence at an annual scale in the study area, we further classified the sighting or occurrence of elephants in each beat on a monthly basis (12 months). For example, if all the 50 beats had elephants occurring or being sighted in the month of January (Jan) then a value of 1 will be attributed to the month of Jan. If only 25 of the 50 beats reported elephant occurrence it would take the value 0.5. From the results it can be clearly seen that, elephant occurrence peaks in the months between Sep and Jan with the lean being in the months of Mar, Apr and May.

A clear rise in elephant occurrence or sighting could be observed in the monsoon and post-monsoon seasons till the month of January when the crops are being dried and processed. The increase in elephant occurrence coincides with the period during which the new flush of bamboo

that is spread profusely in the altitude between 700 to 1000 m above msl occurs and is available to elephants. With its long interface with human habitations, this region is also traditionally known for its conflict. The peak in elephant sighting or occurrence well into the post-monsoon season could be driven by availability of crops in the region. Reporting of elephants could also be high in this season in particular as the field staff engage more in elephant related activities such as crop guarding and conflict mitigation. This is further corroborated by the data on participatory monitoring of elephants, as almost an equal number of elephants have been reported per sighting across the monsoon (Jun to Sep), pre-monsoon (Feb to May) and post-monsoon (Oct to Jan) periods within the forest through direct observation by the field staff. It could be that even if the number of elephants is less during the cropping season, since the elephants are involved in crop raiding, simply because crops are available as fodder, and hence elephant occurrence is reported to be high. A correlation between number of elephants and the extent or level of conflict therefore may not be true in this case. However, one cannot deny the fact that the presence of elephants is felt the most in the post-monsoon season within the region.

Interestingly, on asking the field staff, what they think is the reason influencing the length of stay of elephants in their beat, they reported that along with forage (F) and water (W), the apsect of safety and undisturbed locales (Saf) was important for elephants. Even migratory route (MR) was mentioned among the beats indicating that some of the beats might be used exclusively for movement by elephants occuring in this region, further corraborating the findings on the LOS.

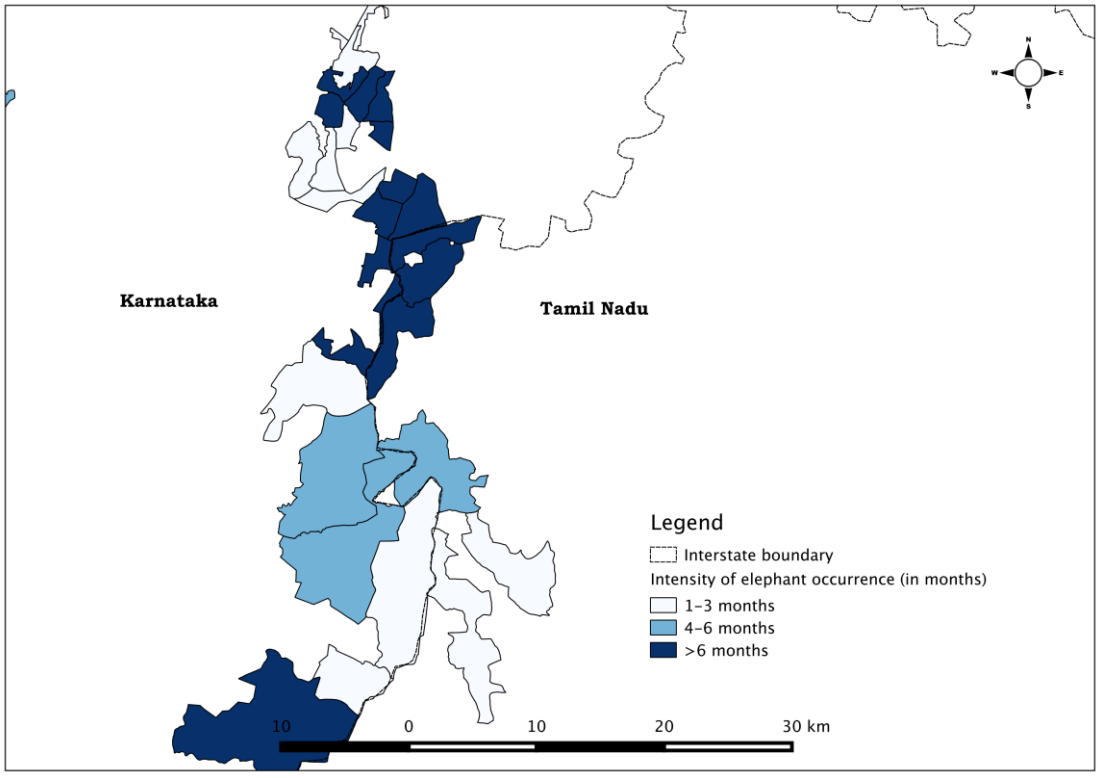


Figure 2: Length of Stay (LOS) of elephants in the study region

Elephants are known to respond to changes in the local ecological and anthropogenic settings, and social organization in elephants might be a very good indicator of the type of stressors in the region. The most frequently encountered social group types in elephants per beat was classified into 6 categories. Beats in which there were no elephants as Nil (0), beats in which only herds were encountered (H, 1), only solitaries (S, 2), only all-male groups (AMG, 3) and in which a combination of these, namely solitary and herds (SH, 4), solitaries and AMG (SAMG, 5) were seen. The presence (1) or absence (0) of each of the category in a beat was scored and a cumulative value for the division under each catergory obtained. For example, if all the 50 beats reported sighting only herd (H) then a value of 1 would be given to H, if only 25 of the 50 beats reported sighting only H, then it would get a value of 0.5.

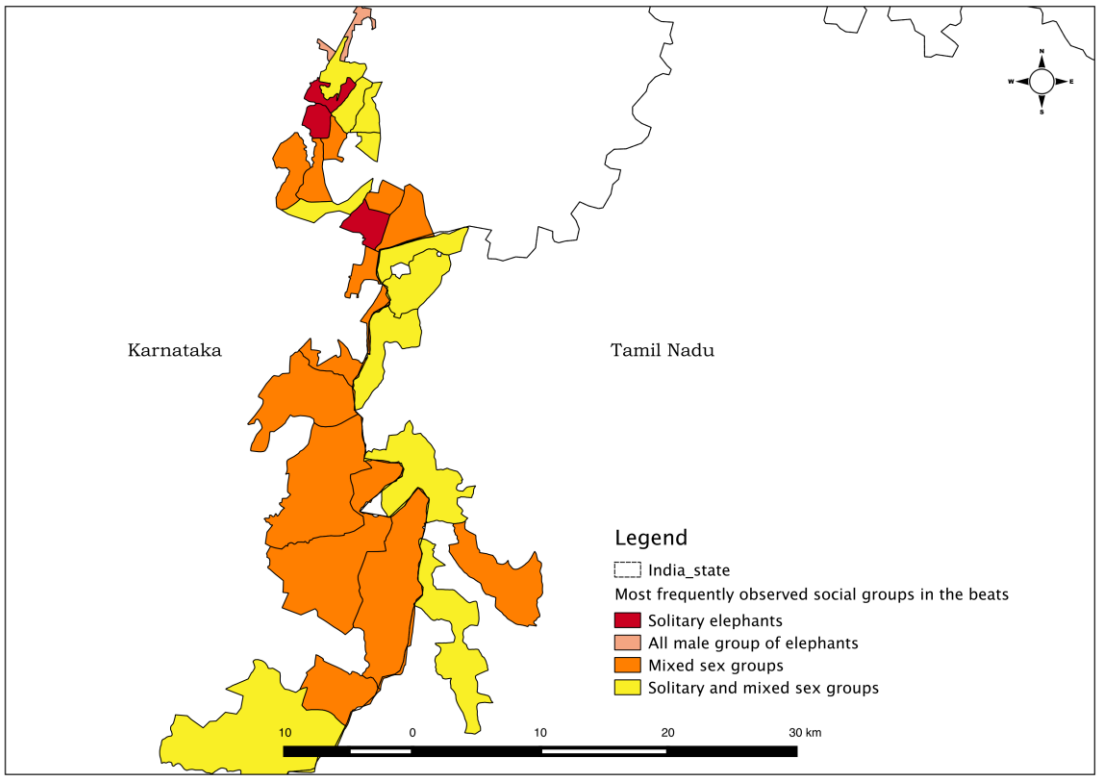


Figure 3: Occurrence of most commom group types in the study region

Chapter 3

The Antagonistic Interaction between Elephants and People

An assessment of conflict levels and its determinants

Human-elephant conflict in the region – status

All the beats, reported conflict incidence to have occurred within the last five years. However, conflict in the majority of beats was limited to the boundary between human-habitations and forested areas and was not spread across the entire beat.

The conflict between humans and elephants, a negative interaction between the two mega-vegetarians in this case is being assessed in terms of loss or damage to property and life. We have not accounted for the emotional and other innate loss or cost which is associated with such antagonistic interactions. Damage to property was measured in terms of crop damage, present (1) or absent (0), damage to infrastructure, present or absent and injury or loss of life of humans and elephants, present or absent. In order to estimate the duration and intesity of conflict in ther region, respondents were asked about the occurrence of conflict in their beat across the months in a year. The value for each month was estimated based on the presence (1) or absence (0) of HEC in that beat, calculated across all the beats for the particular division. For example, if HEC was reported in the month of January across the 50 beats, a value of 1 would attributed to the month of Jan, if it were reported in only 25 of the 50 beats in the month of Jan then its value would be 0.5. We also carried out a similar exercise to understand the types of property damaged across the divisions as this might be a good indication of the behavioural change in elephants and increased habituation to conflict situations. An effort was also made to assess the deaths of elephants and people in the area, its cause.

All the beats reported loss of both subsistence and plantation crops. However, the damage to crops was seasonal, with some of the beats experiencing longer periods of conflict than others. The study region has a conflict peiord of six months from August to January, with values of 0.46, 0.82, 0.82, 0.75 and 0.61 for the months of Aug, Sep, Oct, Nov and Dec repsectively. All the beats report conflict in the month of September and October. There is also considerable conflict in the dry season months of Jan and April, attributed mostly to male elephants and the lean season is for a period of three months between May and July.

