

TECHNICAL SUMMARY REPORT

**ANNUAL MONITORING OF TIGERS, CO-
PREDATORS AND PREY IN MANAS
NATIONAL PARK, INDIA**

2019

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EXECUTIVE SUMMARY

- Manas National Park (500 sq km), the core of the Manas Tiger Reserve (TR) is a key tiger habitat with a growing tiger population, as monitored since 2010.
- The TR is also part of the core area of the Transboundary Manas Conservation Area (TraMCA), on the Indo-Bhutan international border area is contiguous with the Royal Manas National Park, Bhutan.
- Joint monitoring of tigers across the border revealed regular movement of tigers between Manas National Park and Royal Manas National Park, across the international boundary.
- This summary report presents the findings of the annual tiger monitoring exercise carried out between 12 December, 2018 to 28 March 2019 using the mark recapture method as prescribed (Phase IV) by the National Tiger Conservation Authority.
- The study covered ~480 sq.km covering all three ranges, viz. Bhuyanpara, Bansbari and Panbari ranges of the park.
- In total, camera traps were placed at 128 locations in the park out of which camera traps from six locations were stolen by miscreants and one displaced by animal.
- Followed by a camera trapping effort of 7637 trap-days spread across MNP we obtained 25371 photographs of mammals belonging to 28 different mammal species.
- The study was carried out jointly by a team of frontline forest staff, Aaranyak and WWF-India on an invitation by the Field Directorate to assist in the Phase IV monitoring.
- The study identified 25 individual adult tigers and 05 cubs. Among the adult tigers, 18 were females and 07 were males.

1. BACKGROUND

The tiger *Panthera tigris* symbolizes wilderness values and acts as an umbrella species for the conservation of biodiversity in the forest systems of South and Southeast Asia. As a top predator, tigers play a vital role in regulating and perpetuating ecological processes and systems (Sunquist *et al.* 1999). Tigers, being highly adaptable, exist in a wide range of forest types, and climatic regimes and subsist on diverse prey (Schaller 1967; Sunquist *et al.* 1999). Tigers have an extensive range spanning a total of 1.5 million sq. km area across Asia, within which surviving populations occur patchily and at low densities. Over the past 100 years, in Asia, tigers have lost 93% of their former range (Sanderson *et al.* 2006; Dinerstein *et al.* 2006). Only 5% of the world's wild tigers continue to survive since the last century (Stokes 2010). India represents the world's greatest stronghold for the species, with an overall population of more than 2,200 individuals. The All India Tiger Monitoring (AITM) (once in four years) employs rigorous and robust camera trap mark recapture techniques to estimate tiger population initially developed by Karanth (1995). The method has been refined subsequently (Karanth and Nichols 1998). Over the years this method got lot of faiths from the scientific community and has proved as a reliable technique for estimating abundance of tigers and other cryptic animals.

The large and medium sized ungulates are one of the key factors for the survival of tigers and other co-predators. Over the years the large ungulates have faced the onslaught of hunters and several other anthropogenic threats. The densities of tropical ungulates are often extremely low and even extirpated from several habitats. Decline and complete loss of prey population eventually affects the tiger population of an area. It is crucial that populations of prey animals are assessed reliably.

2019-Phase IV Tiger Monitoring Report-Manas National Park

After a long period socio-political turbulences that led to loss of infrastructure and protection and loss of population across species, Manas National Park and Tiger Reserve are reviving back at a slow but steady pace since 2004. Hence it is urgent to embark on long-term population monitoring of tigers, co-predators, prey and their habitat to understand the demographic features for continued management intervention.

Thus, it is a serious mandate of the park authority and Forest Department, Bodoland Territorial Council (BTC) to monitor the tigers, co-predators and prey population in the National Park. The present study was carried out jointly by a team of Aaranyak and WWF India with support from forest officials and frontline staff on ground on an invitation by the Field Directorate to assist in the Phase IV monitoring.

2. STUDY AREA

Manas National Park is located in the foothills of the Bhutan Himalayas in Baksa and Chirang districts (26°35'-26°50'N, 90°45'-91°15'E) of Assam. The boundary of Manas NP is clearly distinguished by the international boundary with Bhutan to the north, to the south by thickly populated villages and to the east and west by the forest reserves. Elevation ranges from 50 m above MSL on the southern boundary to 200 m above MSL along the Bhutan hills. Manas NP occupies an area of 500 sq. km. that forms the core area of Manas Tiger Reserve which is 2837 sq. km. The tiger reserve stretches over as a continuous belt of forests along the foothills between the River Sankosh in the west to the River Dhansiri in the east. The Manas NP is contiguous with the Royal Manas National Park (1059 sq.km.), Bhutan.

Manas National Park is located at the junction of Indo-Gangetic, Indo-Malayan and Indo-Bhutan realms and is a key conservation area in the Jigme Dorji-Manas-Bumdaling conservation landscape in the eastern Himalayan eco-region. The park is situated in the eastern *duār* and has extensive *Bhabar* and some *terāi* areas, typical of Himalayan foothills. These *terai* like tracts are more or less flat. The northern belt of the tract with major grassland area of Manas is almost flat and well drained.

The climate of Manas is moist tropical with an annual rainfall between 3000 mm to 4000 mm. Grasslands cover about 45% of the National Park area. It is classified as the “Eastern wet alluvial grassland” (Champion and Seth, 1986). In broader scale this grassland can be categorized as *Phragmites-Saccharum-Imperata* type.

Apart from grasslands rest of Manas forest types are represented by Sub-Himalayan high alluvial Semi-evergreen-2B/C/s, Eastern Himalayan Moist Mixed Deciduous-3c/c3 and Assam valley Semi-evergreen- 2B/C (a, b). There is also a considerable variety of aquatic flora long the riverbanks and in the numerous pools.

The Manas National Park has a 110 year of conservation and protection history with a number of designations:

- ✓ 1905: Reserve Forest called the North Kamrup Reserve Forest.
- ✓ 1907: Manas Reserve Forest.
- ✓ 1928: Manas Wildlife Sanctuary (360 sq.km).
- ✓ 1973: Manas Tiger Reserve (2837 sq.km).
- ✓ 1985: World Heritage Site.
- ✓ 1989: Biosphere Reserve.
- ✓ 1990: National Park (500 sq.km).
- ✓ 2003: Chirang-Ripu Elephant Reserve (2600 sq.km).
- ✓ 2004: Important Bird Area.
- ✓ 2017: Extended the area of MNP from 500 sq.km to 850 sq.km

