

Mammals: The Jewels of Banpale Forest, Kaski District, Nepal

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Abstract

Study of mammals outside protected area is limited in Nepal especially small patches of forest used by small carnivores and very less is known about current biodiversity status. With the importance of research in such area, this study was carried out in the Banpale forest using non-invasive method camera trapping and past records as a tool to monitor the mammals. A total of 20 mammal species were recorded in 36.33 ha patch of forest in between December, 2016 to March, 2017. Large Indian civet has been trapped in the camera for the most time during the entire survey. Common leopard was also sighted and camera trapped however the prey species were neither camera trapped nor any direct sighting was made. The forest has a wide diversity of least researched small mammals which have been trapped by the camera. The threats have been in the peak causing negative interaction between the wildlife and humans. Conservation action plan for the wildlife should be duly implemented with strict rules and regulations for the conservation of remaining wildlife present in the forest.

Keywords: Banpale forest; Camera trapping; Mammals; Encroachment

Introduction

The first complete systematic review of all mammals of the world was produced by Trouessart [1] followed this number of taxonomical research has been made on mammal species of the world by Simpson and Gaylord [2] Walker [3], Nowak [4], Sokolov [5] Corbett and Hill [6], McKenna and Bell [7], Wilson and Reeder [8] reported a total of 5416 species of mammal belonging to 154 families and 29 orders have been reported from the globe. Because of the variance in climate, from tropical to arctic, Nepal has a large variety of plants and animals [9].

Nepal harbors 208 mammalian species constituting 4.2% of world's mammalian species [10,11] along with the discovery of two species Pallas cat (*Otocolobus manul*) [12] and Rusty-spotted cat (*Prionailurus rubiginosus*) [13] in Nepal makes the total species of mammals to 210 in Nepal. Of the 208 known species of mammal in Nepal, one is considered Regionally Extinct, 8 are considered Critically Endangered, 26 are considered Endangered, 14 are considered Vulnerable and 7 are considered Near Threatened [11] and 2 other species added new on the list Pallas cat and Rusty-spotted cat falls under the Near-threatened category by IUCN red data list.

Banpale forest which is under the ownership of Institute of Forestry (IoF), Pokhara campus, Nepal is scientifically unexplored forest to great extent. Much of the biodiversity in the country has been conserved through the establishment of the protected area system, which covers nearly 25% of the country's land mass and represents diverse ecosystems at various elevations [11]. The main objective of the research was to understand the mammalian profile in the small patch of forest outside the protected area.

Study area

Banpale forest lies in the South-west of Pokhara metropolitan city, ward number 15 which is under the ownership of Institute of Forestry, Pokhara campus [14]. The altitude varies from 750m at Seti river bed to 915m at the top of small hill lock of forest above mean sea level. The total area of the forest is 31.85 hectare and the area of the campus is 15 hectare however, we deployed the camera to few more hectare of land which

is connected with the Banpale forest [15]. As a result, the total area surveyed was 36.33 hectare. Study area covered the whole of Banpale Forest featuring trees, shrubs, rocky slopes, landslide area and the flat land of Iof along the surrounding area consist of human settlement and agricultural fields [14]. Banpale forest is a natural forest of Katus (Schima species.)- Chilaune (Castanopsis species) as main species conserved and managed by IOF Pokhara [15,16]. The other species in Banpale forest are *Diospyrus melabaricum*, *Dalbergia latifolia*, *Dalbergia sissoo*, *Albezia* species, *Cinnamom camphora*, *Delonix regia*, *Acacia catechu*. Total 155 species of plant have been reported in IOF premises (Map 1) [17].

Methods and Methodology

Camera trap (Bushnell, 8MP; active motion inbuilt function) approach, which is non-invasive and reduces survey effort substantially was used for this research [18-22]. Single piece of camera trap was used during the whole survey. Camera was placed based on the presence absence of the signs and on pocket areas as well as through the key informant survey was carried out with forest guard and local people around the forest. Camera was transferred from the initial site to the new sites and followed the same rules for all the remaining sites (except site E and J; both were highly potential sites as per key informants). The camera trap survey was carried out from December, 2016 to March 2017 for about four months and consisted of a total survey effort of 120 trap night in 11 different camera trap station. The camera trap locations are from the 735-844m altitude ASL. Active Motion sensor camera trap were placed at the height from 25cm to 65 cm in different locations from the

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Received June 02, 2017; **Accepted** August 08, 2017; **Published** August 15, 2017