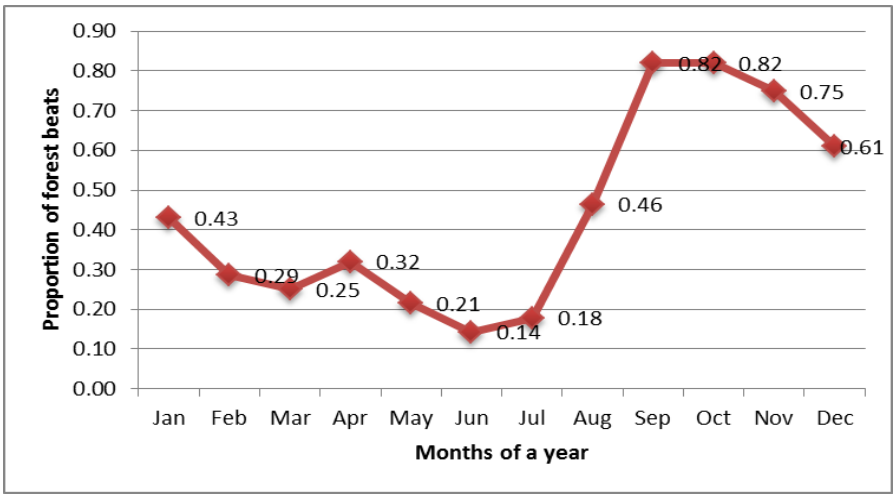


Figure 1: Seasonality in human-elephant conflict in the study region

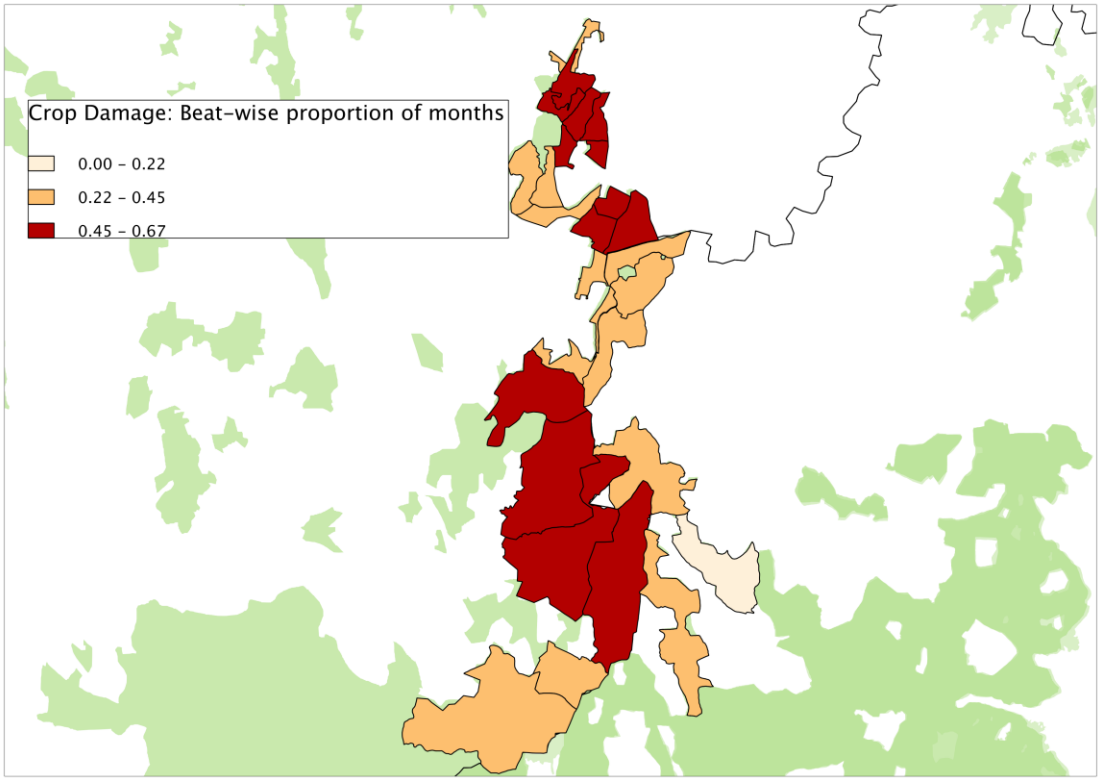


Figure 2: Mapping the seasonality in crop damage in the study region

Property damage measured in terms of loss of infrastructure, such as buildings (B), pump-set and motor (PSM), water pipeline (WP), vehicles (V), livestock (LS) and others was assessed across the beats in each division. Property damage was reported from all the conflicted beats. The damage to PSM (0.54) was the highest, follwoed by water pipeline (0.39) and livestock (0.11). Regions in and around the study region are rapiduly urbanizing landscapes and frequent encounters with people unawares of elephant presence in the area could be expected.

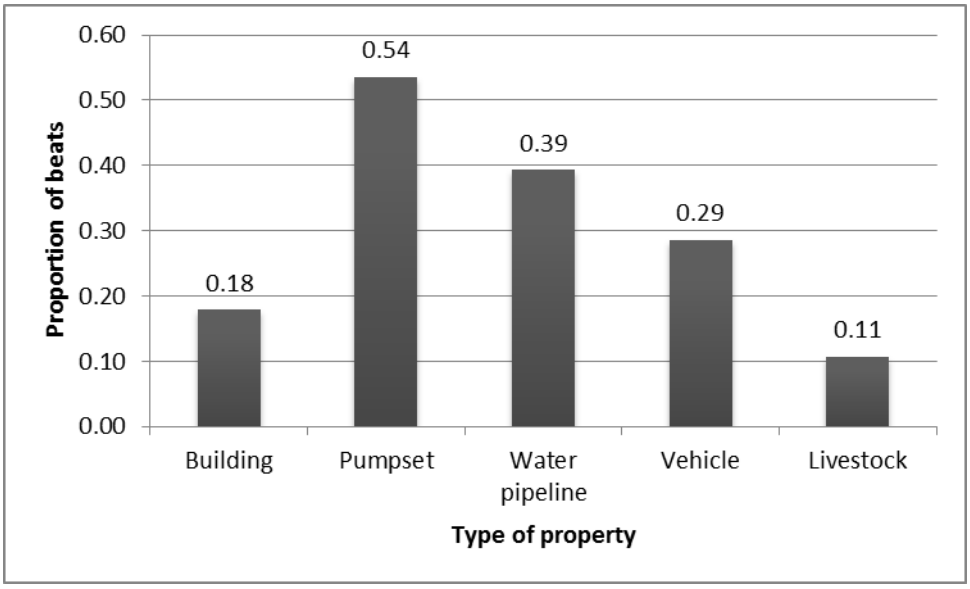


Figure 3: Graph showing the different types of property damage other than crops loss recorded across the beats in the three divisions.

The occurrence of human and elephant deaths in the region over the last 15 years was recorded during the survey. Nearly 80% of all the beats reported human deaths and elephant deaths to have occurred. The main cause of the elephant death however was due to electrocution (50%, n=10) followed by disese (25%, n=5) and poaching (15%, n=3). We note here that, since this is sensitive information and is also based on the recollection of the respondent of the incident, better measures such as official records of elephant and human deaths from the region is a must for better and more accurate assessment of the issue. The crop compensation data collated by the state forest department across the three divisions has been collected for a period of three years and is being analysed to cross check and corroborate with the survey results and to map the conflict regions with more detail and accuracy.

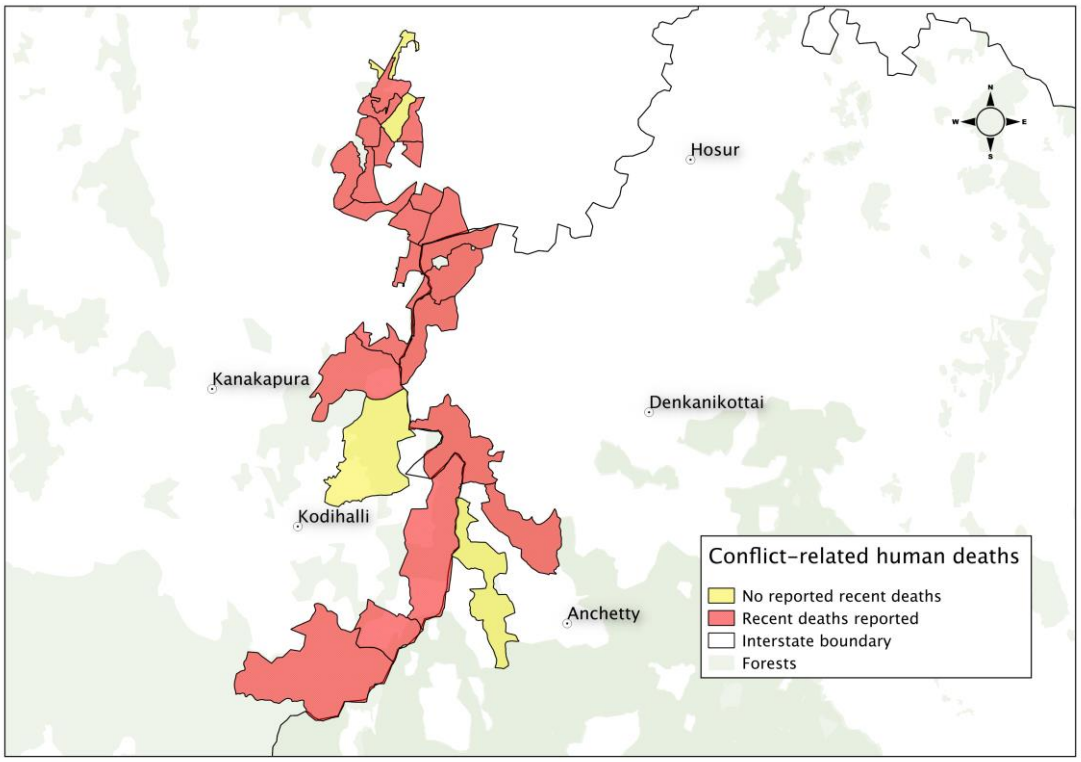


Figure 4: Mapping the recent human deaths due to elephants in the study region

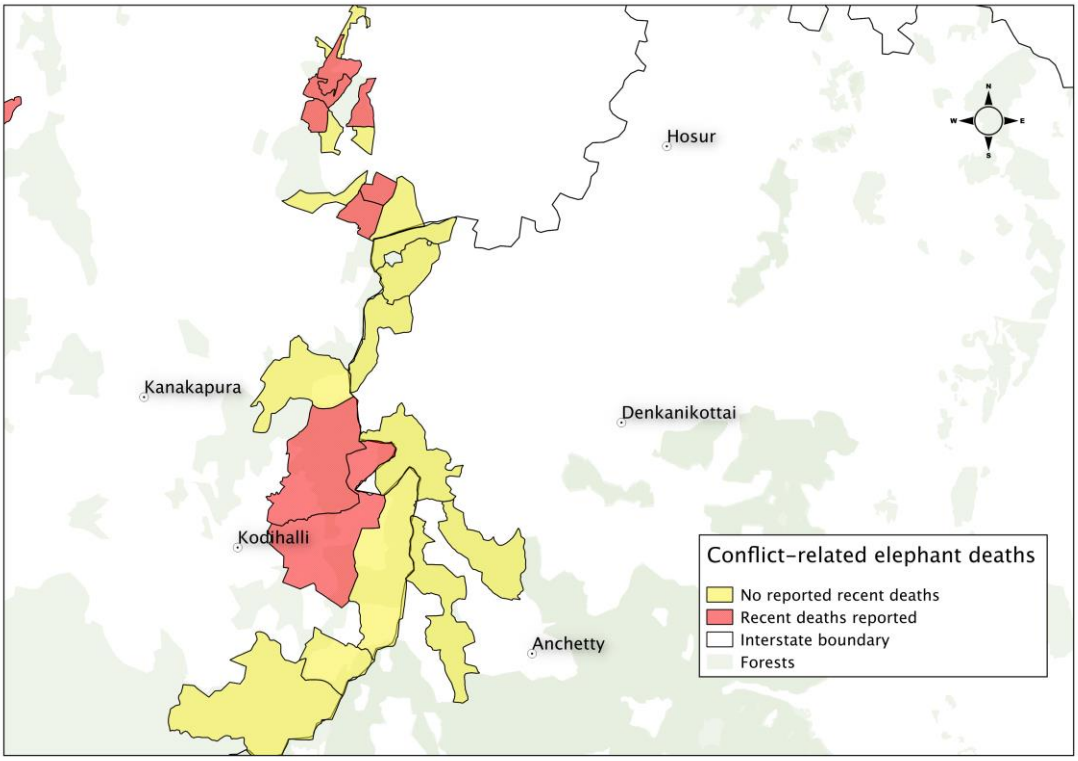


Figure 5: Mapping recent elephant deaths due to humans

Chapter 4

The Mitigation of Human-Elephant Conflict

An assessment of current mitigation measures, practices and its efficacy

The mitigation measures used – status

A great deal of investment has been made by the forest departments to mitigate conflict in their respective divisions. Currently the mitigation of conflict is being carried out through the payment of ex-gratia amount for loss of life and property, construction of sedentary barriers. Barriers include solar fences (SF), elephant proof trench (EPT), rubble wall (RW), concrete wall (CW) and other special structures all along the boundary of the PA and human habitations to prevent elephants from coming out of the PA or forest area. More direct and active measures such as drives and chasing of elephants using crackers (C), drums (D), torches (T), shouting (Sht), firing in the air with guns (G), and jeeps (J) away from the site of conflict is also employed. The mitigation measures used therefore can be classified as monetary, passive and active mitigation strategies. In this chapter however, we will discuss only the latter two forms of mitigation.