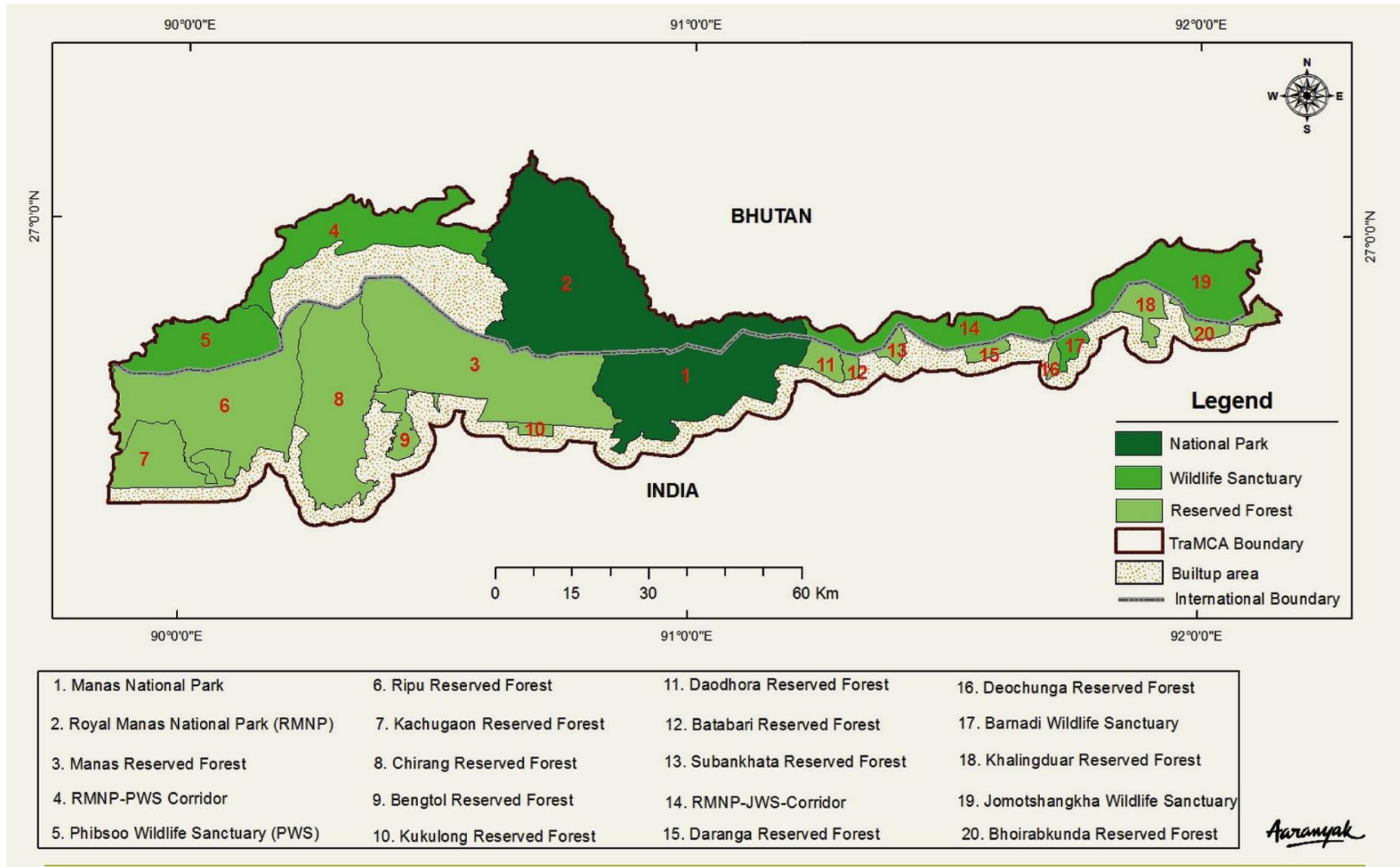


Figure 1. Map of Trans-boundary Manas Conservation Area (TraMCA) which is 6500 sq.km.

3. METHODOLOGY

3.1 Camera Trapping: We used grid based (2 x 2) camera trapping as suggested by National Tiger Conservation Authority (NTCA) for the source population sites under phase IV monitoring in 2019. We have covered the entire study area (Covering three ranges – Bhuyanpara, Bansbari and Panbari) in two study blocks. In total, camera traps were placed at 128 locations in the park. Out of which camera traps in seven locations were lost or stolen.

3.2 Photographic Capture Recapture Index: To calculate the Photo-Capture Rate Index (PCRI) of all species captured we first identified independent captures (i.e. captures that were 30-minutes apart for each station). We then divided the number of independent captures obtained at each trap by trap-specific effort and expressed the estimate per 100 trap-days. Trap specific PCRI were then used to map the spatial variation in capture rates. All maps were created in the open source software QGIS.

3.3 Mapping: We used open sourced QGIS to create vector layers and maps.

4. RESULTS

4.1 Camera Trapping Efforts

GRID SIZE	: 2 x 2 km
DURATION	: 108 days
EFFORTS (Trap-days)	: 7637
NO OF CAMERA STATION USED IN ANALYSIS:	121
AREA SAMPLED	: 480 sq km
TYPES OF CAMERA TRAP USED	: Panthera (version 4, 5 & 6) and Cuddeback Attack & C ₁
TEAMS INVOLVED	: Three teams (at Banasbari, Mathanguri & Kahiteam and Panbari)

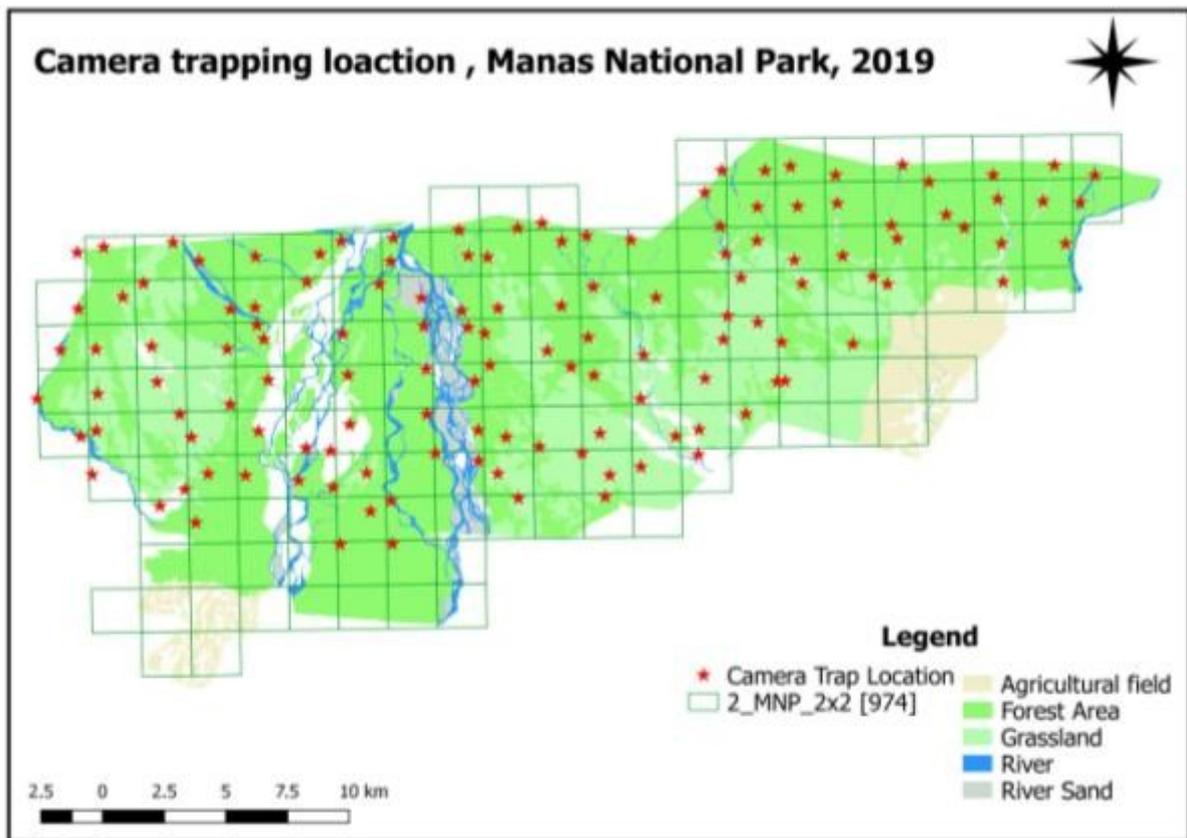


Figure-2. Map showing the trap location (red stars) spread across the Manas National Park, Assam, India (2019).

