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TIGER IN THE CORRIDOR

Assessing large carnivores presence, status of their prey and habitats of Kanha - Achanakmar corridor

Rahul Kaul, R.P. Mishra, Vivek Tumsare, Subrat Bahera,
Tapajit Bhattacharya, Prafulla Bhamburkar,
Anil Kumar, Soumya Dasgupta,
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CONTENTS

PREFACE

Securing elephant corridors have been one of the main projects of the Wildlife Trust of India. This signature Right of Passage project not only documented and mapped but also showed viable pilot projects of how to secure these key movement areas for pachyderms that connected two habitats. This particular Rapid Action project looks at a key corridor for the tiger instead. Tigers do not move in herds like the elephants and also do not have seasonal movements akin to local migrations that elephants are wont to do. However, tigers, especially sub-adult males, do disperse so as to occupy and establish new territories. Such animals require habitat and prey linkages between the source and sink habitats

Here, a key linkage in central India, the Kanha Achnakamar corridor is sampled for predator and prey presence and its importance arrived at. The short term study shows that it is a connector for the habitats that straddle Madhya Pradesh and Chhattisgarh even though the presence of both prey and predators are low in the area. Six carnivores being recorded despite low abundance shows at least that the corridor is active and has the potential of being revived by ongoing efforts of the forest department and civil society, including WTI.

Very clear recommendations are given including protection of the area from tree felling and encroachment even though it lies outside protected areas, the prioritisation of this territorial division forest is key for wildlife management. Work with local communities especially those who are dependent on those corridor forests for livelihood is key as well. It is in doing such targeted measures that India's international commitment of doubling tiger numbers lie. If more habitats which are well protected and stocked with prey are not available for tigers an increase would only result in more conflict with humans and or inter specific fights resulting in mortality. This projects shows the way for one such linkage.

Vivek Menon
Executive Director

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WTI team is also grateful to field assistants, trackers and local villagers for providing help and support for implementation of this project.

EXECUTIVE SUMMARY

Tiger corridors have assumed importance as most large tiger landscapes are fragmented. The Kanha-Achanakmar tiger corridor is one such crucial linkage connecting Kanha Tiger Reserve with Achanakmar Tiger Reserve through Phen Wildlife Sanctuary which is part of satellite core area of Kanha TR. Most of this cotrridor area falls within the Kawardha and Mungeli Territorial Forest Divisions of Chhattisgarh and Dindori and East Mandla Territorial Forest Division of Madhya Pradesh. The terrain in this forest corridor is undulating with a few valleys and patches of Sal forest.

The team surveyed the Kanha-Achanakmar corridor to assess the presence of tiger (*Panthera tigris*) and leopard (*Panthera pardus*) and their prey. Sign surveys and camera trapping were used to detect the presence of the target species. The team used a grid design for sampling, using 25 cells of 144 km² each, corresponding to the home range of a tiger. The team was able to confirm the presence of six carnivores in the sampled grids. The mean encounter rate of evidences (#/100km) for carnivores were leopard (7.34 ± 1.58), sloth bear (*Melursus ursinus*) (7.31 ± 2.23), jackal (*Canis aureus*) (1.60 ± 0.83), hyena (*Hyaena hyaena*) (1.42 ± 0.89), tiger (0.85 ± 0.35) and jungle cat (*Felis chaus*). The team found tiger signs in four grids through their tracks and signs. Presence of leopard and sloth bears were recorded in 16 and 13 grids respectively out of the 25 grids sampled. Among the ungulates and other prey, presence of eight prey species was confirmed. Langur (*Semnopithecus entellus*) was the most commonly encountered animal during the survey followed by cheetal (*Axis axis*).

The decreasing order of encounter rates (#/100km) evidences for prey species were langur (17.52 ± 1.99), cheetal (10.12 ± 2.52), sambar (*Rusa unicolor*) (7.13±3.61), gaur (*Bos gaurus*) (6.29 ± 3.60), wild pig (*Sus scrofa*) (4.20 ± 1.22), hare (*Lepus nigricollis*) (3.07 ± 1.07), rhesus macaque (*Macaca mulatta*) (2.73± 0.88) and barking deer (*Muntiacus vaginalis*) (0.85± 0.64). Among the 25 grids sampled, 11 were intact in terms of forest cover and intensity of biotic pressure, six grids represented moderately degraded habitats and eight grids represented

degraded habitats. Leopard was detected at 16 sites (grids) with estimated site occupancy of 0.91±0.05 which was greater than the naive estimate (0.64). Encounter rate of all prey species proved to be the best explanatory variables for detection probability as well as site occupancy of leopard according to the minimum AIC values and least difference in AIC weight. The team feels that this corridor as it stands now is deficient in animal species and numbers but does have the potential to serve as an important movement area for tigers between Kanha and Achanakmar Tiger Reserves.

INTRODUCTION

Growing human populations and developmental activities such as highways, mines, power plants, and dams have all contributed to habitat loss and fragmentation in India (Karanth et al. 2009). Loss of habitat along with poaching of large carnivores especially tigers and their prey have resulted in extensive range contraction of tiger populations globally; restricting them to 13 countries and occupying less than 7 percent of their global historical range (Sanderson et al. 2006). Tigers require large spaces (Karanth et al. 2004), but most of the protected areas are too small to harbor ecologically, demographically and genetically viable tiger populations over the long term (Woodroffe and Ginsberg 1998, Carroll and Miquelle 2006, Dinnerstein 2007). Recently, areas surrounding Protected Areas (PAs) with tiger populations have received greater attention due to the increasing incidences of conflicts, evidence for importance of corridors and possibilities of PA expansion (Carroll and Miquelle, 2006; Sanderson et al. 2006)