Active mitigation has been used extensively across the landscape and was reported from all the beats. As elephants move large distances between stay patches, mitigation of conflict when found in villages is carried out using active measures of drives. In traditional elephant habitats within the forest areas, heavy investment into passive mitigation measures has been carried out. The Bannerghatta National Park has passive measures in place in all its beats.

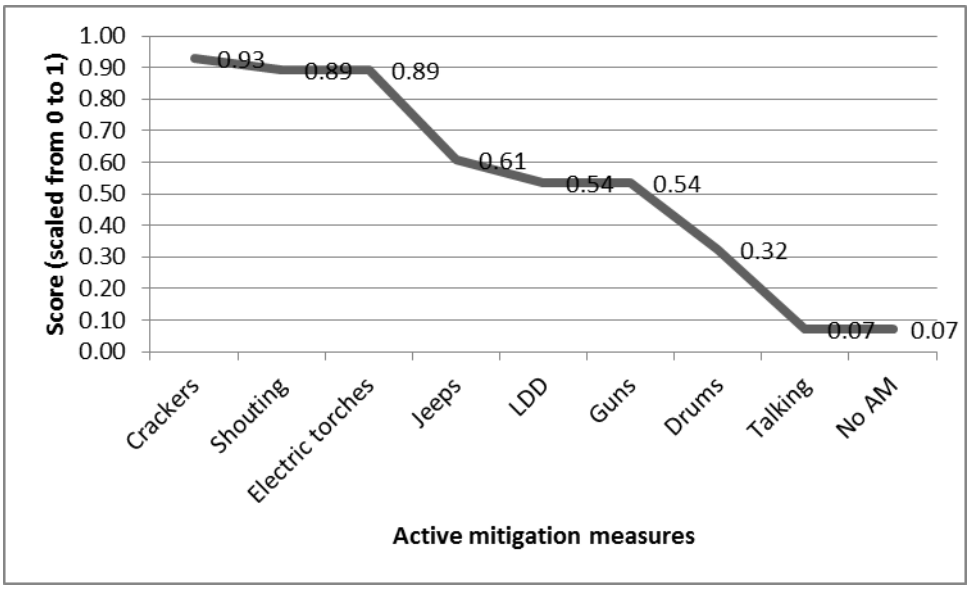


Figure 1: Active mitigation measure types and intensity of use across the study region

Crackers are extensively used by the field staff while driving elephants at the level of 0.93. Drums are used to a lesser extent but mostly by farmers accompanying the forest staff. Shouting to chase away or move the elephants is another technique used extensively but with less desired effect on the animal. Guns (to fire in the air) are also used to scare the elephants away from crop fields.

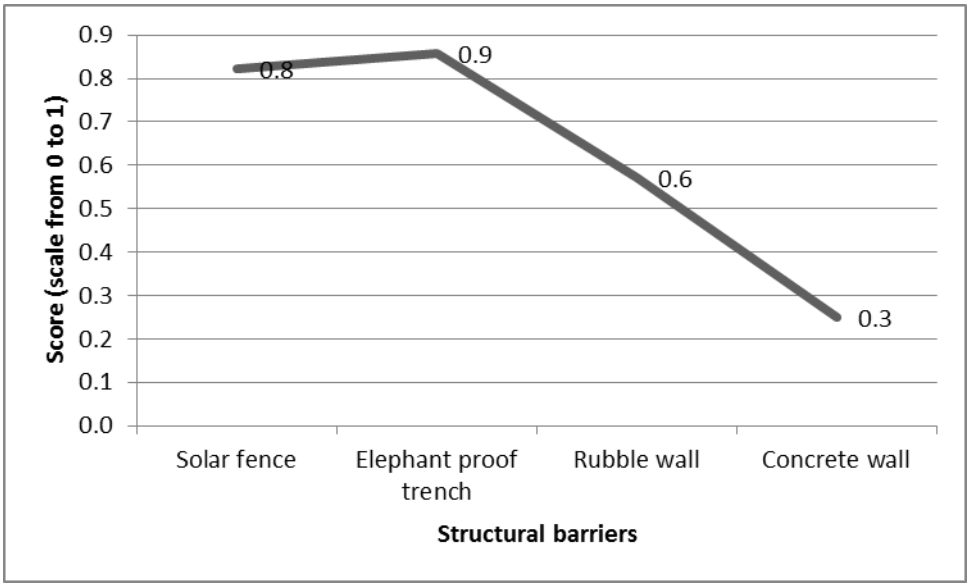


Figure 2: Passive mitigation measure types and intensity of use across the study region

In addition to these measures, elephant watching or driving squads are created during the peak conflict months in order to keep the elephants inside the forest. In the highly human-dominated areas such as villages and towns, elephants stay in large water bodies, ravines and even coconut plantations and hence a different approach, one that will keep people away from elephants, has to be used. For this, once the location of the elephants is known, the FD staff make announcements to the general public living within a radius of 5 to 10 km asking them to not move out after dark to their crop fields through microphone sets installed in the jeeps. They also keep track of elephant movement mostly throughout the night by following them and by checking at important crossing points and facilitate elephant movement in particular directions by using sirens in their jeeps. In addition, in some of the areas long distance drives of elephant have also been carried out in beats at levels of 0.60. These drives unlike driving elephants back into the forest from the crop fields, involves driving elephants from one forest patch to another, usually across an administrative range, division and even state and at times even from one beat to another.

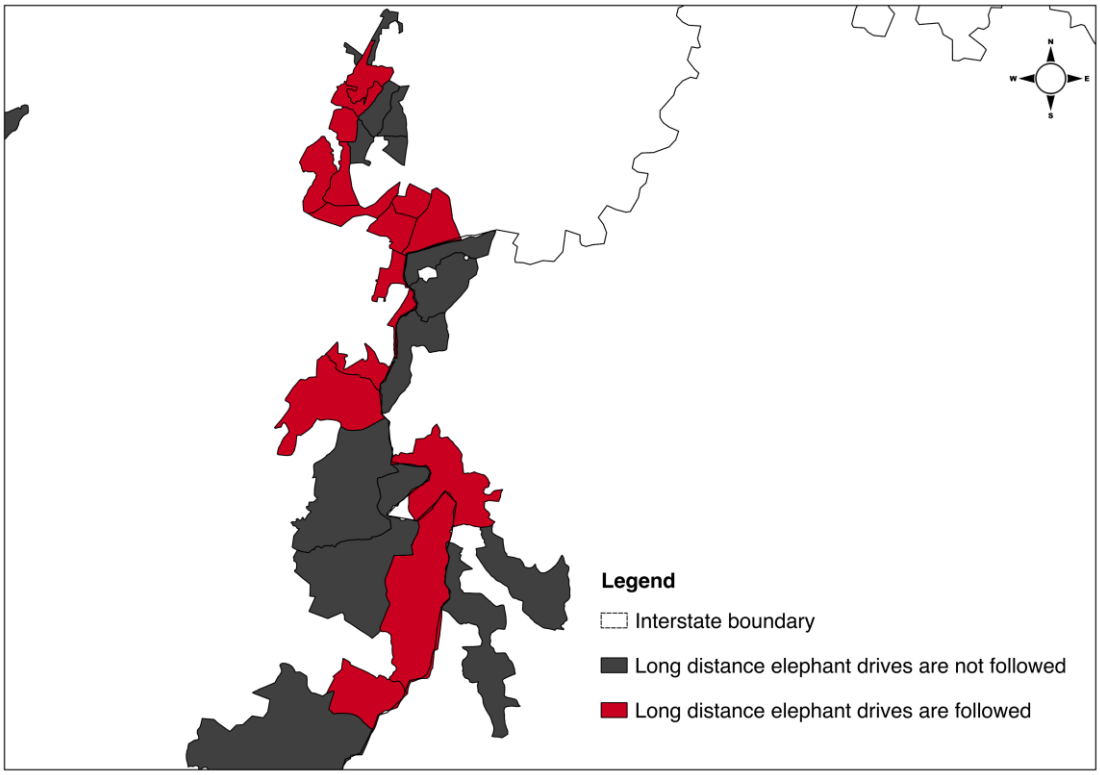


Figure 3: Mapping the beats where long-distance drives are prevelant

A sleuth of passive meaures to mitigate conflict is also used by the forest department largely to hold the elephants within large portected areas. Solar fencing (SF) and elephant proof trench (EPT) are the most extenisvely used passive barriers across the three divisions. SF and EPT were reported to an extent of 0.80 and 0.90 respectively. There is also an extensive network of RW and CW, to an extent of 0.60 and 0.30 across the beats.

Most of the respondents opined that mitigation of conflict using the active and passive measures are very effective in preventing losses. Most respondents also suggested that passive barriers are most effective in keeping the herds inside the forest but ineffecitve against male elephants, especially the tusk bearing ones. Most barriers in the PAs are being maintained on a regualr basis, especially the SF.

Chapter 5

The Elephants

An assessment of demography, body condition and individual identity of elephants

Assessing demography through age-sex structure

In order to assess the demography of elephants in the study region, we relied exclusively on direct sightings of elephants from this region during the survey period. The data on demography is from 59 sightings of elephants obtained through field work either on foot or in vehicle for a period of 10 months and by investing a total effort of 500 km. A total of 404 records of elephants were analysed for the same and individual elephants which were re-sighted were left out of the analysis. Most of the elephant sightings were in the dry deciduous to woodland forests (DF).

All three major group type namely solitary individuals (S), herds (H) and all-male groups (AMG) were seen during the survey across the study area. Off all the sightings, solitary males constituted 1.15% and herd the majority with 98.85%. The direct observation data corroborates the interview survey of the field staff that suggests a similar pattern of occurrence of social group types across the study region.

Age classification

The elephants were classified into four age categories namely calf (C, 0 to 1 year), juvenile (J, 2 to 5 years), subadult (SA, 5 to 15 years) and adult (A, above 15 years) based on their relative shoulder height. When alone, morgphological features on the body such as ear fold, depression of the temporal and buccal cavities were used to assess the age of the individual. The elephants which could not be put under any of these four categories were classified under un-identified class (UID).

As expected the age strucuture of elephants showed that adults constituted the bulk of the population at 41.95%, followed by subadults at 35.63%, juveniles at 20.11% and calves at 2.30%.