Citation: Bist BS, Paudel S, Ghimire P, Bhattarai S, Sharma B, Subedi A, Khanal C, KC JK and Pokhrel CP (2017) Mammals: The Jewels of Banpale Forest, Kaski District, Nepal. J Biodivers Endanger Species 5: 191. doi: [10.4172/2332-2543.1000191](https://doi.org/10.4172/2332-2543.1000191)

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ground level. The time interval between the two photos was 1 second. The mammals were identified using the book Wild Mammals of Nepal [10]. Mist netting wasn't conducted for Bat survey however data were collected from secondary sources. The camera trapping was carried out with the intention to explore the mammals of the Banpale forest. The capture rate of the species was calculated by using the formula: $\text{Capture rate} = \frac{\text{Species photos}}{\text{Total trap nights}} \times 100$ adopted [23].

Results and Discussions

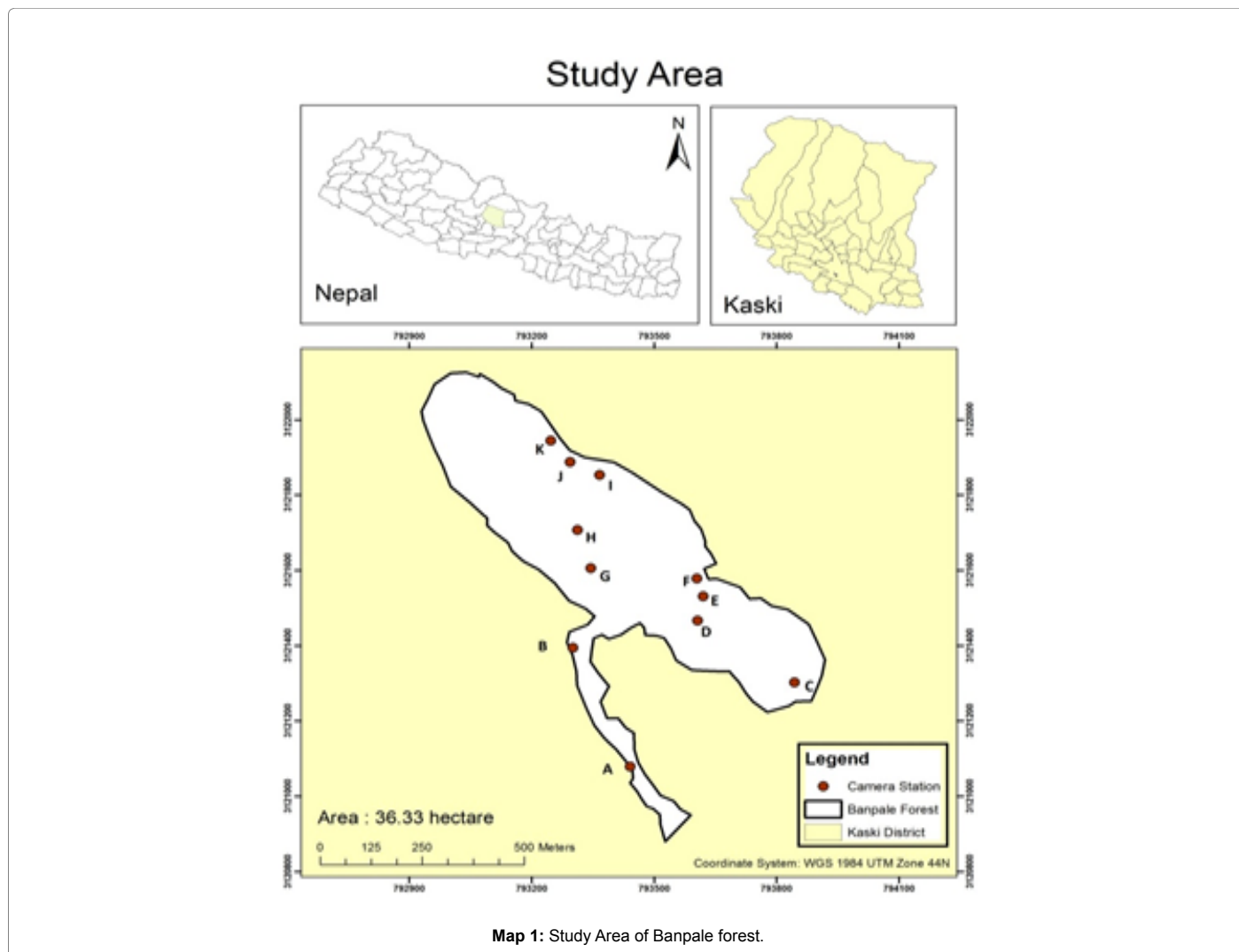
The total number of photos captured and is further best for detection is 1011. Pictures were chosen only if they further improved the detectability and identification of species. Total 19 mammals were identified and is confirmed that some of them are currently using small patch of this habitat. Most frequently sighted species were Large Indian Civet *Viverra zibetha* (capture rate:75.00), Jungle Cat *Felis chaus* (30.833), Himalayan Field Rat *Rattus nitidus* (0.833), Indian Crested Porcupine *Hystrix indica* (2.500), Common leopard *Panthera pardus* (4.1667), Masked Palm civet *Paguma larvata* (0.8333). Other mammals recorded through the photographs and previous studies were Barking deer *Muntiacus muntjak*, Rhesus Macaque *Macaca mulatta*, Indian Hare *Lepus nigricollis*, Northern palm squirrel *Funambulus pennaanti*,