The Central Indian landscape, spanning over the states of Maharashtra, Madhya Pradesh, Odisha, Jharkhand, Chhattisgarh and Andhra Pradesh; holds several important tiger habitats and breeding populations (Jhala et. al., 2011). Most of these occur within a matrix of different land-use types, and are protected within 19 Tiger Reserves (TR) (Jhala et al. 2011; Joshi et al. 2013), by the Government of India (under the Wildlife Protection Act of 1972). Several forest connectivity areas have been identified in this landscape - the Kanha-Pench corridor, Kanha-Achanakmar, Kanha-Nawegaon and Nagzira-Nawegaon corridor. Of these corridors, the Kanha-Achanakmar complex is perceived to be an important corridor connecting the Kanha Tiger Reserve (Global Priority Landscape according to Sanderson et al 2006) in the state of Madhya Pradesh with the Achanakmar Tiger Reserve in Chhattisgarh. These forest tracts are surrounded by vast stretches of agricultural fields and abandoned fallows. In areas between PAs, the forest is restricted to hilly tracts while the valleys and plateau are occupied by agricultural fields and human settlements. The forest of the corridor is undulating with patches of Sal (*Shorea robusta*) in the valleys. Two indigenous communities, the Gond and Baiga live in this landscape.

The knowledge of large carnivore occupancy outside protected areas is inadequate; such data could allow identification of new habitats and could potentially help in upgrading the legal protection status of these areas. Anthropogenic pressures have put these forest corridors, which large carnivores use to move, under great strain causing disruptions in their movement and escalating human-large carnivore conflict. This may lead to not only retaliatory killings but also negative attitudes of the local community towards wildlife. The present study was aimed to fulfil this knowledge gap about large carnivore occupancy and habitat status in the Kanha-Achanakmar corridor. The objectives of the study were as follows:

Objectives:

1. Determine the distribution of large carnivores in the Kanha-Achanakmar landscape.
2. Identify the anthropogenic factors influencing large carnivore occupancy in this landscape.
3. Assess the connectivity of tiger populations based on habitat and occupancy.

Landscape view of Achanakmar–Kanha corridor

PROJECT AREA

The Achanakmar–Kanha corridor is located across the administrative boundaries of two states i.e. Chhattisgarh and Madhya Pradesh, respectively. This tiger corridor is believed to be a crucial linkage between two tiger population - Kanha and Achanakmar through Phen WLS which is part of the satellite core area of Kanha TR (fig. 1 in pg# 15). Most of the corridor area falls within the Kawardha and Mungeli Territorial Forest Division of Chhattisgarh and Dindori and East Mandla Territorial Forest Divisions of Madhya Pradesh. The total length of the corridor is about 50 km with an average width of 15 km.

Achanakmar Tiger Reserve (ATR; 81º31′0 E, to 81º57′0 E and 22º17′ N to 22º38′ N.), located in the state of Chhattisgarh in Central India, covers an area of 914.017 (626.19 Km² core area and 287.822 Km² of buffer area). This reserve was notified vide the Government of Chhattisgarh, Forest Department notification no.F8-43/2007/10-2, Raipur 20th February 2009. Achanakmar Tiger Reserve is situated within a vast tract of forests extending to the south of Amarkantak.

The forest department, Chhattisgarh has proposed the following areas as Tiger Corridor area between Achanakmar and Kanha for further declaration and management. The areas are as follows:

Sl No	Forest Division	Forest Ranges	Compartments
1	Mungeli	Khudia	416, 417, 418, 419, 420, 421, 422, 423, 424, 463, 464, 465, 466, 467, 468, 469, 474, 475, 476, 477, 478, 480, 481, 482, 483, 484, 487, 488
2	Kawardha	Pandariya West	452,453, 454, 455, 456, 458, 459, 460, 461, 462, 463, 464, 465, 466, 467, 468, 469, 470, 471, 472, 473, 474, 475, 476, 477, 478, 479, 480, 481, 482, 483, 484, 485, 486, 487, 488, 489, 490, 491

3	Kawardha	Pandariya East	532, 533, 534, 535, 536, 537, 538, 539, 540, 541, 542, 543, 544, 545, 546, 547, 548, 549, 550, 551, 552, 1467, 1468

The forest is generally of tropical moist deciduous type. Valleys are mostly with Sal (*Shorea robusta*) but in many areas in gregarious associations with different tree species like *Diospyros melanoxylum*, *Terminalia tomentosa*, *Adina cordifolia, Pterocarpus marsupium, Annogeissus latifolia, Tectona grandis, Madhucha indica*. Lower and higher slopes support bamboo (*Dendrocalamus strictus*) with miscellaneous tree species.

The climate here is tropical with winter (November-February), summer (April-mid June) and rainy seasons (July-September). The maximum temperature recorded may exceed 45°C to while minimum may fall to 4°C. The annual rainfall averages about 1300 mm of which 82% occurs during rainy season.

Apart from tiger, leopard and hyena, the carnivore fauna is represented by dhole (*Cuon alpinus*) jackal (*Canis aureus*), jungle cat (*Felis chaus*) and Indian fox (*Vulpes bengalensis*). The Sloth bear (*Melursus ursinus*) is the only bear species found in this reserve. Chital (*Axis axis*), sambar (*Rusa unicolor*), gaur (*Bos gaurus*), nilgai (*Boselaphus tragocamelus*), wild pig (*Sus scrofa*), barking deer (*Muntiacus muntjac*) and chowsingha (*Tetraceros quadricornis*), are the wild ungulate species found in the study area. The common langur (*Semnopithecus entellus*) and rhesus macaque (*Macaca mulatta*) represents the primate fauna of the area. The Indian porcupine (*Hystrix indica*), black-naped hare (*Lepus nigricollis*) and Malabar giant squirrel (*Ratufa indica*) are also found.

METHODOLOGY

The team surveyed the Kanha-Achanakmar corridor to assess the presence of tiger (*Panthera tigris*) and leopard (*Panthera pardus*) and their prey. Sign surveys and camera trapping was used to detect the presence of the target species.