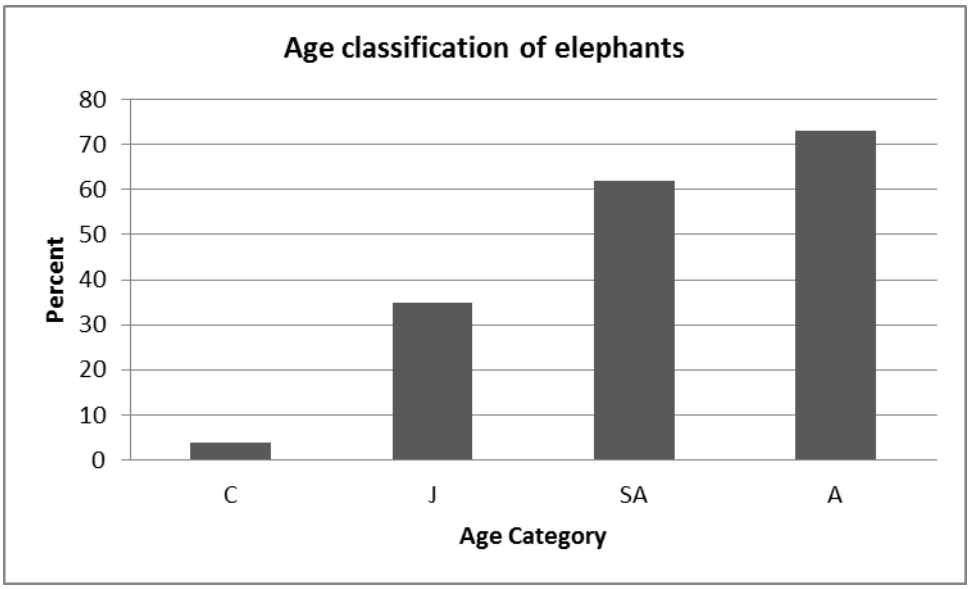


Figure 1: Age structure of elephants in the study region

C	J	SA	A	UID	M	F	UID
4	35	62	73	0	40	104	28

Calf (c), Juvenile (J), Subadult (SA), Adult (A), Male (M), and Female (F)

Table 1: Showing the age and sex classification of elephants based on 59 sightings

Sex classfication

The elephants were classified into two sexes, males and females based primarily on the presence of absence of tusk in the juvenile, subadult and adult individuals. However, since there are tuskless bulls, care was taken to observe other features such as the genitals, and other morphological features such as trunk girth, anal flap bulge and social behaviour in order to assess the sex of tuskless individuals. In the case of calves, it was difficult to assess its sex and hence all the claves are put under the category of unidentified (UID).

As expected the sex strucuture of elephants showed that females constituted the bulk of the population at 60.47%, followed by males 23.26%, nealry 16.28% of the individuals sighted were unclassified (UID).

Assessing the body condition

The body condition was scored on a scale of 0 to 10, with 0 being least desirable and 10 being the most desirable condition of body of the elephants based on Fernando et al. This photographic assessment of the body condition (BCI) could help us understand the life-history strategy adopted by the individual male and female elephants acorss the different landuse types. A comparison of the BCI was carried out for one season, namely summer across the three forest divisions). The individuals, however faired better on the BCI scale with score scale ranging from 5 (F) to 7 (H) with a majority of the individuals (42.35%) obtainning a BCI score of 6 (G), followed by 38.82% obtaining a score of 7 (H). A fair percentage of them (15.29%) also obtained a score of 5 (F). Only a few indiviudals, mostly males (3.53%) got a score of 9 (J).

BCI	0A	1B	2C	3D	4E	5F	6G	7H	8I	9J	10K
Study Individuals	0	0	0	0	0	15.29	42.35	38.82	0	3.53	0

Table 2: Shows the BCI scores given to invidiuals elephants within the study area

The adult female to adult male ratio of elephants and the intercalving interval in the three divisions are given in table 2 below;

FD	AM to AF	Intercalving Interval
BNP	1:5.63	3.1 years

Table 3: Shows the adult female to male ratio and the intercalving interval

Group size of elephants

The group size of elephants ranged from a minimum of 1 to a maximum of 45 individuals. Some of the largest groups were seen in this are during the elephant drives, shooting up the average group size to ~25 individuals. This however, may be an artefact of elephants being driven from one division to another across forested areas where more elephants join the drive party and form large coalitions.

Identifying individual elephants across the state border

More than 100 elephants have been individually identified through photographic marking of the morphological features on their body. The features used for individual identity of elephants include the shape of the ear, tear, nicks, fold and holes; shape of the tail, length, hair brush, kinks; shape and size of the tusk and other unique markings on the animal such as lumps and poke marks. Through continuous monitoring of these individuals, the routes used by them to traverse regions across the political boundary have been mapped. The sighting of the same individual across the political border was important to confirm the movement of elephants across from one state to another and also to identify the exact route they take to identify corridors.

Chapter 6

Participatory monitoring of elephants through Forest Department staff

A case study of Bannerghatta National Park

Introduction

The scale of any assessment on spatial distribution of highly mobile large terrestrial mammals can span hundreds of square kilometers over tough and remote terrain. The involvement of highly enthusiastic non-scientist volunteers from civil society has been increasingly considered as an option for large-scale research efforts. Such participatory approach involving wildlife enthusiasts and more importantly frontline staff of forest department might be invaluable to gather critical information on spatial and temporal distribution patterns of Asian elephants. Forest Department frontline staff has a strong field presence in most of the Indian wildlife reserves and state forests. The primary mandate of frontline staff is to detect and combat poaching and other forms of illegal entry and consequent resource extraction. Often there are permanent camps in every section (a unit of administration) where frontline staff reside and patrol the forests, predominantly on foot. Since frontline staff spends considerable amount of time walking in the forests, they have high probability of encountering wild elephants. Lately, in wildlife reserves such as the Bannerghatta NP (BNP henceforth), the Forest Department has started maintaining wildlife sighting registers in which sighting records of large mammals are recorded with date and time. In the field it is possible to quickly assess the group size demographic composition. Furthermore, Asian elephants can fairly easily be sexed as they are sexually dimorphic and adult males and females have different social organizations (adult females live mostly in family units comprising related individuals and adult males might spent considerable time either alone or with other males). We reasoned that basic sighting registers maintained in the range offices could potentially be a good source of field data in gaining a coarse-level understanding of distribution patterns of elephants.

In this study we make an attempt to understand the spatial and temporal patterns of elephant distribution for a period of one year using sighting records maintained by the frontline staff of Forest Department in the BNP.

Study Area

Nilgiris-Eastern Ghats elephant reserve that spans over 10000 km^2 and support the largest population of Asian elephants in the world. Our study was conducted in Bannerghatta NP which is part of Nilgiris-Eastern Ghats elephant landscape. The extent of Bannerghatta NP is 250 km^2. The mean altitude of the reserve is 865m above msl. The vegetation is predominantly dry deciduous transitioning to scrub along the margins of the reserve. Riparian forests exist in the hill folds and in the valleys. The park boundary has an interface with Bangalore city, villages and crop fields on three sides and forest cover on the fourth side.

Methods

In each range of the BNP, a register on wildlife sightings is maintained. The register has details of every opportunistic wildlife sighting such as date and time of sighting, group composition, and precise location details recorded by the field staff. We collated that information pertaining to the period 2013 to 2014 and performed exploratory data analyses. In this report, we used frequency of elephant sightings as a coarse proxy for spatial distribution, whereby high frequency of sightings in an area would mean high distribution of elephants.

Furthermore, for the pupose of this reporting, we classified the entire period from April 2014 to March 2014 in to four 'seasons'. They are: a) Monsoon – June, July, August and September b) Post-Monsoon - October, November, December and January c) Pre-monsoon – February, March, April and May

Results & Discussion

1. Seasonality of elephant sightings

In habitats where there is seasonal flux in availability of critical resources such as forage and water, elephant distribution could be non-uniform. Similarly, habitats that serve as mere larger conduits for elephant movement between larger patches of forests on each side of the passage might also experience seasonal fluctuation in elephant numbers. Gaining understanding on seasonal distribution of elephants will be invaluable for the management.

For the year 2013, elephant sightings, both frequency and number of elephants appear to be high during monsoon in comparison to other two seasons. During post-monsoon, the frequency of elephant sighting reduced as did the number of elephants sighted.

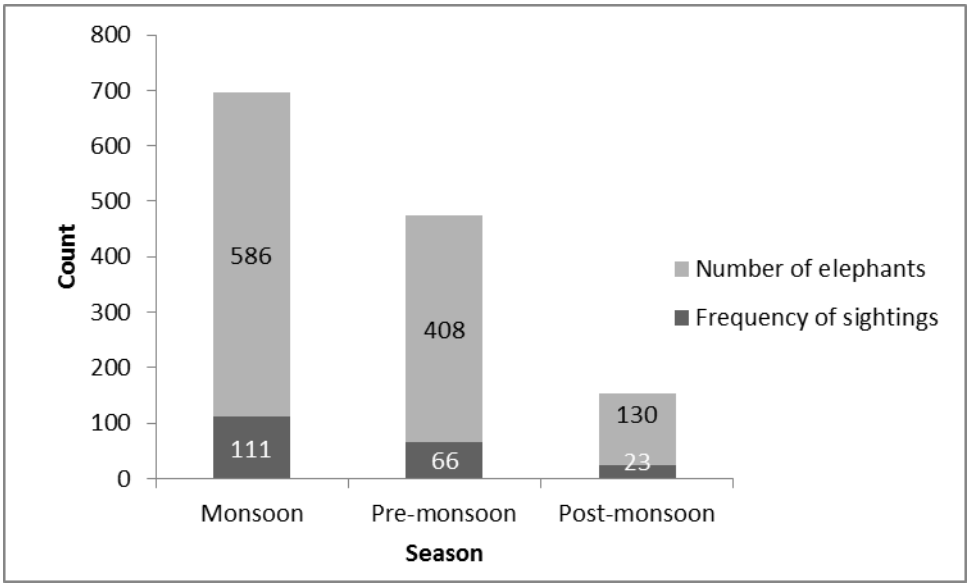


Figure 1: Season-specific frequency and count of elephant sightings in BNP during 2013-2014