Small Indian mongoose *Herpestes auropunctatus*, Asian house shrew *Suncus murinus*, Yellow throated marten *Martes flavigula*, Himalayan field rat *Rattus nitidus*, Little

Nepalese Horse shoe bat *Rhinolophus subbadius*, Small bent winged bat *Miniopterus pusillus*, Painted bat *Kerivoula picta*, Assam Macaque *Macaca assamensis*. A colony of 7 Indian flying fox *Pteropus giagetus* was recorded with its roosting site in *Diploknema butyraceae* species (Table 1 and 2).

Species like Barking deer, Indian hare have been recorded with the photographs previously but were not camera trapped in this present survey. The biggest predator recorded in the forest was Common Leopard *Panthera pardus* however rate of detection is poor based on the trapped capture (0.0074488). The recording of large carnivores is scanty however small carnivores were recorded frequently in the camera traps.

Out of 19 species of mammals found through extensive camera trapping survey as well as through the previous studies and literature survey. Large Indian Civet (*Viverra zibetha*) was most recorded species in camera traps which was followed by the Jungle cat (*Felis chaus*). The Leopard wasn't recorded frequently nor was large prey species recorded for leopard so it could only be a visitor. Jungle cat and Large Indian civet



S.No.	Camera Station	Elevatio(m)	Number of days	Habitat	Species
1	A	735	10	Open canopy, river -forest edge	Common leopard and Large Indian civet, Jungle cat
2	B	751	10	Open canopy, river-forest edge	N/A (Pugmark of leopard was previously Observed)
3	C	818	10	<i>Schima castanopsis</i> closed canopy	Large Indian Civet
4	D	833	10	<i>Schima castanopsis</i> closed canopy	Large Indian Civet
5	E	818	10	<i>Schima castanopsis</i> closed canopy	Large Indian Civet
6	F	817	15	<i>Schima castanopsis</i> closed canopy	Common leopard, Large Indian civet, Indian crested porcupine, Masked palm civet, Jungle cat
7	G	810	10	Partially closed canopy	Jungle cat, Large Indian civet
8	H	822	10	<i>Schima castanopsis</i> closed canopy	Jungle cat, Large Indian Civet
9	I	844	10	<i>Schima castanopsis</i> closed canopy	Jungle Cat, Large Indian Civet
10	J	843	15	<i>Schima castanopsis</i> closed canopy	Jungle cat, Large Indian civet
11	K	833	10	<i>Schima castanopsis</i> closed canopy	Jungle cat, Large Indian civet, Himalayan field rat
Total	11		120		

Table 1: Camera stations Description with elevation, number of days and species trapped.