Sampling design:

The team used a grid design for sampling, each cell of 144 km² (12 km x 12 km) corresponds to the home range of a tiger. The forest cover of each grid was assessed using Google Earth satellite imagery. The sampling intensity was designed within a grid (Table 1), sampling forest roads and trails where substrate was suitable for tracing animal signs and pugmarks in each grid.

The team emphasized on carnivore tracks and signs in addition to biotic pressure on natural resources. All the forest roads and trail tracks sampled were recorded with help of GPS (fig. 2 in pg 16)). Twenty five grids were sampled in all.

Table 1: Forest cover percentage and sampling effort in each grid

Grid No.	Forest Cover (%)	Sampling Effort (km)
1	65	26
2	70	28
3	60	24
4	45	18
5	70	28
6	60	24
7	35	14
8	30	12
9	25	10
10	40	16

11	30	12
12	15	6
13	40	16
14	35	14
15	70	28
16	60	24
17	60	24
18	50	20
19	60	24
20	50	20
21	45	18
22	25	10
23	25	10
24	20	8
25	50	20

Occupancy Modelling:

The occupancy framework (targeted for tiger) was used for presence–absence surveys (1-detection, 0-non detection) on the basis of indirect and direct evidences (MacKenzie & Nichols 2004, MacKenzie et al. 2002). *A priori*, it was assumed that population was closed during the study period and there were no demographic changes (MacKenzie et al. 2002). A grid (144 km²) based sampling design was followed to detect the occurrence of species and 25 grids were sampled. Due to limited logistics, sampling was restricted to spatial replicates only (Hines et al. 2010) instead of the conventional temporal replicates. With the help of GPS (Garmin Vista-8H), location was recorded for every 200 m and 10 spatial replicates were generated by subdividing total distance covered (minimum 6 km) in a grid.

The occupancy model included five site-covariates, three of them are described in Table 2, others are encounter rates of prey and livestock presence evidence. Minimum Akaike Information Criterion (AIC) was

used to select suitable model in PRESENCE software. Analysis was carried out only for leopard as detection of tiger was too low to carry out any meaningful analysis. First, using all the variables, the best model predicting the detection probability was selected according to the minimum Akaike value. This combination of variables was kept fixed (as the best predictors of detection probability) and the site occupancy modeling was carried out with all the variables. The predicted site-occupancy values for each sampled grid of the study area were then plotted and reclassified using Arc-GIS 10.

Table 2. Variables used to estimate the site occupancy rates in the occupancy model.

Categories	Variables	Ranks
Forest cover categories	Canopy, understory and overall forest cover percentage	low (1, < 20%), medium (2, 21-40%), high (3, 41-60%) and very high (4, >60%)
Water availability	Presence of streams, lakes and other water sources	Present (1) or absent (0)
Biotic pressures	Cutting, lopping, logging, bamboo extraction, fuel-wood collection, presence of human trails and presence of livestock evidences.	Absent (0), low (-1), medium (-2) and high (-3)

RESULTS AND DISCUSSION

The team confirmed presence of six carnivores in the sampled grids. The mean encounter rate of evidences (#/100km) for carnivores (fig. 3) were as follows: leopard (7.34 ± 1.58), sloth bear (7.31 ± 2.23), jackal (1.60 ± 0.83), hyena (1.42 ± 0.89), tiger (0.85 ± 0.35) and there was a single sighting of a jungle cat. The team found tiger signs in grid numbers 1, 3, 17, 18 and 19 through their tracks, signs and recently documented conflict situations. In the 25 grids sampled, presence of leopard and sloth bears were recorded in 16 and 13 grids, respectively.

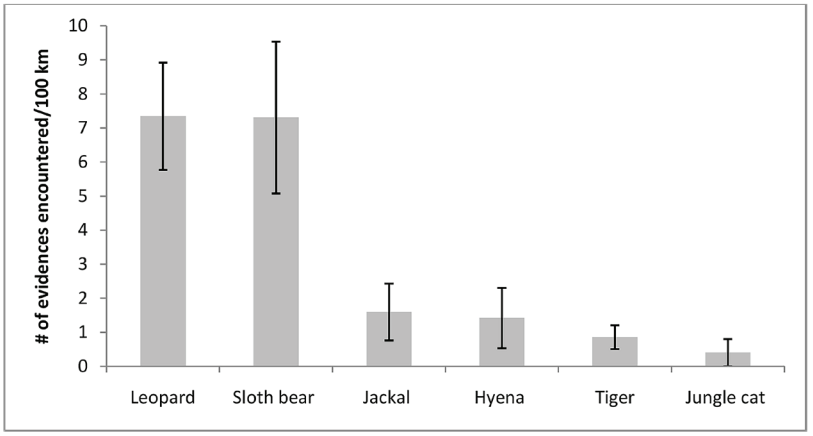

Fig. 3: Encounter rates of evidences (#/100km walk) for carnivores in Kanha Achanakmar corridor during the survey

Among the ungulates and other prey, presence of eight prey species was confirmed. Langur (*Semnopithecus entellus*) was the most commonly encountered animal during the survey followed by chital. The decreasing order of encounter rates (#/100km) evidences for prey species (fig. 4) were as follows: langur (17.52 ± 1.99), chital (10.12 ± 2.52), sambar (7.13± 3.61), gaur (6.29 ± 3.60), wild pig (*Sus scrofa*) (4.20 ± 1.22), hare (3.07 ± 1.07), rhesus macaque (*Macaca mulatta*) (2.73± 0.88) and barking deer (*Muntiacus vaginalis*) (0.85± 0.64). Presence of langur

was recorded in 23 out of 25 grids whereas presence of chital was recorded in 17 grids out of the 25 grids sampled. Evidences of major tiger prey such as gaur and sambar were encountered only in grid 5 & 6 respectively.