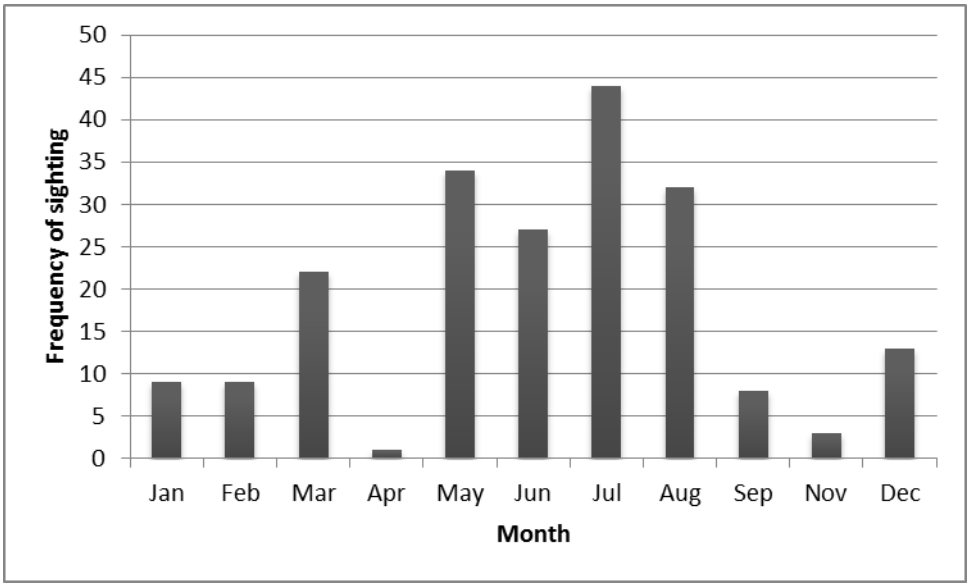
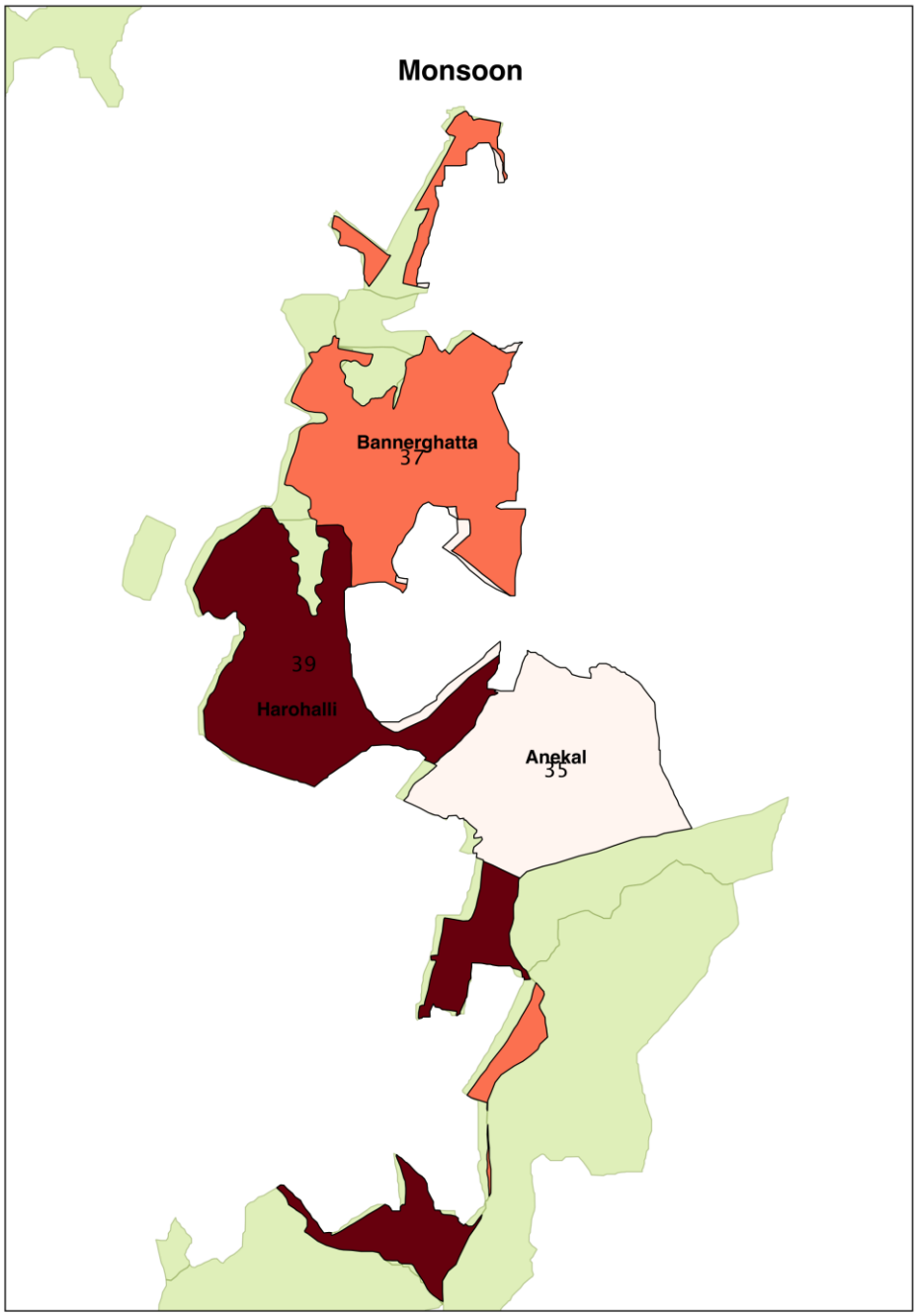
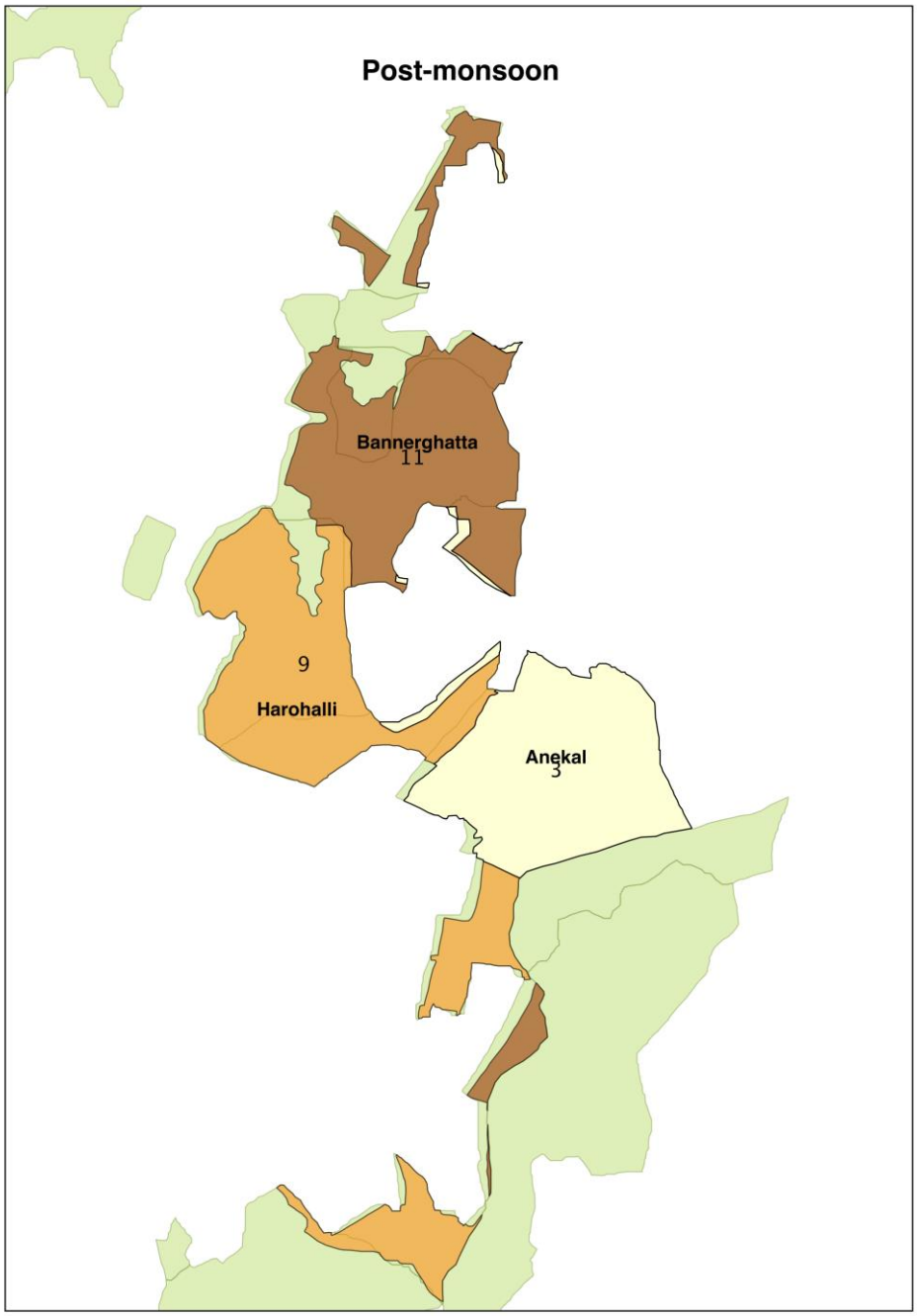


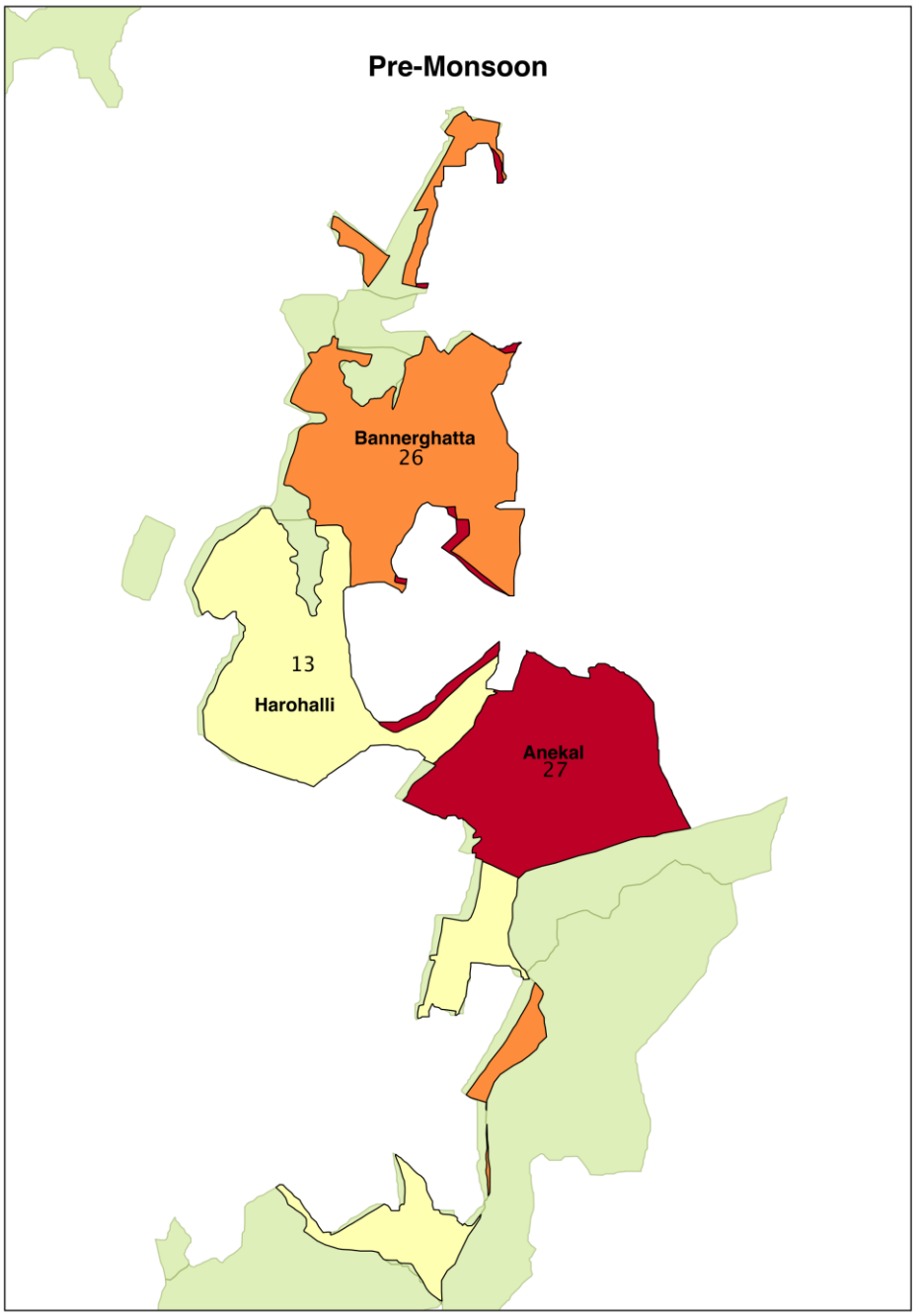
Figure 2: Month-wise frequency of elephant sightings in BNP during 2013-2014