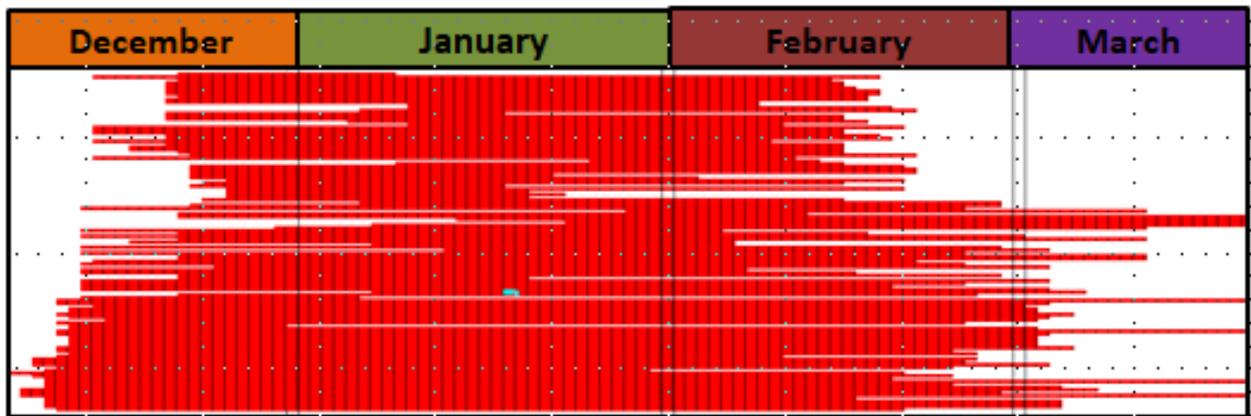


Figure-3. Occasion wise camera trap efforts of different camera trap stations in Manas National park, Assam, India (2019).

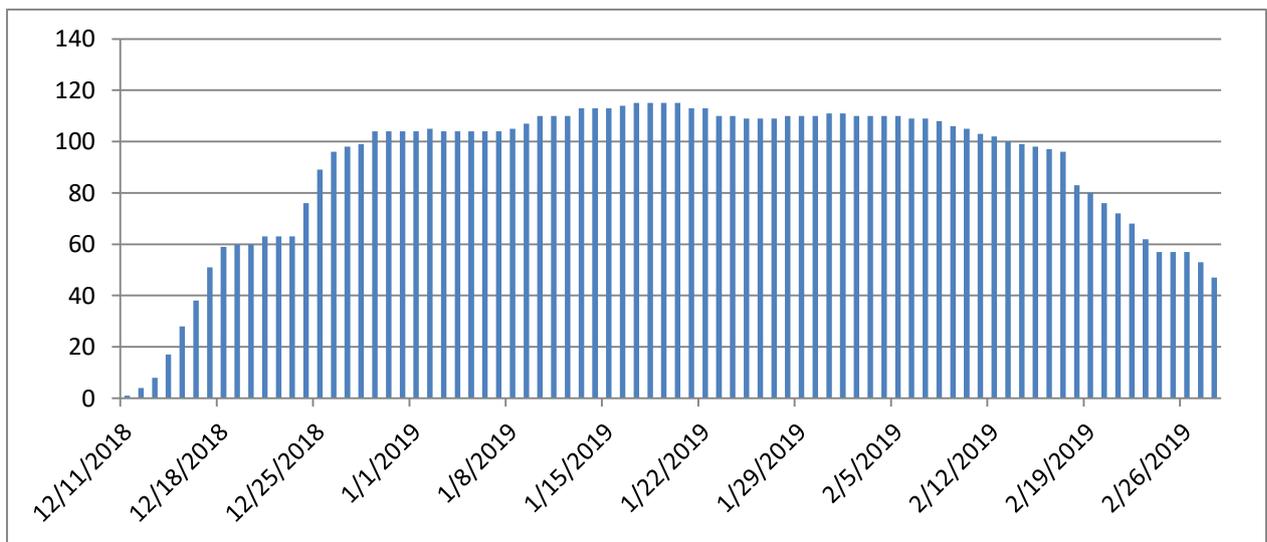


Figure-4. Graph showing the activity of different camera trap stations in Manas National park, Assam, India (2019).