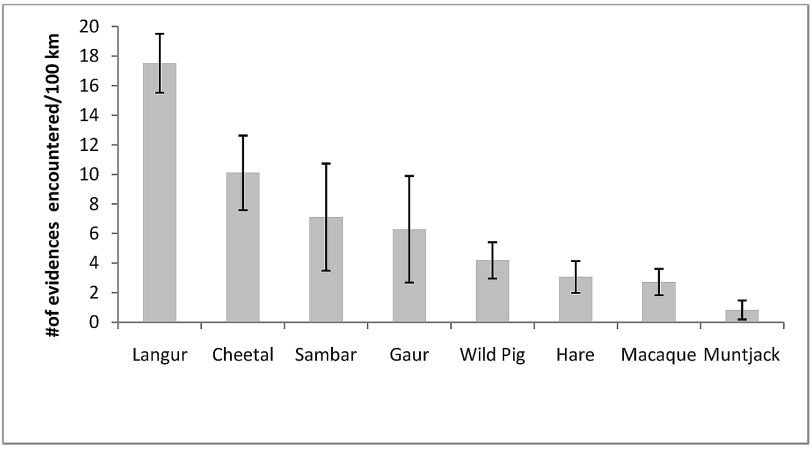

Fig. 4: Encounter rates of evidences (#/100km walk) for ungulates in Kanha Achanakmar corridor during the survey

The team also assessed the habitat quality within the grids. Further, the team collected data on 11 habitat variables such as forest cover percentage, understory, canopy cover, availability to water, biotic pressures such as cutting, lopping, logging, bamboo extraction, fuel-wood collection, presence of human trails and presence of livestock evidences. The forest cover categories (canopy, understory and overall forest cover percentage) was ranked as low (1, < 20%), medium (2, 21-40%), high (3, 41-60%) and very high (4, >60%). Water availability was denoted as present (1) or absent (0). Biotic pressures were also categorized as absent (0), low (-1), medium (-2) and high (-3). Summation of rank values for all variables depicted the overall score of a grid as a habitat. The results (Table 3) depicted among the 25 grids sampled, 11 were relatively intact in terms of forest cover and intensity of biotic pressure (scored 1-4), six grids represented moderately

degraded habitats (scored 0) and eight grids represented degraded habitats (scored -1 to -3) (fig. 5 in pg# 16). However, among these degraded habitats, in grid 19, presence of four carnivores (including tiger) and five prey species was recorded (Table 3). In grid number 18, 22 and 25 (degraded habitats), presence of six to eight species were recorded (fig. 6 in pg# 17). Being close to Kanha TR, these grids need conservation action, especially reduction of biotic pressure which may lead to better species movement. Grids situated just outside the Achanakmar TR (Grid 2,3 and 5) have good forest cover and less biotic pressure and six to eight species of carnivores and their prey were recorded from these grids (fig. 7 in pg# 17 and fig. 8 in pg#18). Four grids (10, 17, 20, 21) situated between these two PAs had six or more number of carnivores and their prey species present (Table 3).

Table 3 Rank of sampled grids and number of species present

Grid No.	Grid Rank	Species present	Carnivore	Prey
1	2	4	1	3
2	1	8	3	5
3	2	6	4	2
4	0	2	0	2
5	2	6	1	5
6	0	4	0	4
7	-1	4	2	2
8	-1	3	2	1
9	0	4	3	1
10	2	7	1	6
11	4	3	1	2
12	2	3	2	1
13	0	4	2	2
14	1	2	1	1
15	3	2	0	2
16	-3	4	0	4

17	1	7	3	4
18	-1	7	3	4
19	-2	9	4	5
20	0	7	2	5
21	0	6	1	5
22	-1	6	1	5
23	1	5	2	3
24	-2	3	1	2
25	-1	8	2	6

A spotted deer in Achanakmar WLS

Occupancy modeling for leopards in Kanha-Achanakmar corridor:

Overall, 25 grids were sampled during the study period between 15 February to 25 June 2012. Leopard was detected at 16 sites (grids) with estimated site occupancy of 0.91±0.05 which was greater than the naive estimate (0.64). Encounter rate of all prey species proved to be the best explanatory variable for detection probability as well as site occupancy of leopard according to the minimum AIC values and least difference in AIC weight (Table 4 and 5). Other factors such as livestock presence and human disturbance also affected the detection probability and site occupancy along with prey presence as the main factor influencing leopard distribution in the study area.

Table 4: Top models for detection probability of leopard in Kanha-ATR corridor

Model	AIC	ΔAIC	AIC wgt	Model Likeli-hood	no. Par.	-2*Loglike
psi,thta0, thta1,p(.P)	171.64	0	0.3283	1	5	161.64
psi,thta0, thta1,p(.DP)	172.88	1.24	0.1766	0.5379	6	160.88
psi,thta0, thta1,p(.LDP)	173.7	2.06	0.1172	0.357	7	159.7
psi,thta0, thta1,p(.LD)	174.06	2.42	0.0979	0.2982	6	162.06
psi,thta0, thta1,p(.D)	174.5	2.86	0.0786	0.2393	5	164.5
psi,thta0, thta1,p(.L)	174.52	2.88	0.0778	0.2369	5	164.52
1 group, Constant P	174.71	3.07	0.0707	0.2155	2	170.71

P= All prey species, C= Forest Cover, L= Livestock, D= Disturbance, W= Water availability

Table 5: Top models for site occupancy of leopard in Kanha –ATR corridor

Model	AIC	Del-ta AIC	AIC wgt	Model Likeli-hood	no. Par.	-2*Loglike
psi(P),thta0, thta1,p(.P)	173.43	0	0.2119	1	6	161.43
psi(PC),thta0, thta1,p(.P)	174.01	0.58	0.1586	0.7483	7	160.01
psi(PL),thta0, thta1,p(.P)	174.11	0.68	0.1508	0.7118	7	160.11
psi(PD),thta0, thta1,p(.P)	174.58	1.15	0.1192	0.5627	7	160.58
psi(PDC), thta0, thta1,p(.P)	174.77	1.34	0.1084	0.5117	8	158.77
psi(PDL),th-ta0,thta1,p(.P)	175.02	1.59	0.0957	0.4516	8	159.02
psi(PW),th-ta0,thta1,p(.P)	175.59	2.16	0.072	0.3396	7	161.59

P= All prey species, C= Forest Cover, L= Livestock, D= Disturbance, W= Water availability

The individual site estimates of occupancy for each grid (n=25, range 0.86 to 0.94) were plotted over the study area boundary to identify the areas with extremely high (0.90-0.95), very high (0.85-0.90) and high (<0.85) probability of leopard occurrence (fig. 9 in pg# 18).