Map 1: Frequency of elephant sightings in BNP during monsoon



Map 2: Frequency of elephant sightings in BNP during post-monsoon



Map 3: Frequency of elephant sightings in BNP during pre-monsoon

2. Range-specific and season-specific frequency of elephant sightings

From the analyses we excluded Kodihalli range as the sighting register did not have sufficient details. Although we did not do test statistics to discern if there is statistically significant difference between ranges in the frequency of sightings, it appears that frequency of sightings is very similar between the ranges (Fig 2)

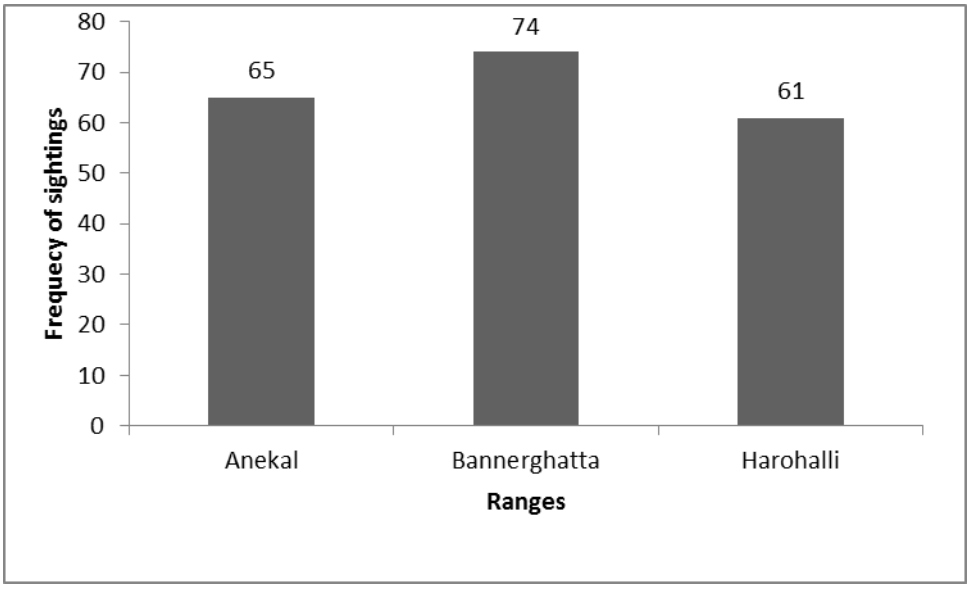
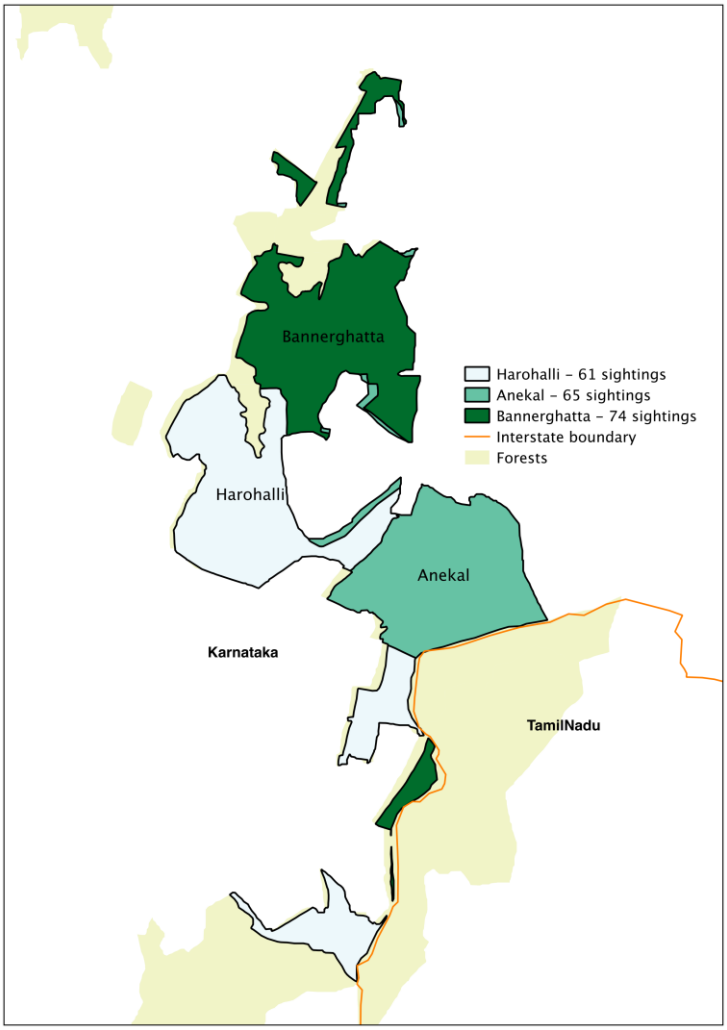
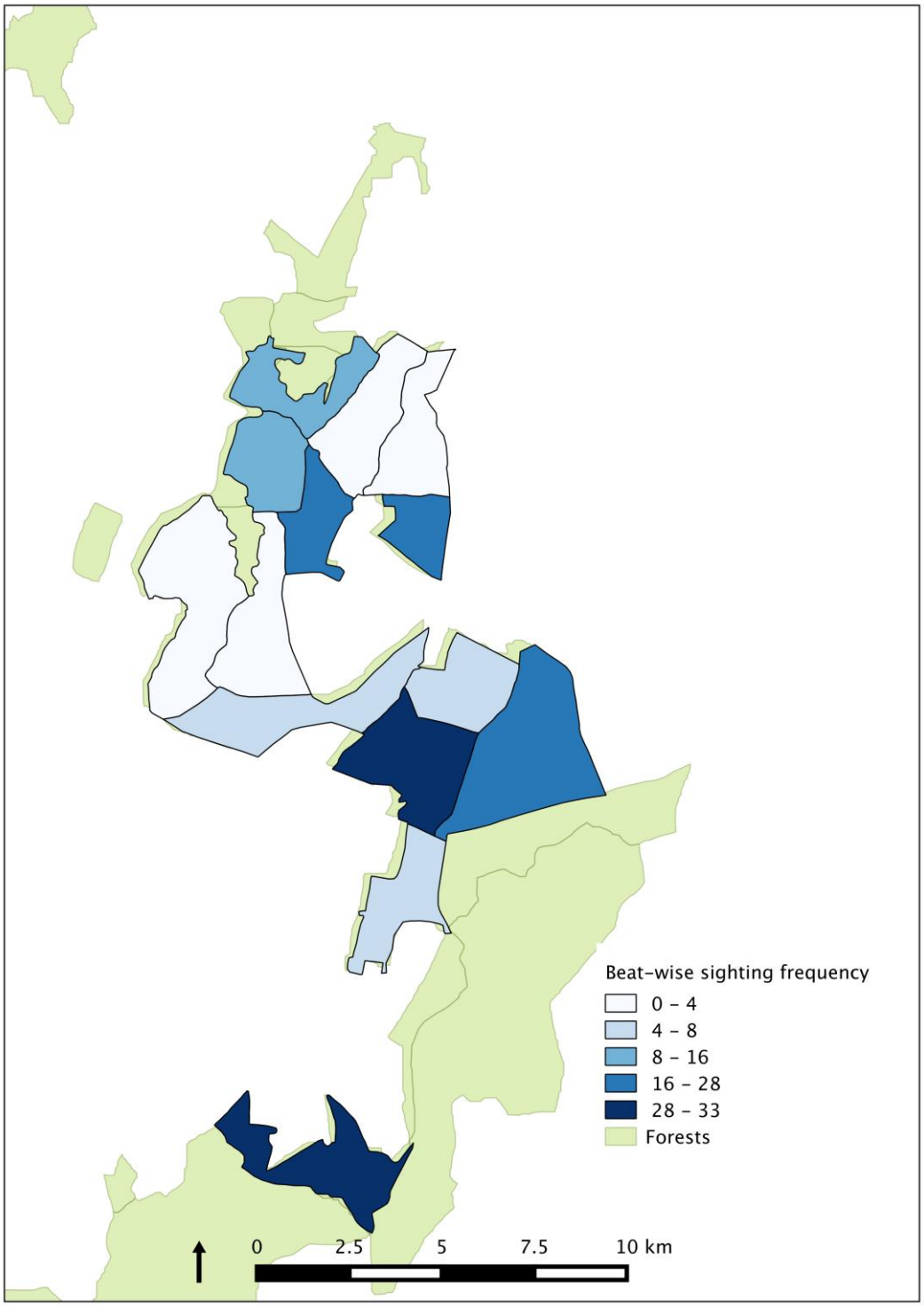


Figure 2: Range-specific frequency of elephant sightings in BNP during 2013-2014



Map 4: Range-wise frequency of elephant sightings in BNP for 2013-2014



Map 5: Beat-wise frequency of elephant sightings in BNP during the period

Furthermore, we examined seasonal distribution of elephants across the ranges. From Fig 3, it appears that across BNP, elephant distribution as deduced through the frequency of sightings is high during monsoon relative to other seasons.

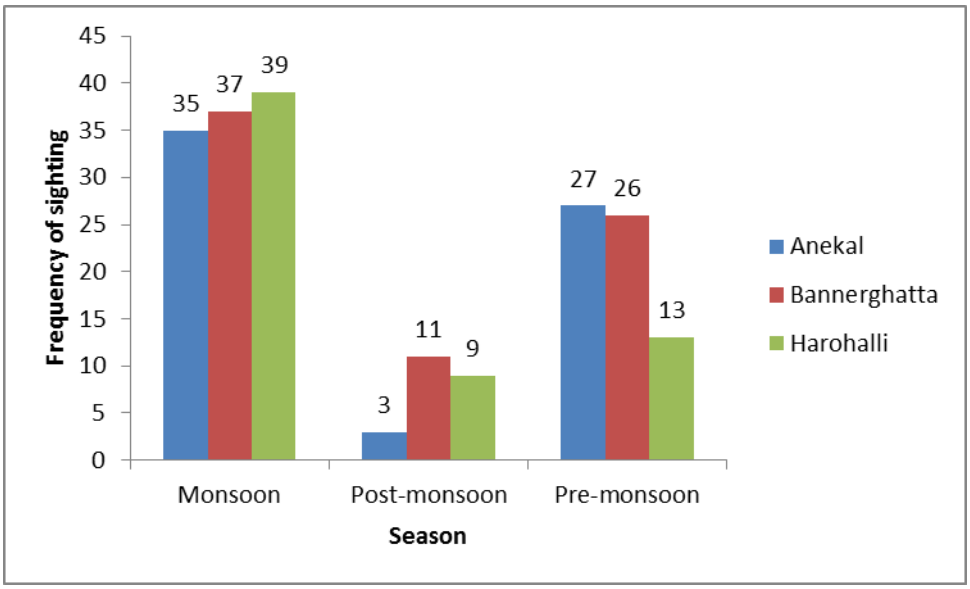


Figure 3: Season-specific range-wise frequency of elephant sightings in BNP during 2013-2014

3. Mean group size of sightings

Group size of elephants that is number of individuals per group can be influenced by a variety of factors such as elephant societal, behavioural and physiological factors; environmental stimuli (resource availability) and management factors (such as drive episodes). Systematic longitudinal understanding variables such as group size, demographic composition etc might help in interpreting aspects of social organization, behaviour and age & stage structure of the population. Although the current data set permits only assessment of mean group size, we note that with some more planning and prior training, it is possible to systematically collect more valuable information on elephant distribution and certain demographic variables.