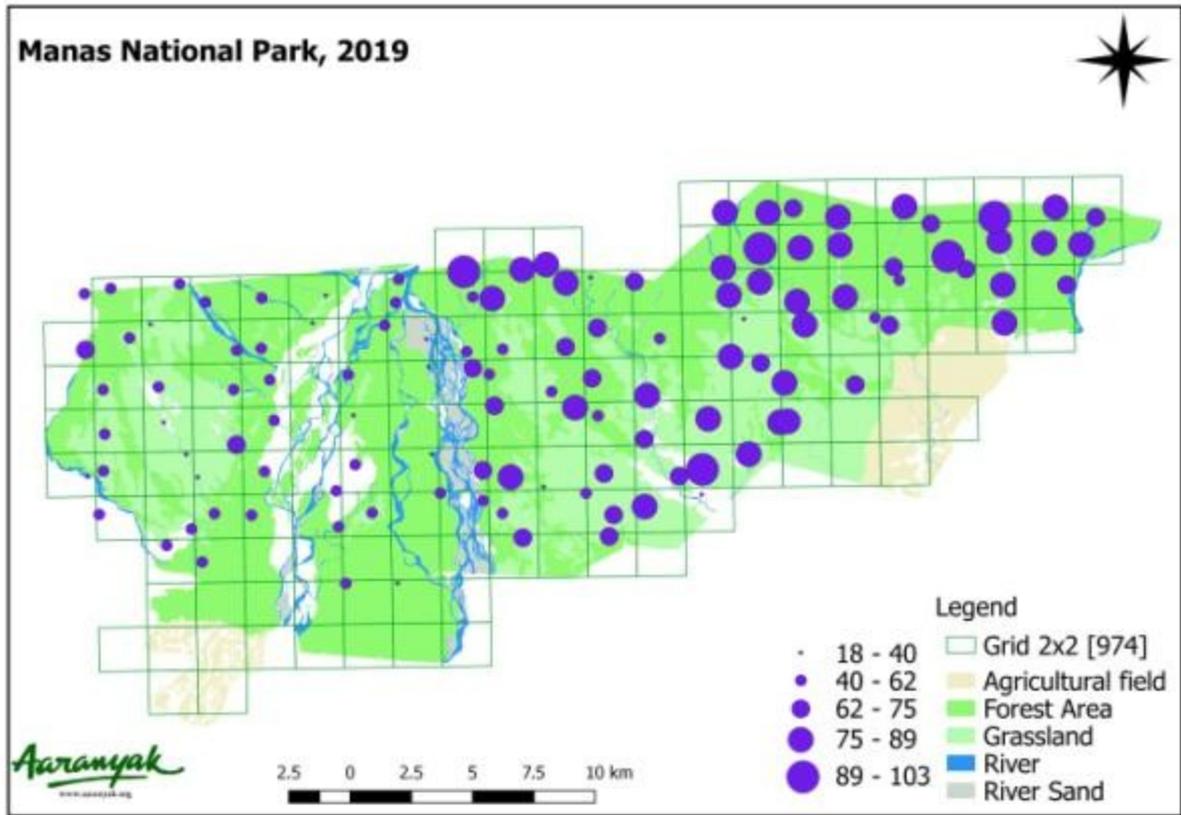


Figure-5. Bubble map showing the efforts of all the camera trap stations in Manas National Park, Assam, India (2019).

4.2 Camera Trap Account

TOTAL CAMERA TRAP USED	: 226
STOLEN	: 15
DESTROYED BY WILDLIFE	: 6
DESTROYED BY PEOPLE	: 0
CAMERA MALFUNCTION	: 0



Figure-6. Camera trap used for the population monitoring of tiger in Manas National Park, Assam, India (2019).

4.3 Animal capture details

Animals	Number of Images
Tiger	898
Leopard	632
Ungulates	14585
ALL ANIMALS	25371

Table-1. List of mammals captured in camera traps in Manas National Park, Assam, India 2019

Serial No.	Common Name	Scientific Name	IUCN Status
1	Large Indian Civet	<i>Viverra zibetha</i>	Near Threatened
2	Asian Elephant	<i>Elephas maximus</i>	Endangered
3	Bengal Tiger	<i>Panthera tigris</i>	Endangered
4	Hog Deer	<i>Axis porcinus</i>	Endangered
5	Wild Dog	<i>Cuon alpinus</i>	Endangered
6	Hispid Hare	<i>Caprolagus hispidus</i>	Endangered
7	Wild Buffalo	<i>Bubalus arnee</i>	Endangered
8	One Horned Rhinoceros	<i>Rhinoceros unicornis</i>	Vulnerable
9	Indian Gaur	<i>Bos gaurus</i>	Vulnerable
10	Leopard	<i>Panthera pardus</i>	Vulnerable
11	Sambar	<i>Rusa unicolor</i>	Vulnerable
12	Swamp Deer	<i>Rucervus duvaucelii</i>	Vulnerable
13	Himalayan Black Bear	<i>Ursus thibetanus</i>	Vulnerable
14	Clouded Leopard	<i>Neofelis nebulosa</i>	Vulnerable
15	Crab Eating Mongoose	<i>Herpestes urva</i>	Least Concern
16	Leopard Cat	<i>Prionailurus bengalensis</i>	Least Concern
17	Wild Pig	<i>Sus scrofa</i>	Least Concern
18	Yellow Throated Marten	<i>Martes flavigula</i>	Least Concern
19	Barking Deer	<i>Muntiacus muntjac</i>	Least Concern
20	Spotted Deer	<i>Axis axis</i>	Least Concern
21	Jungle Cat	<i>Felis chaus</i>	Least concern
22	Small Indian Civet	<i>Viverricula indica</i>	Least Concern
23	Palm Civet	<i>Paradoxurus hermaphroditus</i>	Least Concern
24	Golden Jackal	<i>Canis aureus</i>	Least Concern
25	Crest-less Porcupine	<i>Hystrix indica</i>	Least Concern
26	Asiatic brush-tailed porcupine	<i>Atherurus macrourus</i>	Least Concern
27	Indian Grey Mongoose	<i>Herpestes edwardsii</i>	Least Concern
28	Indian Hare	<i>Lepus nigricollis</i>	Least Concern

4.4 Species photo-captured for the first time in MNP during 2015-2019.



Spotted Deer



Marbled Cat



Brush-tailed Porcupine



Large toothed Ferret Badger

5. INDIVIDUAL IDENTIFICATION OF TIGERS

Given that the maximum number of photos was of the left flank of the tigers, we used the left flank pictures of the individuals for identification.

MALES	: 07
BREEDING FEMALES	: 02
OTHER FEMALES	: 16
TOTAL ADULTS	: 25
SUB ADULTS	: 00
CUBS	: 05
TOTAL DETECTED	: 30

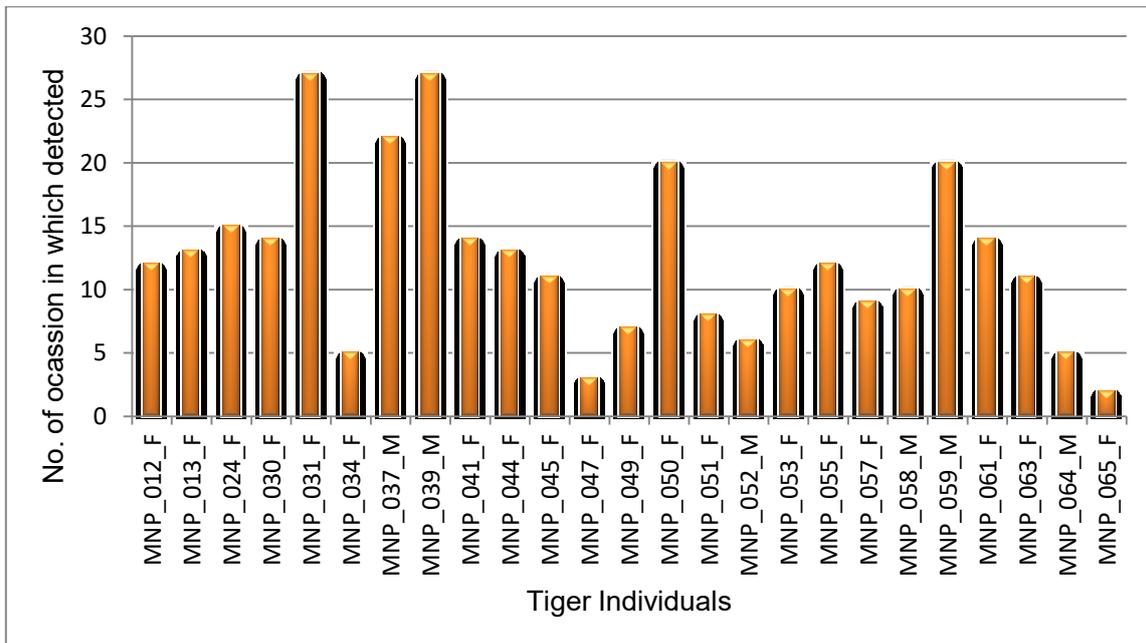


Figure 7. Number of independent captures of each of the individual tiger in Manas National Park during Phase IV monitoring (2019).