S.No.	Local Name	Common Name	Scientific name	Family	IUCN Status	Remarks	Citation
1	Chituwa	Common Leopard	<i>Panthera pardus</i>	Felidae	Vu	CT footage	[14]
2	Ratuwa	Barking deer	<i>Muntiacus muntjak</i>	Cervidea	LC	Photograph	[14]
3	Rato bandhar	Rhesus Macaque	<i>Macaca mulatta</i>	Cercopithecidae	LC	Photograph	This study and [14]
4	Syal	Golden Jackal	<i>Canis aureus</i>	Canidae	LC	Photograph	This study
5	Ban biralo	Jungle Cat	<i>Felis chaus</i>	Felidae	LC	CT photograph	This study
6	Kharayo	Indian hare	<i>Lepus nigricollis</i>	Leporidae	LC	Photograph	[14]
7	Lokharke	Northern palm squirrel	<i>Funambulus pennaanti</i>	Sciuridae	LC	Photograph	[14]
8	Nyaurimusha	Small Indian mongoose	<i>Herpestes auropunctatus</i>	Herpestidae	LC	Photograph	[14]
9	Ghar chhuchundro	Asian house shrew	<i>Suncus murinus</i>	Soricidae	LC	Photograph	[14]
10	Malsapro	Yellow throated marten	<i>Martes flavigula</i>	Mustelidae	LC	Photograph/Direct sighting	[14]
11	Himali Khetmuso	Himalayan field rat	<i>Rattus nitidus</i>	Muridae	LC	Photograph	This study and [14]
12	Chamera	Little Nepalese Horse shoe bat	<i>Rhinolophus subbadius</i>	Rhinolophidae	LC	Photograph	[14]
13	Chamera	Small bent winged bat	<i>Miniopterus pusillus</i>	Vespertilionidae	DD	Photograph	[14]
14	Chamera	Painted bat	<i>Kerivoula picta</i>	Vespertilionidae	LC	Photograph	[14]
15	Pahare Bandar	Assam Macaque	<i>Macaca assamensis</i>	Cercopithecidae	NT	Photograph	This study
16	Thulo nirbiralo.	Large Indian Civet	<i>Viverra zibetha</i>	Viverridae	LC	CT footage/ Photograph	This study
17	Gajale nir biralo	Masked palm Civet	<i>Paguma larvata</i>	Viverridae	LC	CT photograph	This study
18	Dumshi	Indian crested Porcupine	<i>Hystrix indica</i>	Hystriidae	LC	CT photograph	This study
19	Raj chamero	Indian flying fox	<i>Pteropus giagentus</i>	Pteropodidae	LC	Photograph	This study

CT- Camera trap, LC- least concern, Vu- Vulnerable, NT- Near threatened, DD- Data deficient

Table 2: Captured Fauna: Local name, Common name, their scientific name, Family, IUCN status, Remarks and Citation.

both have been recorded in the same camera traps in 7 stations which depicts that these two small carnivores are sharing the same habitat. Since the area of forest is small with few prey species so the forest is best for the small carnivores. A total of 4 bat species have been reported in this forest. Out of 210 species of mammals present in the Nepal, 19 have been recorded from this small patch of forest which is 9.047% of the total mammals present in Nepal.

The Forest of Banpale has been under severe encroachment since many years. Nowadays, the jungle has been unwisely used for subsistence living along with the destruction of the forest trees. The forest has been used as the shorter route to cross two villages which has created a human dominated trail in the forest. The garbage and sewage thrown in the forest area is directly and indirectly affecting the wildlife. Since prey species weren't recorded much which might be due to excessive hunting by locals. Thus, it seems hard to thrive in such existing forest for large carnivores. Forest is suitable for small carnivores and bird species so proper management and protection should be given priority to protect the remaining population of wildlife in this forest.

It seems that the remaining folds of mammals are surviving with great threat and with less prey distributed area which has really made the existence very hard.

Recommendation

Conservation action plan for the wildlife should be duly implemented with strict rules and regulations for the conservation of remaining wildlife present in the forest. Forest guard (Ban heralu) should be active enough to monitor the forest time by time in the day and night as well to stop the encroachment. Similarly, use of Banpale forest as a shortcut route to pass to another village should be stopped so as to increase the density of the forest suitable for the wildlife. Locals around the forest should be abandoned using the resources unwisely. Human induced forest fire should be stopped in the forest. Livestock and cattle grazing on the forest should be strictly prohibited. For long term conservation awareness seems to be utmost need of the time.

Author's Contributions

Bist BS, Paudel S and Ghimire P were involved in idea generation. Sharma B

and Subedi A worked together with Bist BS and Ghimire P during field survey. All co-authors were involved in manuscript writing and collecting previous data.

Acknowledgements

Our special thanks goes to Milan Budha, Kritigaya Gyawali, Bishal Aryal, Pawan Poudel, Binamra Thapa, Milan Aryal, Nabin Pandey, Gaurav Raj Baral, Anup Raj Adhikari, Rabindra Gautam, Naresh Shrestha, Niraj Bhattarai and Samrat Subedi for assisting us during the field days. Similarly, special felicitation goes to Mr. Yajna Prasad Timilsina for the manuscript review and Yadav Ghimirey for his constructive suggestions. We would also like to felicitate Professor Karan Bahadur Shah for his genuine support in identification. Similarly, Gajendra Bahadur Shrestha deserves the special mention for his help in Map works. Last but not the least, special thanks to IOF family for the motivation and courage to work as well as the permission to conduct the survey in the Forest.