Camera Trapping:

The team deployed camera traps on cattle kills reported by villagers and forest staff. Also in sites with strong indications of large carnivore presence. The team did try to camera trap as many large carnivores as possible but due to low number of animals, chances of camera trap theft and vandalism were not very successful. While the exercise captured Langur, Rhesus Macaque, Chital, Wild pig, and Jackals in the process, large carnivores such as tiger and leopard remained evasive.

The team observed moderate to low sign detection rate in most of the grids surveyed in the corridor. Although it was tempting to blame loss of forest cover and encroachment or subsequent human interference for the low detection, there were grids like number 19 where four species of carnivores were detected. Also, some grids did possess reasonable cover but were bereft of animal detections. The team feel that this corridor as it stands now is deficient in animal species and numbers but does have the potential to serve as an important movement area for tigers between Kanha and Achanakmar. This is significant for Achanakmar because this tiger reserve has very low tiger numbers and the only chance of tiger movement would be through this corridor. Evidence of tigers in five cells indicates that tigers have used this area for movement. Other possible issues include the invasion of exotic weed species which has colonized several areas. The only good sign observed during this project was good availability of water through many perennial water resources throughout the Chhattisgarh part of the corridor.

Camera trap photographs of carnivores and prey in Kanha-Achanakmar corridor

Camera trap photographs of mammals in Kanha-Achanakmar corridor

Perennial water bodies (top) and transects walks on the border of M.P and Chhattisgarh states (bottom)

THREATS AND POSSIBLE SOLUTIONS

In Kanha-Achankamr corriodor increasing anthropogenic pressures, forest fire and hunting may have resulted in habitat-fragmentation and decline in wildlife population. In particular, in grid number 18, 19, 22 and 25, the forest require urgent management intervention and habitat restoration initiatives. Some notable threats posing serious damage to this tiger corridor and possible solutions to these problems are discussed here.

• **Thinning and degradation**: After fragmentation, major threat to this corridor is the thinning of forest cover and further leading to degradation.

A. **Fuel-wood extraction** is the main cause of forest-thinning. Local communities are highly dependent on forests for fuel-wood. As of today with no check on the fuel-wood extraction, it is a free commodity. Apart from household use, the wood is in high demand in local markets and especially in Dhabas (roadside restaurants).

Solution: The solution for this problem is to take strict action against wood extraction no matter how small the quantity is. Major hurdle in implementation is that most of the extraction is carried out by women and this needs well trained guards (female) to take action. Most of the forest guards neglect this due to interference of local politicians. A parallel solution to this problem can be the introduction of fuel efficient cooking stoves to reduce fuelwood requirement by more than 40% in villages of Nagzira-Navegaon corridor. Proper training as well as manufacturing these cooking units may also work as an economic booster for the villagers.

B. **Forest fire**: Setting fire during collection of tendu leaves (*Diospyros melonoxylon*) and mahua flowers (*Madhuca longifolia)* is a common practice in these areas. Some burning by shepherds are done for new grasses. These manmade fires leads to immense destruction and wipes out the undergrowth. These fires are set in the summer which makes it difficult for wild ungulates to survive as whatever little undergrowth is present in the dry season gets burnt.

Solution: Burning for Mahua is completely unnecessary; these fires are set to clean the area under the tree so the flowers can be collected easily. With a simple broom one can clear the area in less than 10 min. Proper training on sustainable harvesting procedure is needed to train the villagers about the correct procedure of collection. Apart from that, value addition procedures can also be taught to the interested villagers. Knowledge from the trainings should improve the economic condition of the villagers in the long run. Tendu collectors believe that after fire new Tendu shoots grow which are of better quality and yield more. But recent field based experiments shows that even unburnt areas yield same quantities of Tendu leaves. Awareness programmes among the villagers depicting the negative impacts of fire can be of great help to reduce these kinds of activities. As mentioned above, similar kind of sustainable harvesting trainings can also be tried to make the villagers aware about the correct and more sustainable ways of Tendu leaf collection.

• **Encroachments**: This is one of the major problem in the corridor specially in Pandaria area. It was noted that some of the areas were completely denuded due to large scale felling and land conversion.

Solution: Proper demarcation of the area and stand boundary and compartments pillars (*Munaras*) in the area.

• **Forest weeds** : There are several invasive weeds like *Phoenix occaulis, Lantana camara, Eupatorium, Hyptis suaveolense,* etc. found in the forest which are reason for decreasing the quality and quantity of grasses.

• **Hunting**: Hunting of herbivores poses a continuous threat. The occupancy results show that the presence of prey species is critical for tiger-occupancy. Snares are set regularly for catching hare and nets are used to catch wild-pig. These activities go unnoticed but have a profound effect on wildlife. During the survey several snares and nets were detected and removed.

Solution: Effective patrolling and training in law and enforcement should be given to the staff of the Territorial divisions in addition to anti-snare walks.