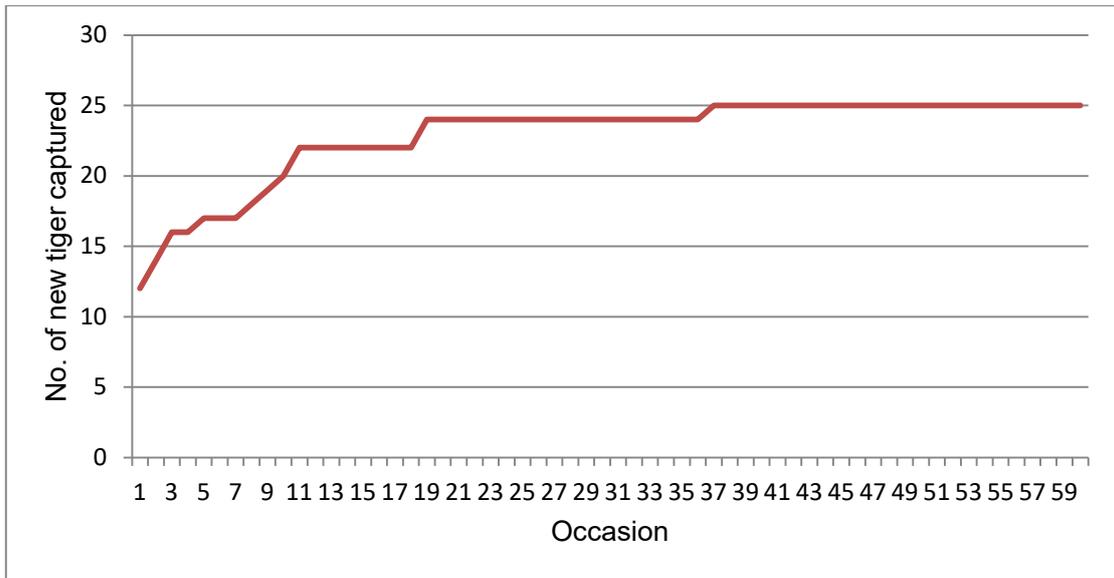


Figure 8. Individual accumulation curve of tigers in Manas National Park, Assam, India during the session 2019.

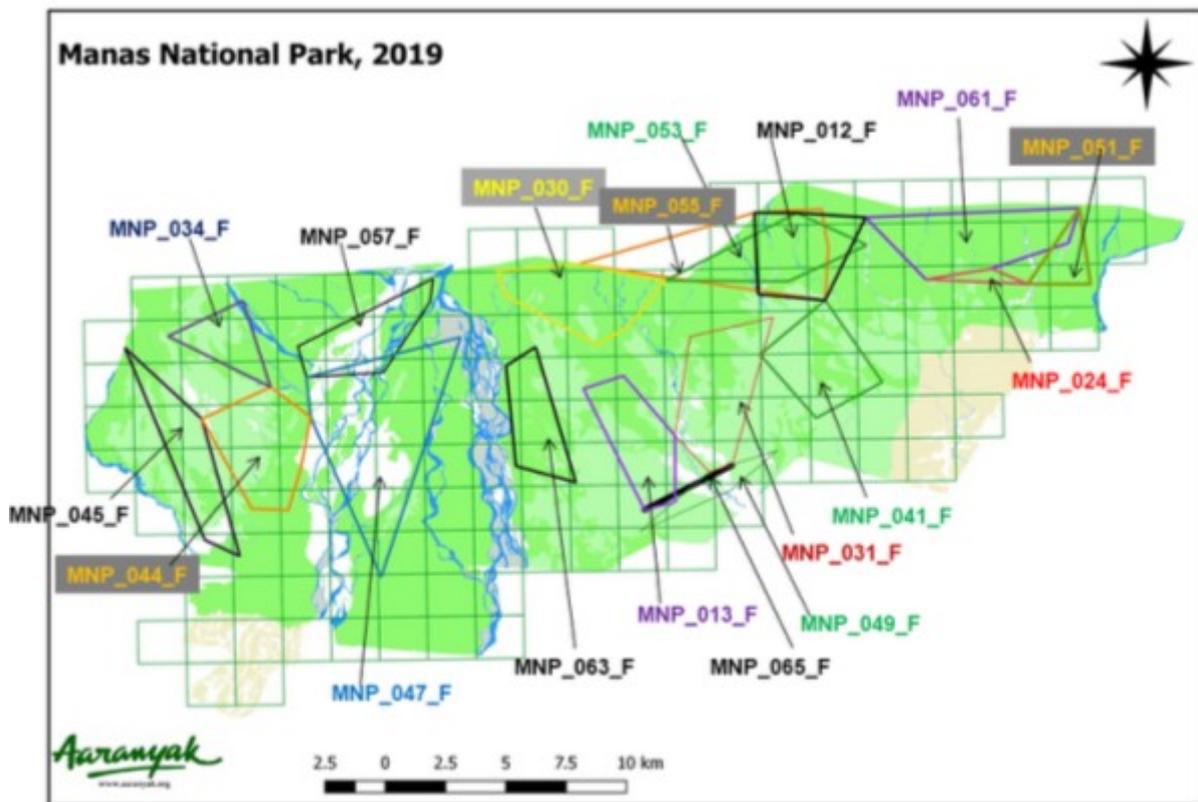


Figure 9. Camera trap detection polygon of female individual tigers captured in Manas National Park, Assam, India (2019).