References

1. Trouessart EL (1885) [Tomus 1-1897; Tomus 2-1898; Quinquennale supplementum, fascic. 1 & 2- 1904; fascic. 3 1904 & 4 -1905] Friedlander Rand Shon, Berlin, 1 & 2 pp: 1469; Quin sup pp: 929.
2. Simpson, Gaylord G (1945) The principles of classification and a classification of mammals. *Bulletin of the American Museum of Natural History* 85: 1-350.
3. Walker EP, Warnick F, Hamlet SE, Lange KL, Davis MA, et al. (1964) *Mammals of the World*. John Hopkins Press, Baltimore, Baltimore., 1: 1-646; 2: 647-1500; 3: 1-769.
4. Nowak RM (1991) *Walker's Mammals of the World* (5th Edn.) Johns Hopkins University Press, Baltimore.
5. Sokolov VE (1973-1979) *Sistematika mlekopitayushchikh* (Systematics of mammals) Vol I-III.
6. Corbet GB, Hill JE (1980) A world list of mammalian species. *British Museum (Natural History)*, London, pp: 254.
7. McKenna, Malcolm C, Bell SK (1997) *Classification of Mammals above the Species Level*. Columbia University Press, New York, pp: 631.
8. Wilson DE, Reeder DM, (eds.) (2005) *Mammal Species of the World: A Taxonomic and Geographic Reference* (3rd Edn.). Johns Hopkins University Press, Baltimore, MD, 2: 1-2141.
9. Walske Z, Christine (2008) *Nepal in Pictures*. Twenty-First Century Books pp: 14.
10. Baral HS, Shah KB (2008) *Wild Mammals of Nepal*. Himalayan Nature, Kathmandu.
11. Jnawali SR, Baral HS, Lee S, Acharya KP, Upadhyay GP, et al. (2011) *The Status of Nepal Mammals: The National Red List Series*, Department of National Parks and Wildlife Conservation, Kathmandu, Nepal.
12. Pokharel S (2014) New wild cat species found in ACAP area. *República*.
13. Appel A (2016) The first records of Rusty-spotted Cat in Nepal. *Small Wild Cat Conservation News* 2: 8-10.
14. Lama ST, Lama RP, Adhikari B, Bhatta NB, Adhikari A, et al. (2013) *Wildlife Conservation Action Plan for Banpale Forest*. Project Paper Submitted to Institute of Forestry Pokhara, Kaski, Nepal.
15. Subedi DK (2010) *Species Diversity of Snakes and other reptiles in Banpale Danda and Campus area*, IOF Pokhara, Kaski, Nepal.
16. Bhatta J (2008) *Species Diversity and Composition of Forest vegetation of Banpale Forest, Pokhara, Kaski*.
17. SHEAC (2010) *Checklist of tree species found in IOF, Pokhara*.
18. Ng SJ, Dole JW, Sauvajot RM, Riley SP, Valone TJ (2004) Use of highway under crossings by wildlife in southern California. *Biol Cons* 115: 499-507.
19. Di Bitetti, Paviolo MSA, De Angelo C (2006) Density, habitat use and activity patterns of ocelots (*Leopardus pardalis*) in the Atlantic Forest of Misiones, Argentina. *J Zool* 270: 153-163.
20. Burton AC, Neilson E, Moreira D, Ladle A, Steenweg R, Fisher JT, et al. (2015) *Wildlife camera trapping: a review and recommendations for linking surveys to ecological processes*. *J Appl Ecol* 52: 675-685.
21. Caravaggi A, Zaccaroni M, Riga F, Schai-Braun SC, Dick JTA, et al. (2016) An invasive-native mammalian species replacement process captured by camera trap survey random encounter models. *Remote Sens Ecology Conservation*. 2: 45-58.
22. Rovero F, Zimmermann F (2016) *Camera trapping for wildlife research*. Pelagic Publishing Ltd, UK.
23. Carbone C, Christie S, Conforti K, Coulson T, Franklin N, et al. (2001) The use of photographic rates to estimate densities of tigers and other cryptic mammals. *Animal Conservation* 4: 75-79.

Citation: Bist BS, Paudel S, Ghimire P, Bhattarai S, Sharma B, Subedi A, Khanal C, KC JK and Pokhreal CP (2017) Mammals: The Jewels of Banpale Forest, Kaski District, Nepal. *J Biodivers Endanger Species* 5: 191. doi: [10.4172/2332-2543.1000191](https://doi.org/10.4172/2332-2543.1000191)

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