Instances of encroachment, hunting and forest fires in Kanha-Achanakmar corridor

THE WAY FORWARD

The future of this corridor depends on the physical connectivity of the forests, availability of prey and effective protection. Effective mitigation measures need to be taken to maintain the functional connectivity of the corridor. Preparation of management plan for the corridor and subsequent implementation is necessary. Initiation of afforestation programs with strict action against encroachment and fuel-wood extraction will exert a positive effect on tiger habitat. Critical areas showing breakage in forest connectivity should be given priority and measures should be taken to fill these gaps wherever possible.

Regular and scientific monitoring of tigers is a key to measure the success of conservation interventions and management decisions. Maintaining a database of individuals helps to track individuals over several years and understand how they use the landscape. Other than effective monitoring, there is a need to train the territorial-staff in law and enforcement techniques. It is important to equip them with essential kits required to effectively patrol their areas and boost their morale. This corridor presents a unique opportunity to conserve tigers at a landscape level. This corridor is deficient in mammal species but does have the potential to serve as an important movement area for tigers between Kanha and Achanakmar Tiger Reserves. Other corridors in this landscape should be explored to understand their potential and new tiger bearing areas can be identified. If the target of doubling tiger numbers is to be achieved such connectivities to areas where currently tiger densities are low are critical.

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ANNEXURE - I

Forest ranges surveyed with name of rest houses:

Forest Ranges	Rest House	Duration
Khuria range	Karidongari	2 Mar-25 March, 2014
Lormi Part-1	Karidongari	2 Mar-25 March 2014
Pandaria East & West range	Kukdur	26 Mar-6 April 2014
Taregao range	Taregao	12 April-3 May 2014
Kawardha range	Taregao	12 April-3 May 2014
Chilfi range	Chilfi	12 April-3 May 2014
Chanda & Bajag Range	Dindori	10 May-15 May 2014
Motinala & Mawai	Mawai & Dindori	10 May-15 May 2014
East Karanjia	Karanjia	16 May- 20 May 2014
West Karanjia	Jagatpur	20 May-26 May 2014

ANNEXURE II
Data sheet using during survey

Occupancy Survey Datasheet

Start location:

Site: Grid: Sub Grid: TM1: TM2: TM3:

Date. Start Time. End Time. GPS Unit. Page No.

RLP No	Distance (in mt.) from Start Pt.	Location		Predator Sp.	Evidence	Age	Substrate	Prey Sp.	Evidence	Age	Substrate	Under storey	Canopy	Invasive Sp.	Disturbance		Vial ID
		Lat (N)	Long (E)									L/M/H			Type	H/L	

Species: GAR, SBR, MJK, CHT, FHA, PIG, NLG, BBK, CHN **Evidence:** Track-TRK, Pellet-PLT, Direct Sighting-DST **Age:** F (<1day), B (1-7days), O (>7days)
Substrate: Leaf liter-LL, Soft Soil-SS, Hard Soil-HS, Grass-GR **Under Storey Cover:** Low-L, Medium-M, High-H
Human Activities: Lopped Tree-LP, Cut Stem-CS, Cut Bamboo-CB, Tree Notch-TN, Logging-LG, Fuel Wood-FW, Cattle/Livestock-CT, Human Trail-HT, Fire-FR, Honey Collection HC, Weed Infested WD, Human Habitation HH, Agriculture AG, FD Protection FD, Fire FR, Exposed Soil ES, Poaching PH, Dead Wood DW

ANNEXURE III

कार्यालय प्रधान मुख्य वन संरक्षक (वन्यप्राणी प्रबंधन एवं जैव विविधता संरक्षण
एवं मुख्य वन्यप्राणी अभिरक्षक), छत्तीसगढ़
बस्तर भवन, अंबिकापुर रोड चौक, रायपुर
ईमेल – pccfwl@sify.com (Tel 0771-2552228, Fax 0771-2552227)

क्रं./व.प्रा./बजट-08/13/2[illegible] रायपुर दिनांक 31/08/2013

प्रति,

वन संरक्षक (वन्यप्राणी) एवं क्षेत्र संचालक
उदंती–सीतानदी टायगर रिजर्व, रायपुर
छत्तीसगढ़.

विषय :– मांग संख्या 10–2406 –0101– राज्य आयोजना (सामान्य) (3943) वन्य जीवों को संरक्षण एवं विकास के अन्तर्गत वित्तीय वर्ष 2013–14 हेतु बजट आवंटन बाबत्।

संदर्भ:– **WTI letter no. wti/rhci/rpm/17 dated 17-05-2013**

o

विषयांतर्गत संदर्भित पत्र द्वारा मांग संख्या 10–2406 0101 राज्य आयोजना (सामान्य) 3943 – वन्य जीवों को संरक्षण एवं विकास अन्तर्गत वित्तीय वर्ष 2013–14 में **Ground Truthing & Sign Survey on Kanha-Achanakmar Tiger Reserve Corridor** संबंधित इस पत्र के साथ संलग्न परिशिष्ट 1 अनुसार परियोजना क्रियान्वयन हेतु निम्नानुसार स्वीकृति दी जाती है। परियोजना हेतु प्रस्तावित कुल लागत की राशि रू. 4.22 लाख में से शेष राशि की व्यवस्था WTI द्वारा स्वयं की जायेगी।

(राशि लाखों में)

क्र.	वनमंडल का नाम	कार्य का नाम	वित्तीय वर्ष 2013–14 में आवंटित राशि		
			#02 मजदूरी	#25 सामग्री और पूर्तियां	योग
1	2	3	4	5	6
1	रायपुर	Hirringa four wheeler vehicle	0.70	-	0.70
2		Fuel	0.40	-	0.40
3		Food	0.40	-	0.40
4		Batteries	-	0.25	0.25
		योग	1.50	0.25	1.75

उपरोक्त राशि कार्यालयीन पत्र क्रमांक/व.प्रा./बजट/914 दिनांक 16.04.2013 द्वारा दिये गये बजट आवंटन में से आबंटित की जाये। उक्त राशि **Wildlife Trust of India, New Delhi** को आबंटित कर इस कार्यालय को सूचित करें।