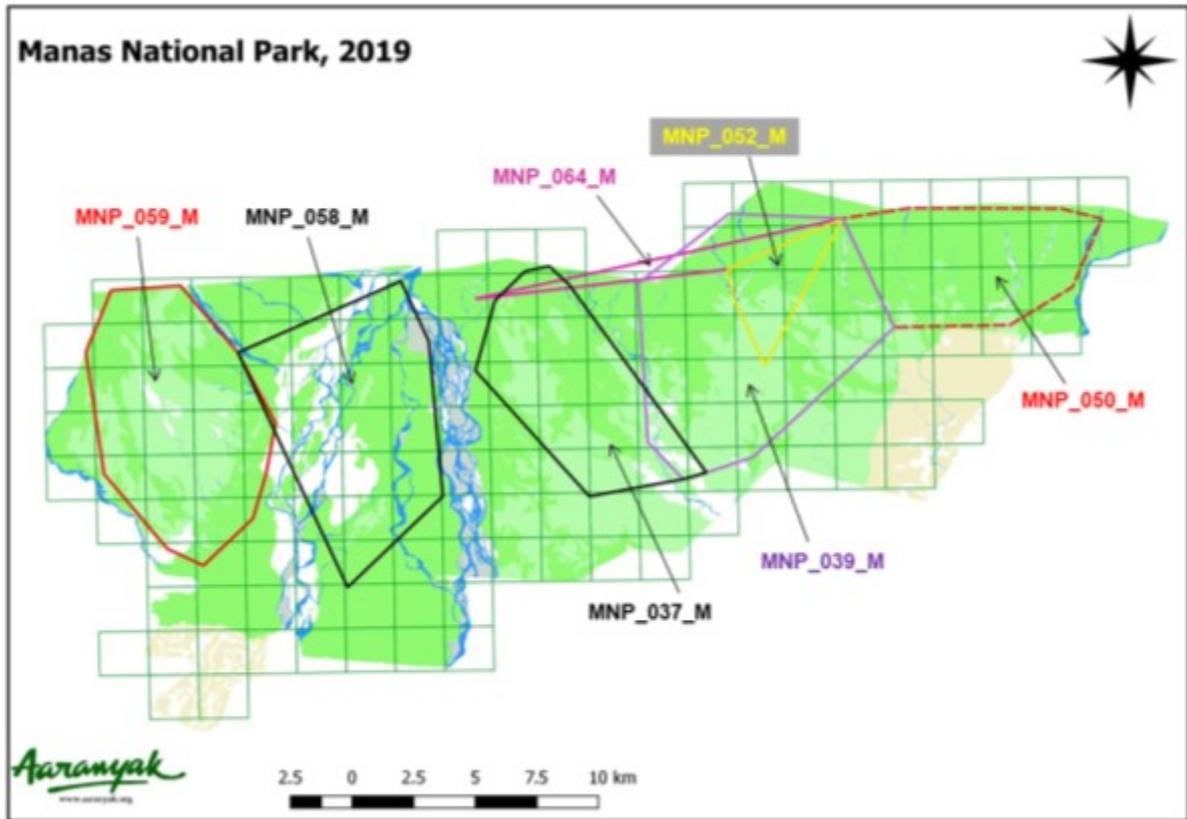


Figure 10. Camera trap detection polygon of male individual tigers captured in Manas National Park, Assam, India (2019).

6. PHOTOGRAPHIC CAPTURE RECAPTURE INDEX (PCRI)

Photographic Capture Recapture Index (PCRI₁: No. of independent events (30-minutes apart) per 100 trap-days and PCRI₂: No. of trap-days required to get a single photo capture for major prey animals, tiger and co-predator species) recorded in camera traps from Manas National Park, 2019.

Species	IUCN Status	Independent Events	PCRI₁ (Efforts-7637 trap-days)	PCRI₂ (Efforts-7637 trap-days)
Barking Deer	Least concern	554	7.254157	13.7852
Clouded Leopard	Vulnerable	03	0.026282	2545.667
Elephant	Endangered	1648	21.57915	4.634102
Gaur	Vulnerable	580	7.594605	13.16724
Hog Deer	Endangered	362	4.740081	21.09669
Jungle Cat	Least concern	33	0.432107	231.4242
Leopard	Vulnerable	300	3.928244	25.45667
Leopard Cat	Least Concern	219	2.867618	34.87215
Rhino	Vulnerable	127	1.662957	60.13386
Sambar Deer	Vulnerable	2267	29.68443	3.368769
Tiger	Endangered	416	5.447165	18.35817
Wild Buffalo	Endangered	336	4.399633	22.72917
Wild Dog	Endangered	65	0.85112	117.4923
Wild Pig	Least Concern	479	6.272096	15.94363

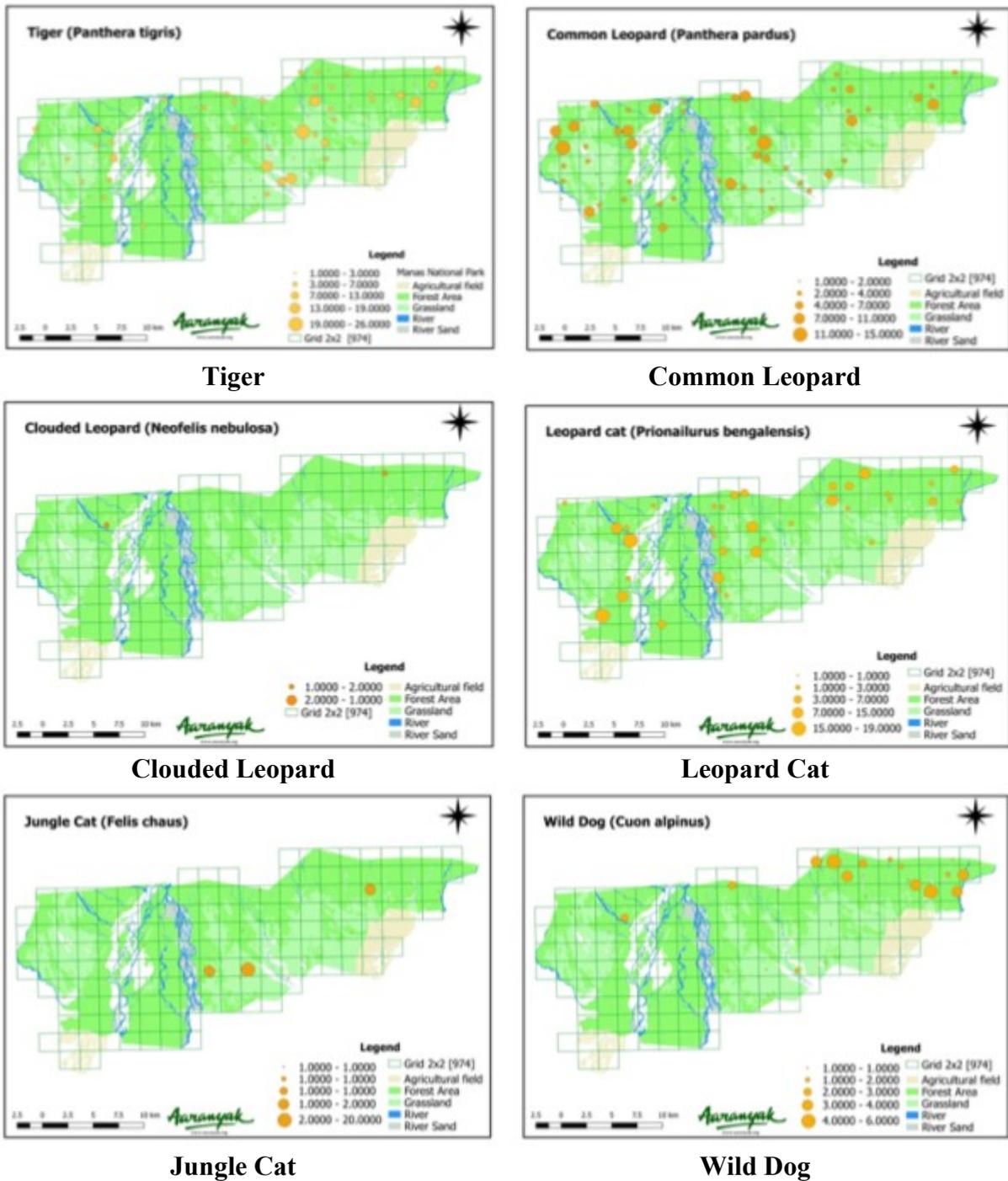
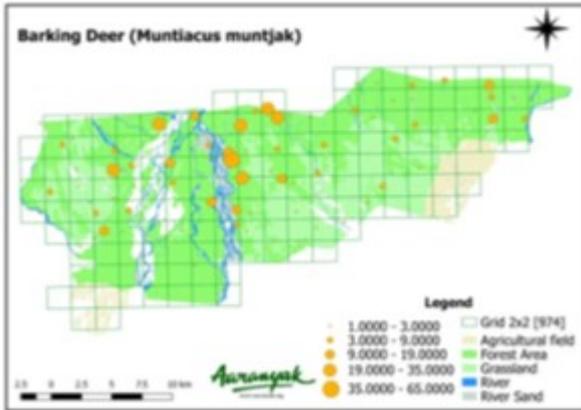
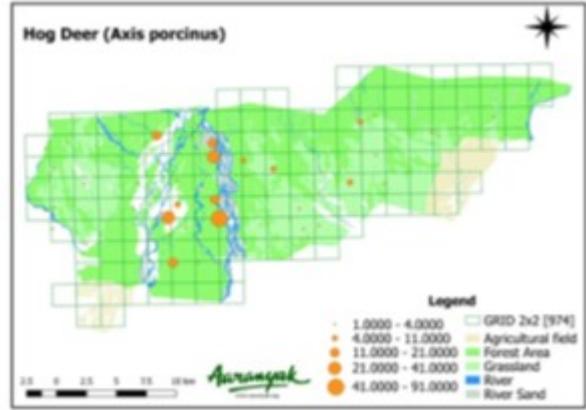