For the period 2013-14, a total of 50 sightings of solitary animals have been recorded. We note that although male elephants are usually solitary, it is not wise to conclude that 50 solitary sightings could pertain to males as factors such as visibility could have hindered detection of other elephants, if they were around.

The mean group size based on 150 sightings is 7.5 (SD 5.7).

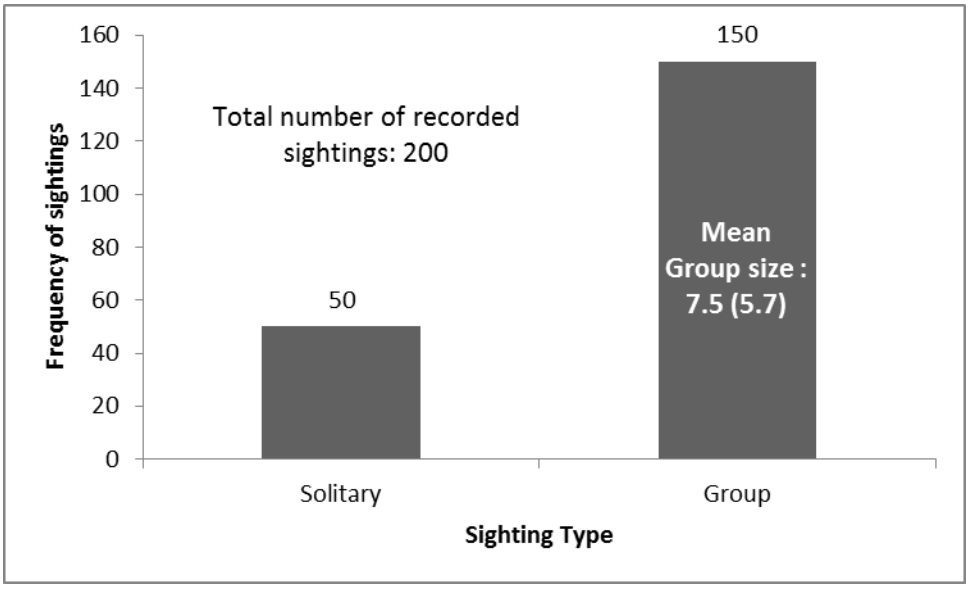


Figure 4: Sighting type and mean group size of elephant sightings in BNP during 2013-2014

Conclusions and recommendations:

We note that the sightings record maintained by field staff in BNP proves to be valuable in gaining an understanding of the spatial and temporal distribution of elephants. While it is recommended that continuous data collection by field staff in the same format be followed, it required more rigour in collecting location details and count information on elephants. To make the data points spatially explicit, which would then allow us to make better inferences on spatial patterns of habitat utilization, we also recommend the use of GPS units to mark sighting locations.

Chapter 7

Response of elephants to changing land use and anthropogenic activities

A summary of preliminary findings, recommendations and the way forward

Decision-making in response to the ecological and anthropogenic factors

Elephants are known to respond to changing local ecological and anthropogenic settings by varying their occurrence (spatio-temporal) in these habitats while showing short-term and long-term displacement. They are known to show behavioural adaptations at the level of the population through differences in habitat use at the age, sex and group sizes and also at the individual-level by showing idiosyncratic behaviours. Here, we discuss population-level behavioural variations displayed by elephants across the study area and individual-level variation.

At the population-level

It is a well known fact that elephants first preference when it comes to habitat selection is undisturbed and large patches of forests with adequate forage, water and shade. In the study area too, elephants show a preference towards forested areas with more number of connected beats, lesser area to perimeter ratio. They are also known to occur at higher levels in areas where more than at least 2 natural land use types (refer chapter 1 on LUN and LUUN) are present. With the first showers, movement of elephants towards bamboo patches in the elelvations between 700 to 1100 m above msl was observed. However, since their habitat is highly fragmented, especially towards the northern parts of the PA and in the human-dominated areas, their ocurrence seems to be also influenced highly by the presence of crops in the region (Figure 1). This is also driven mostly by the tendancy of a number of male elephants in the region to use the human-dominated landscape to feed on both subsitence and plantation crops alomost throughout the year.

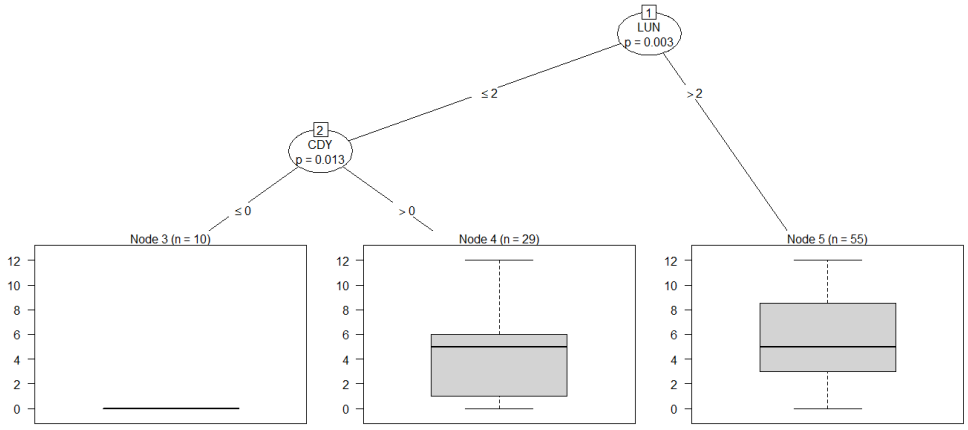


Figure 1: Classification tree showing the behavioural response of elephants in terms of occurrence and duartion of stay in the habitat in response to land use types

Even with the two sexes, females and therefore largely herds seems to use a risk averse startegy their occurrence and duration of stay is limited to habitats with the best available natural resource areas, least fragmentation and best connectivity. The males on the other hand do occur across the spectrum of land use and anthropogenic activities and do show risk taking behaviour. All-male groups especially those with large number of individuals of 5 and above were seen more in the highly fragmented regions with poor connectedness and high human-densitites (Figure 2).

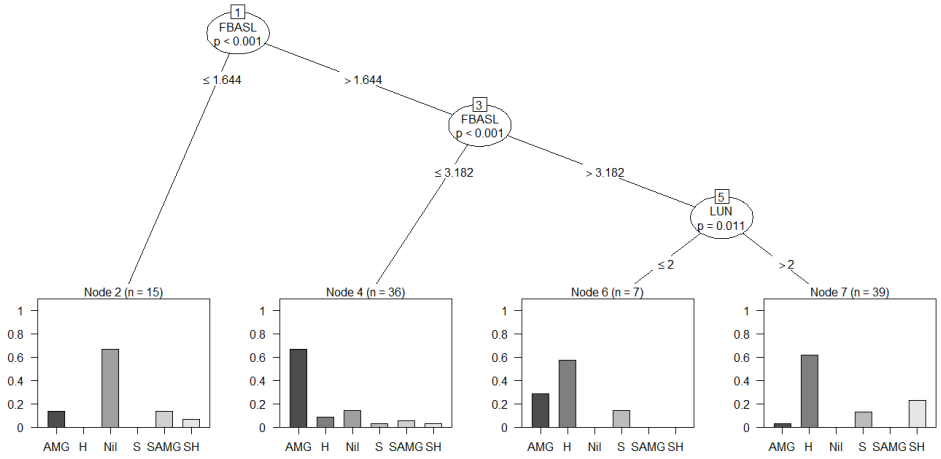


Figure 2: Classification tree showing the distribution of differenct social group types (refer chater 2 for SGT) in the habitat in response to land use types

When specifically assessed for human activities such as crop guarding that may expose the elephants to dangers of being injured or even death and historical poaching which is trageted towards males speciafically, we found that male elephants do occur in higher numbers in areas with crops (high gain and therefore higher risk as well). Some of strategies are quite obvious, such as crop raiding at night in the cover of darkness and when human activity is at its lowest. However, further long-term work and greater analysis of the data collected on male elephants could help throw light on this aspect and on other aspects of the behavioural ecology of Asian elephants in human-dominated landscapes.

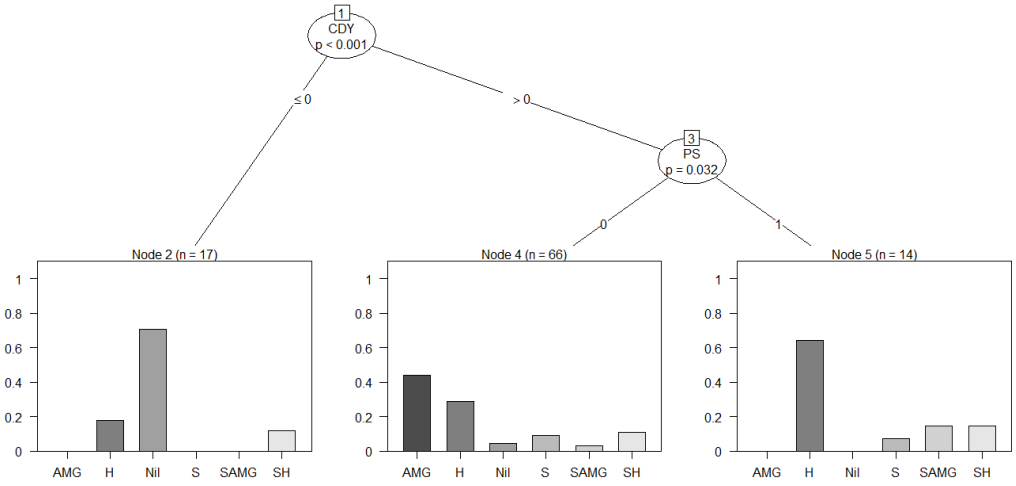


Figure 3: Classification tree showing the distribution of different social group types in response to crop damage and historical poaching

Conflict and conservation barriers

From our survey, it is evident that solar fence is the most well maintained physical barrier in the study site. Even though EPT spans over significant extent of the forest boundary, it is currently not well maintained as exemplified by numerous breaches. However, in locations where SF is not laid, EPT serves as the main physical barrier to contain outward movement of elephants from the park. Regions along the barrier that are vulnerable to breaches have been identified and details provided to the FD which may be taken up for maintenance and repair on priority.

The way forward

The efforts of the Forest Departments in securing more habitats for elephant conservation in the recent past especially in the study area is comendable. Increased monitoring and protection and improved habitat in the long-run will provide a safer and better place for elephants and other wildlife to live in. Expansion of both BNP and declaration of the North-Cauvery Wildlife Sanctuary (NCWLS), ensures connectivity with the larger elephant habitat south and was critical to the elephant conservation in the landscape as a whole.