उपरोक्त व्यय मांग संख्या 10–2406 –0101– राज्य आयोजना (सामान्य) (3943) वन्य जीवों को संरक्षण एवं विकास के अन्तर्गत मांग के कॉलम नंबर 4 एवं 5 में उल्लेखित उद्देश्य शीर्षों में विकलनीय होगा।

संलग्नः– परिशिष्ट–1

मुख्य वन संरक्षक (वन्यप्राणी)
छत्तीसगढ़, रायपुर

-34-

पृ.क्र./व.प्र./बजट-05/13/2[illegible] रायपुर दिनांक :/06/2013

प्रतिलिपि :-

1. महालेखाकार, छत्तीसगढ़ रायपुर,
2. प्रमुख सचिव, छत्तीसगढ़ शासन, वन विभाग महानदी भवन मंत्रालय नया रायपुर
3. संयुक्त सचिव छत्तीसगढ़ शासन, वित्त विभाग महानदी भवन मंत्रालय नया रायपुर
4. संचालक, कोष लेखा एवं पेंशन शंकर नगर रायपुर
5. वनमंडलाधिकारी रायपुर वनमंडल की ओर भेजकर लेख है कि मासिक लेखा प्रतिवेदन महालेखाकार कार्यालय रायपुर को भेजते हुये उसकी प्रति इस कार्यालय को भी भेजा जावे।
6. श्री आर0पी0मिश्रा, वैज्ञानिक वाइल्ड लाईफ ट्रस्ट ऑफ इंडिया, नई दिल्ली की ओर सूचनार्थ प्रेषित। कार्य की प्रगति से समय-समय पर इस कार्यालय को अवगत करावें।

की ओर सूचनार्थ सम्प्रेषित।

मुख्य वन संरक्षक(वन्यप्राणी)
छत्तीसगढ़, रायपुर

ANNEXURE IV

कार्यालय मुख्य वन्यप्राणी अभिरक्षक एवं प्रधान मुख्य वन संरक्षक (वन्यप्राणी) मध्यप्रदेश,
प्रगति भवन, तृतीय तल, एम.पी.नगर, ज़ोन–I, भोपाल
दूरभाष : 0755–2674206, 2674248, फैक्स : 0755–2766315
e-mail pccfwl@sancharnet.in, pccfwl@mpforest.org

क्रमांक/तकनीकी–I/ 383 भोपाल, दिनांक 20/01/2014

प्रति,

डॉ0 राजेन्द्र मिश्रा,
रीजनल हेड,
सेन्ट्रल इंडिया वाइल्ड लाईफ ट्रस्ट ऑफ इंडिया,
एफ–13, सेक्टर–8, नोएडा,
उत्तरप्रदेश–201301

विषयः– **Assessing tiger (Panthera Tigris Tigris) distribution and the factors influencing tiger occupancy in the Kanha-Achanakmar corridor.**

संदर्भः आपका पत्र कमांक **WTI/RHCI/RPM/25** दिनांक 20.12.2013.

आपके संदर्भित पत्र से प्राप्त अध्ययन प्रस्ताव अनुसार मध्यप्रदेश की सीना में स्थित कान्हा–अचानकमार टाईगर रिज़र्व्स के कारीडोर क्षेत्र में 01 फरवरी 2014 से 15 जनवरी 2015 तक विषयांकित अध्ययन की अनुमति वन्यप्राणी अधिनियम की धारा 28 (c) तथा मध्यप्रदेश वन्यप्राणी (संरक्षण) नियम 35 के अंतर्गत संलग्न दिशा–निर्देशों के अधीन प्रदान की जाती है ।

सर्वेक्षण कार्य के दौरान वन्यप्राणी अधिनियम 1972 के प्रावधानों एवं संलग्न निर्देशों का पालन करना सुनिश्चित करें। नियमों का उल्लंघन पाये जाने पर अनुमति निरस्त कर दी जावेगी। कार्य के पूर्ण होने के पश्चात् अध्ययन रिपोर्ट की एक प्रति इस कार्यालय को भी भेजना सुनिश्चित करें।

आपके द्वारा प्रस्तावित मैथोडोलाजी में सर्वेक्षण कार्य के लिए क्षेत्र को ग्रिड्स में विभाजित किया गया है तथा प्रत्येक ग्रिड का क्षेत्रफल 188 वर्ग कि0मी0 रखा गया है। जिसमें अध्ययन दल द्वारा 7 दिवस तक बाघ की उपस्थिति के प्रमाण एकत्रित किया जाना है। प्रस्ताव में यह उल्लेख नहीं है कि प्रत्येक ग्रिड्स में कितने व्यक्तियों के द्वारा साक्ष्य एकत्रित करने का कार्य किया जाएगा। चूँकि 188 वर्ग कि0मी0 क्षेत्र अत्यंत विस्तृत क्षेत्र होगा, इसमें 7 दिवस के भीतर एक सीमित टीम के द्वारा पर्याप्त साक्ष्य एकत्रित नहीं किया जा सकेगा। अतः यह सुझाव है कि सर्वेक्षण इकाई (ग्रिड) की साइज़ 20 से 25 वर्ग कि0मी0 रखा जाना चाहिए एवं प्रत्येक ग्रिड में दो व्यक्तियों के द्वारा साक्ष्य एकत्र करने का कार्य कम से कम तीन दिवस तक किया जाना चाहिए तभी उपयोगी डेटा संग्रहित किया जा सकेगा।

संलग्न :– उपरोक्तानुसार।

(नरेन्द्र कुमार)
मुख्य वन्यप्राणी अभिरक्षक एवं
प्रधान मुख्य वन संरक्षक (वन्यप्राणी), म.प्र.