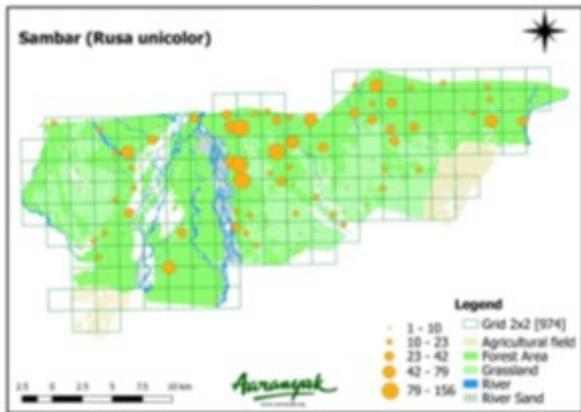
Figure 11. Photographic Capture Rate Index (PCRI) of the major mammalian predator species captured in Manas National Park, Assam, India (2019).



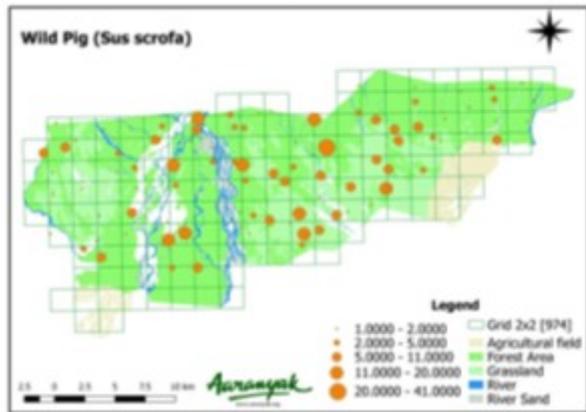
Barking Deer



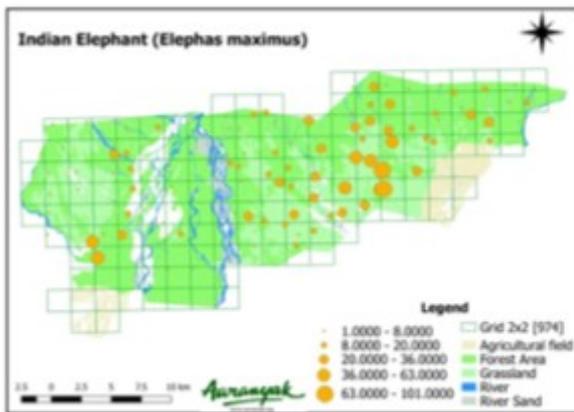
Hog Deer



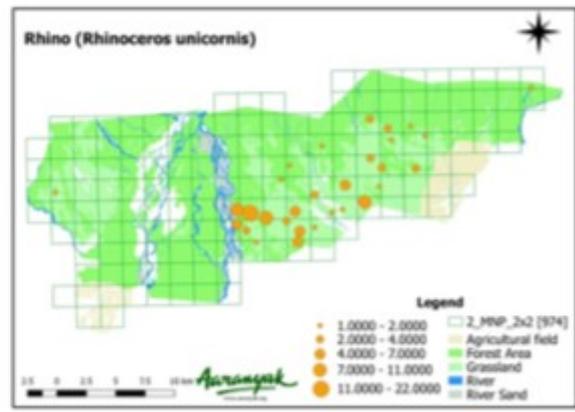
Sambar



Wild Pig



Indian Elephant



Indian One-horned Rhino

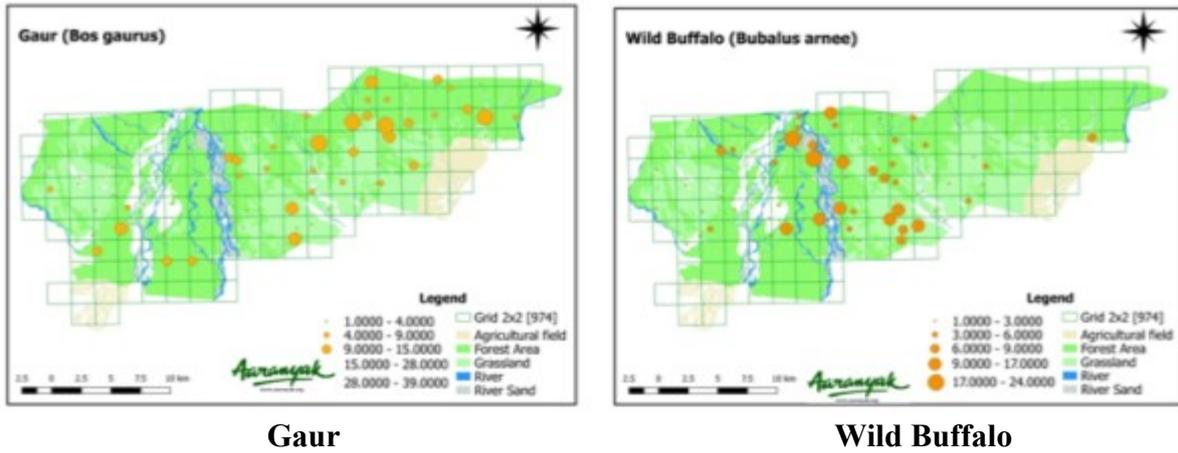


Figure-12. Photographic Capture Rate Index (PCRI) of the major mammalian prey species captured in Manas National Park, Assam, India (2019).