Conflict levels could drop in these areas to a large extent simply because of new space that has been made available to elephants by securing more areas and removal of anthropogenic stessors or at least reduing their impact on the habitat as is evident in BNP and other areas of NCWLS. However, the presence of permanent settlements within the habitat and the rapid urbanization of areas around remains a persistence threat. The presence of large number of elephants in BNP also staying for longer duration could be counter acted by improving habitats both in NCWLS and in the Hosur Forest Division (HFD) in the Tamil Nadu state. Also increased prtotection on part of HFD would help in the conservation of elephants in BNP within the state of Karnataka.

It is important to note that the use of early warning systems to alert people of elephant presence, increased awareness among the stakeholders through workshops and meetings across the divisions, and continued monitoring of elephants in the region along with protection of habitat is essential to address the issue relating to conflict and conservation of elephants in the landscape. It is vital that elephant occurrence acorss the study area is looked at beyond the divisional boundaries but at a landscape. Our effort in this report has been to showcase that even though the levels of threats and resources differ across the divisions it is the same population of elephants and at times the same individuals displyaing behavioural adaptablity in response to stimuli across a vast area. Hence, a landscape level elephant management action plan would be vital in order to follow the best and uniform management practices across the landscape with

least impact on elephant ecology and behaviour based on the understanding of elephants in this region is in order to conserve these elephants through the anthropocence epoch.

Mapping elephant movement paths across the state borders

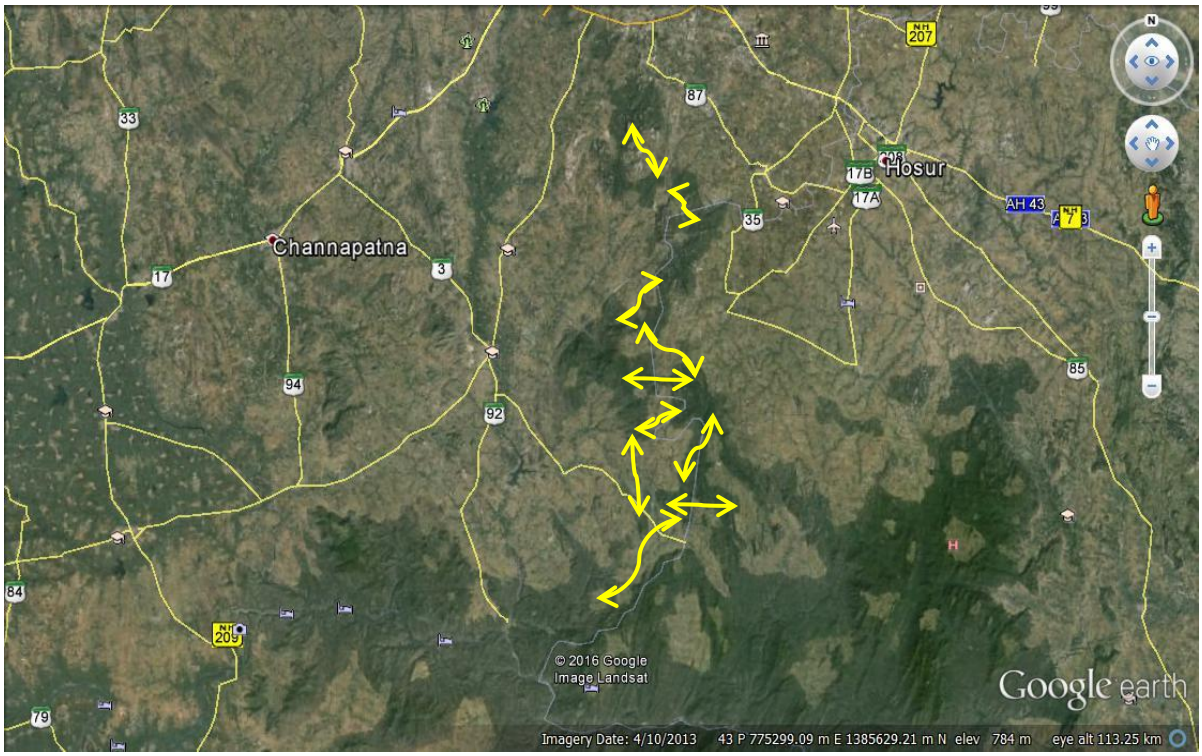


Figure 4: Map showing the critical movement paths of elephants across the political boundary, identified during the study

Chapter 8

Outreach activities and conservation impact

A case study of engaging with local stakeholders and forest staff across the borders

Identifying the different types of human activity (land use and conflict mitigation measures, especially long distance drives), agricultural practices (livestock activity and cropping patterns) and infrastructural activities (roads, rail lines and other linear intrusions to elephant movement) at a fine-scale of the beat (the smallest administrative area, beat), in the study site helped us in addressing issues critical to elephant conservation. These activities have altered the behaviour and use of the region by elephants, resulting in increased conflict, which needs to be redressed on priority. We have also built up a large database on the behaviour and activity patterns of individual elephants using the region, through our long-term study on this elephant population. Our learning of working with elephants and their habitat in this landscape had to be effectively employed through workshops and consultation meetings with the local stakeholders, to inform them of elephant movement patterns and bring about practical changes in their lifestyles that can help reduce conflict.

Training has been imparted to local conservation groups, the Forest Department staff and villagers of affected villages in managing elephants in conflict situations through three stakeholder meetings and workshops

The participating key stakeholders in the capacity-building exercises included:

1. Nature and Wildlife Conservation Committee (NWCC), Nirantara Foundation, Vanodaya, Asian Nature Conservation Foundation (ANCF) and National Institute of Advanced Studies (NIAS) – Local Organizations
2. Karnataka and Tamil Nadu State Forest Department staff and officers
3. Villagers from the five most affected Talukas along the state border

The select groups, showed commitment to work towards the larger goal of the project and to help build capacities, not only of their own staff but also of other stakeholders that they interact with regularly during the course of their work. This helps in effectively spreading the techniques

taught to the participating stakeholders to a larger audience at the grassroot-level and is likely to be sustainable in the long term. During the course of the project, we also hoped to identify and include more stakeholder groups in these capacity-building exercises.

Figure 1: Traning and capacity building exercise for volunteering non-governmental organizations

We held three consultation meetings with farmers, and the state forest departments to explore the feasibility of working together across the borders to facilitate free and easy movement of elephants without any barriers, either passive or active while ensuring minimal conflict with people

Three village level awareness programmes were also conducted in collaboration with the state forest departments apart from training the local stakeholders in conflict mitigation and conservation activities

These workshops, meetings and discussions helped in;

1. Regular monitoring of elephant movement and activity through direct observations by forest staff and local community members as elephant occurrence in the region and hence, its associated threats vary over space and time.
2. Identification of human activities incompatible with elephant use of the region and identification of locations particularly vulnerable to conflict

3. Redressal of incompatible activities through land-use planning during the development of villages and towns as well as improved farm-based practices through increased awareness among local stakeholders and identification of their activities detrimental towards elephants and their habitats
4. Informed use and disuse of direct and indirect mitigation measures in elephant management, modifications in agricultural and other practices, such as cropping patterns and other related activities while living with elephants
5. Capacity building of local forest department staff, personnel of local organisations and other community stakeholders in the monitoring and early detection of conflict, prevention of human and elephant deaths, and reduction of crop losses
6. Creation of rapid-response teams and improved co-ordination between local forest staff across administrative divisions to manage conflict and improved patrolling in and protection of areas identified as sensitive regions in the landscape, preventing both human and elephant deaths
7. Improved inter-division and inter-state coordination on monitoring of threats to both humans and elephants and their effective reduction and development of strategies to mitigate human-wildlife conflict in the region
8. Identification of new corridors for elephant movement between the two states across the political boundary

Figure 2: Mitigating human-elephant conflict with the forest staff at night, awareness programmes at the conflict affected villages and issue of pamphlets on do's and don'ts when mitigating conflict

Figure 3: Linking forest staff, villagers and local conservation organization to act together towards conservation of the elephant at the grass-root level

Figure 4: Forest Department Officals addressing the volunteers at the workshop

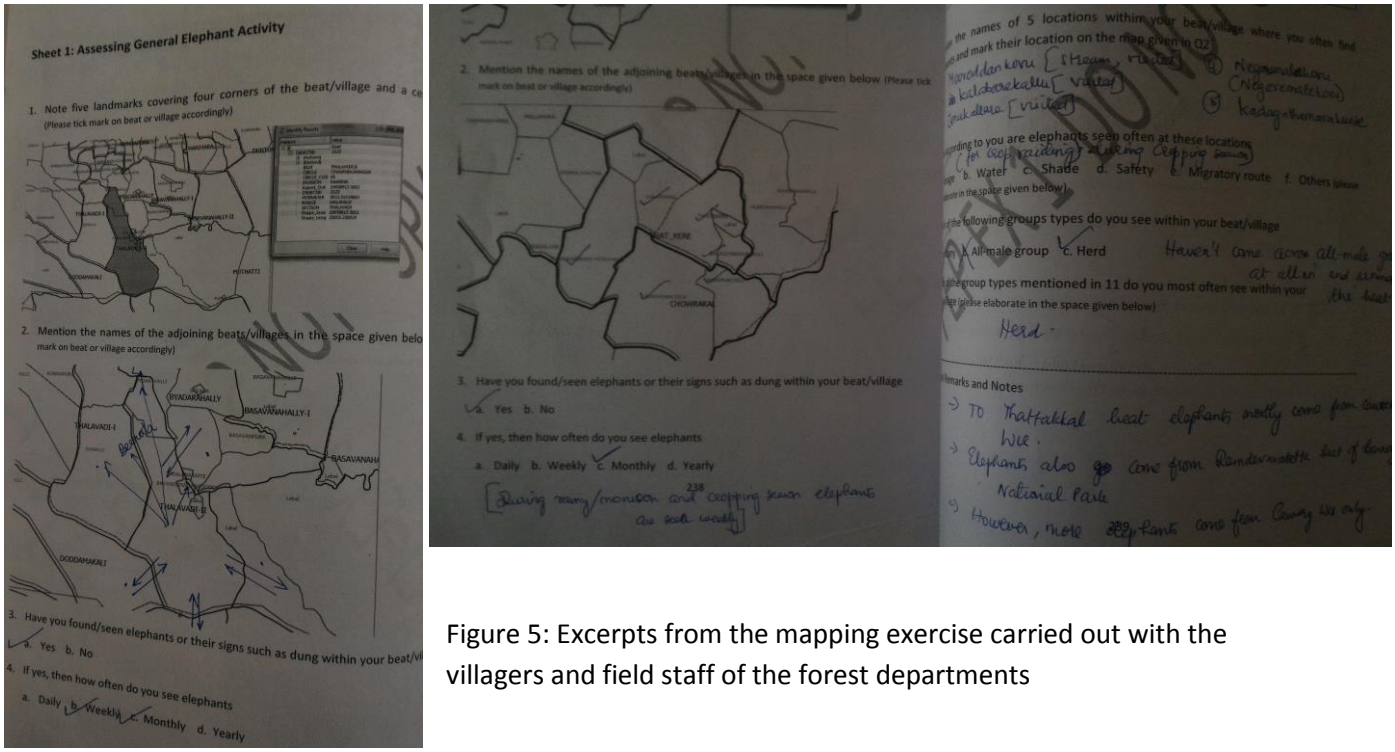


Figure 5: Excerpts from the mapping exercise carried out with the villagers and field staff of the forest departments