पृ. क्रमांक/तकनीकी–I/ 384 भोपाल, दिनांक 20/01/14

प्रतिलिपि :– 1. प्रधान मुख्य वन संरक्षक एवँ मुख्य वन्यप्राणी अभिरक्षक, अरण्य भवन, फाफाडीह चौक, रायपुर, छत्तीसगढ़ की ओर सूचनार्थ अग्रेषित।
2. क्षेत्र संचालक, कान्हा टाईगर रिजर्व, मण्डला की ओर सूचनार्थ एवं आवश्यक कार्यवाही हेतु अग्रेषित। कृपया संलग्न दिशा निर्देशों में निहित शर्तों का पालन किया जाना सुनिश्चित करते हुए कार्य के दौरान अध्ययनकर्ताओं को आवश्यक सहयोग प्रदान करें।

संलग्न :– उपरोक्तानुसार।

मुख्य वन्यप्राणी अभिरक्षक एवं
प्रधान मुख्य वन संरक्षक (वन्यप्राणी), म.प्र.

O/C

OTHER WTI PUBLICATIONS

A. OCCASIONAL REPORTS

Tribal Territories:
Impact assessment around the Jarawa tribal reserve, middle and south Andaman Islands

Captive Concerns:
Health and management of captive elephants in Jaipur

Jumbo Express:
A scientific approach to understanding and mitigating elephant mortality due to train accidents in Rajaji National Park.

Fair Concern:
Health and management of captive elephants in Sonpur

Elephant in Exile:
A rapid assessment of the human-elephant conflict in Chhattisgarh

Ganesha to Bin Laden:
Human-elephant conflict in Sonitpur district of Assam

Healing Touch:
Health and management of captive elephants at Kaziranga elephant festivals

Dog and Bull:
An investigation into carnivore-human conflict in and around Itanagar Wildlife Sanctuary, Arunachal Pradesh

Against the Current:
Otters in the river Cauvery, Karnataka

Making Way
Securing the Chilla-Motichur Corridor to protect elephants of Rajaji National Park

Silent Stranglers:
Eradication of mimosa in Kaziranga National Park, Assam

Living at the Edge:
Rapid survey for the endangered Ladakh urial (*Ovis vignei vignei*) in Leh district of Ladakh Trans-Himalaya

Search for Spectacle:
A conservation survey of the Phayre's leaf monkey (*Tranchypithecus phayrei*) in Assam and Mizoram

Sighting Storks:
Status and distribution of Greater adjutant storks (*Leptoptilos dubius*) in the Ganga and Kosi river floodplains near Bhagalpur, Bihar

Bait and Watch:
Popularization of alternatives to dolphin oil among fishermen for the conservation of the Ganges river dolphin (*Plantanista gangetica*) in Bihar

No Mast Kalandar:
The beginning to the end of dancing with bears

Awaiting Arribadda:
Protection of Olive Ridley turtles (*Lepidochelys olivacea*) and their nesting habitats at Rushikuliya rookery, Orissa

Living with Giants:
Understanding human-elephant conflict in Maharashtra and adjoining areas

Crane Capital:
Conservation strategy for Sarus Crane (*Grus antigone*) habitat in Etawah and Mainpuri Districts, Uttar Pradesh

Deadly Tracks:
A scientific approach to understanding and mitigating elephant mortality due to train hits in Assam

Carnivore Conflict:
Support provided to leopards involved in conflict related cases in Maharashtra

India at the International Whaling commission:
A policy document on India's involvement in the IWC 1981-2003

Hunt for Hangul
Establishing the presence of hangul outside Dachigam National Park, J&K

Bear Necessities
A swcientific approach to understand and mitigate Human Sloth Bear conflict in Madhya Pradesh

B. CONSERVATION ACTION REPORTS

Beyond the Ban:
A census of Shahtoosh workers in Jammu & Kashmir

Biodiversity, Livelihoods and the Law:
The case of the 'Jogi Nath' snake charmers of India

Goats on the Border:
A rapid assessment of the Pir Panjal markhor in Jammu & Kashmir distribution, status and threats

The Ground Beneath the Waves : (2 Volumes)
Post-tsunami impact assessment of wildlife and their habitats in India

Walking the Bears:
Rehabilitation of Asiatic black bears in Arunachal Pradesh

Mountain Migrants:
Survey of Tibetan Antelope (*Pantholops hodgsonii*) and Wild Yak (*Bos grunniens*) in Ladakh, Jammu & Kashmir, India

Predator Alert:
Attacks on humans by leopard and Asiatic black bear in the Kashmir valley – Analysis of case studies and spatial patterns of elevated conflict

Turning the Tide:
The campaign to save Vhali, the Whale Shark (*Rhincondon Typus)* in Gujarat

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Project Investigator

Rahul Kaul

Project Coordinator

R.P Mishra

Project Team

Rahul Kaul, R.P. Mishra, Vivek Tumsare,
Subrat Bahera, Tapajit Bhattacharya,
Prafulla Bhamburkar, Anil Kumar,
Soumya Dasgupta, Shameem Ahmed,

Editorial Team

Series Editor: Vivek Menon
Technical Editor: Rahul Kaul
Editor: Ananda Banerjee

Today habitat loss and fragmentation are huge threats to our wildlife. It is therefore imperative to link our Protected Areas to allow species movement between important habitats to maintain genetic diversity in wildlife populations. Without this, local extinctions can occur. The Kanha-Achanakmar tiger corridor is one such crucial linkage connecting Kanha Tiger Reserve, Madhya Pradesh, with Achanakmar Tiger Reserve, Chhattisgarh. This Occasional Report highlights the challenges and importance of this corridor as an important area for tigers and prey species.

Wildlife Trust of India

F-13 Sector 8, National Capital Region NOIDA -201301, India
Tel.: +91 120 4143900, Fax: 91 120 4143933
Website: http//www.wildlifetrustofindia.org