7. PHOTO-CAPTURE RATE IN MANAS NATIONAL PARK, ASSAM, INDIA

Species	PCRI ₁ in 2017	PCRI ₁ in 2018	PCRI ₁ in 2019
	Total effort in trap-days= 6220	Total effort in trap-days = 14059	Total effort in trap-days = 7637
Major Prey			
Barking Deer	4.35	6.81	7.25
Hog Deer	2.71	5.12	4.74
Sambar Deer	23.76	31.11	29.68
Wild Pig	5.67	9.56	6.27
Wild Buffalo	3.49	4.67	4.39
Gaur	7.44	11.23	7.5
Rhino	0.91	1.48	1.66
Elephant	16.97	22.14	21.57
Major predators			
Tiger	4.95	2.48	5.44
Common Leopard	5.47	3.10	3.92
Clouded Leopard	0.53	0.064	0.026
Leopard Cat	3.02	1.30	2.86
Jungle Cat	0.43	0.19	0.43
Wild Dog	0.32	1.98	0.85



Panthera tigris



Panthera pardus



Neofelis nebulosa



Prionailurus bengalensis



Felis chaus



Cuon alpinus



Muntiacus muntjak



Axis porcinus



Rusa unicolor



Rucervus duvaucelii



Sus scrofa



Bos gaurus



Bubalus arnee



Elephas maximus



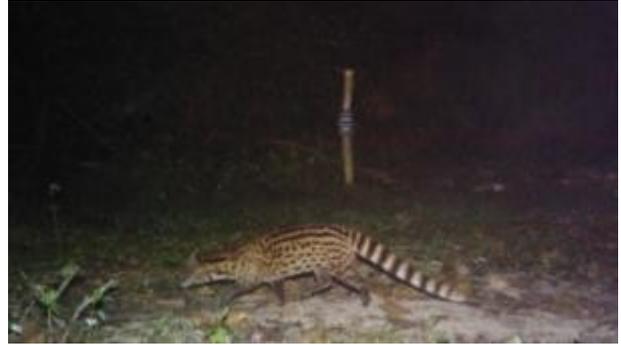
Lepus nigricollis



Caprolagus hispidus



Viverra zibetha



Viverricula indica



Paradoxurus brachyuranbtes



Herpestes urva



Herpestes edwardsii



Hystrix brachyuran



Ursus thibetanus laniger



Rhinoceros unicornis



Martes flavigula



Axis axis



Atherurus macrourus

Figure 13. Photograph of mammalian species captured in Manas National Park, Assam, India in 2019

**Photo-plates of individual tigers of
The Manas National Park
(2019)**

Details

Adult Females:	18
Adult Males:	07
Total Adults:	25
Cub:	05
Total Individuals:	30
First time captured adult individuals:	03
Last session cub turned to adult:	01

Individual Tigers of Manas NP, Session 2019 [Plate 1]

MNP_012_F



MNP_013_F



MNP_024_F



MNP_030_F



MNP_031_F



Individual Tigers of Manas NP, Session 2019 [Plate 2]

MNP_034_F



MNP_037_M



MNP_039_M



MNP_041_F



MNP_044_F



Individual Tigers of Manas NP, Session 2019 [Plate 3]

MNP_045_F



MNP_047_F



MNP_049_F



MNP_50_M



MNP_051_F



Individual Tigers of Manas NP, Session 2019 [Plate 4]

MNP_052_M



MNP_053_F



MNP_055_F



MNP_057_F



MNP_058_M



Individual Tigers of Manas NP, Session 2019 [Plate 5]

MNP_059_M



MNP_061_F



MNP_063_F



MNP_064_M



MNP_065_F



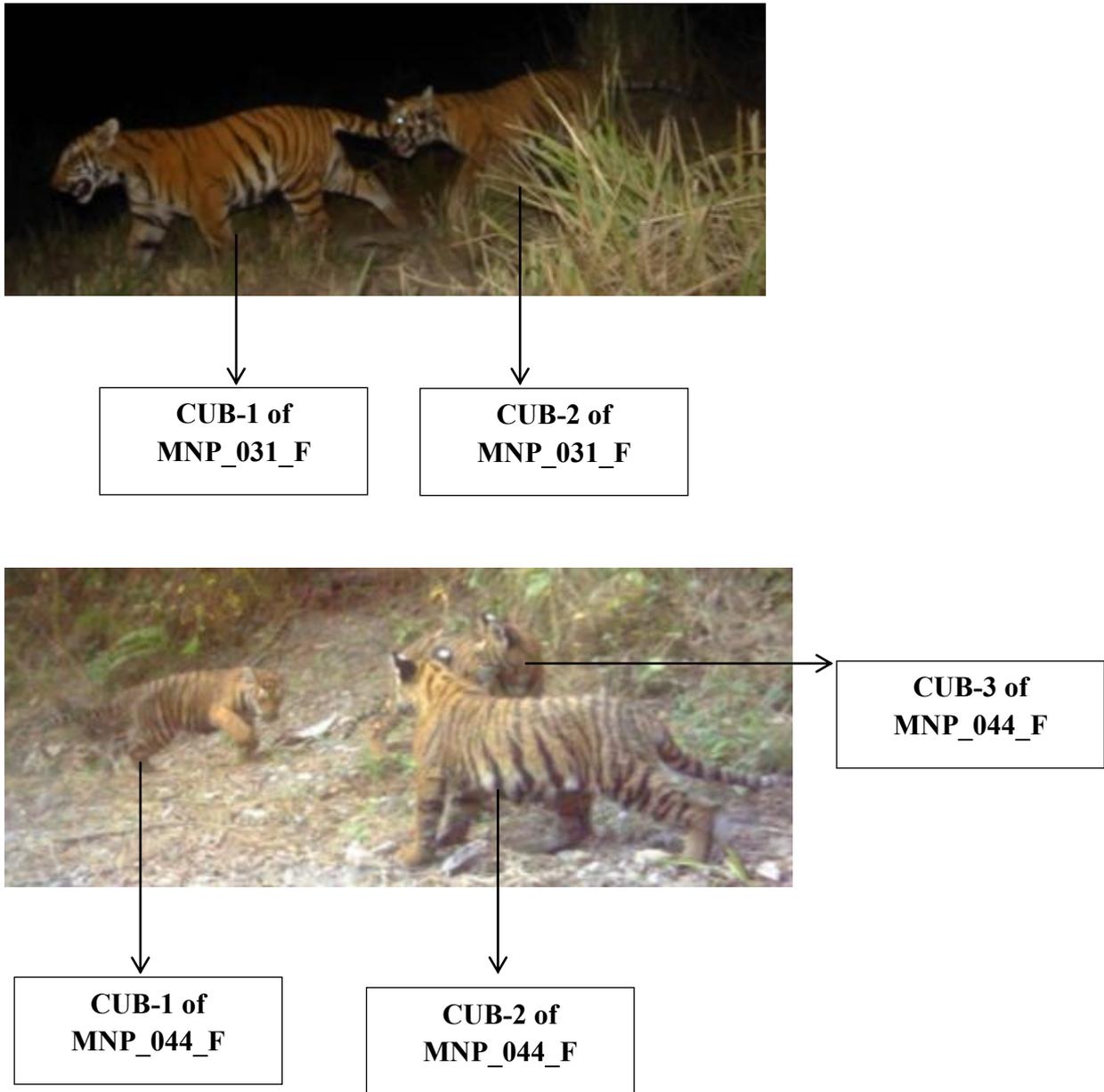


Figure 14. Tiger cubs captured in camera traps in Manas National Park, Assam India (2019).

Annuxer-1. Map showing the lost/stolen camera traps in Manas National Park, Assam, India (2019).

