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# news





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# Clouded leopard co-exists with six other felids in Royal Manas National Park, Bhutan

**Seven species of wild cats were camera trapped in Royal Manas National Park making it one of the parks with the highest diversity of wildcats in the world and hence rightly the title, 'hotspot of felid diversity'. The camera trapped species were tiger *Panthera tigris*, leopard *Panthera pardus*, clouded leopard *Neofelis nebulosa*, Asiatic golden cat *Captopuma temminckii*, marbled cat *Pardofelis marmorata*, leopard cat *Priornailurus bengalensis* and jungle cat *Felis chaus*. Fishing cat *Priornailurus viverrinus* still remains to be confirmed. We report at least 11 individual clouded leopards in the study site and we suggest that their habitats could be threatened by human disturbances but data is insufficient to determine whether the threat is significant.**

Clouded leopard is one of the most elusive of the larger felids in Asian forests (Rabinowitz et al. 1987) and one of the world's most enigmatic wild cats (Austin et al. 2007). However, they face many conservation challenges (Nowell & Jackson 1996). Classified as Vulnerable by the International Union for Conservation of Nature and Natural Resources (IUCN 2015), the clouded leopard has disappeared from part of its wide range in Southern Asia due to habitat destruction and hunting (Choudhury 1993). Little is known about the species anywhere in its range and there is still a lack of basic ecological information (Limin & Jutzeler 2010).

Camera trapping has emerged as a powerful wildlife study tool in Bhutan (Tempa et al. 2013) and is being used for researches on felids particularly on tigers and snow leopards.

Interestingly, it is generating valuable information on the habitat and occurrences of other small and medium felids as well. Royal Manas National Park produced the first photographic evidence of clouded leopard in Bhutan (Penjor 2016). Recent surveys in the protected areas suggest a widespread spatial occurrence of the species across Bhutan; they have been reported from Royal Manas National Park (Tempa et al. 2013, Borah et al. 2013) in the south, Jigme Singye Wangchuck National Park (Tempa et al. 2013, DoFPS 2013a) and Thrumshingla National Park (DoFPS 2008) in the centre, Jigme Khesar Strict Nature Reserve (WCD 2011) in the west, Jigme Dorji National Park (Thinley et al. 2015) in the north, and Bumdeling Wildlife Sanctuary (DoFPS 2013b) in the east. However, there is clearly a paucity

of information and substantial deficiency in baseline ecological data on clouded leopards in Bhutan due to lack of census, research and monitoring to assess population trends (Penjor 2016; Fig. 1).

Clouded leopard is currently listed under Appendix I of the Convention on International Trade in Endangered Species of wild Flora and Fauna (CITES; IUCN 2006) and is a totally protected species in Bhutan. The species is listed under schedule I of the Forest and Nature Conservation Act of Bhutan, 1995, and poaching or trading of clouded leopard or its part is strictly prohibited (DoFPS 1995). However, three cases of trade of clouded leopard skins were detected in the country in the last two years (DoFPS 2015).

## Study Area

Royal Manas National Park (RMNP), Bhutan's first protected area, is located in the eastern Himalayas and forms part of the ten global biodiversity "Hot Spots". It is also a part of the Trans Boundary Manas Conservation Complex TMCC. It constitutes an integral part of the protected areas in Bhutan due to its strategic location and forms a contiguous belt of very rich forest with Manas National Park in Assam, India. It is the largest and the most representative of the tropical and subtropical ecosystems in the country that intercept with swathes of grassland and wide river beds. Covering an area of 1,057 km<sup>2</sup>, the park comprises of three areas: Gomphu, Umling and Manas. The park is drained by Chamkhar chu, Mangde Chu and Drangme chu which finally join together to form the mighty Manas River. (Fig. 2).

## Methods and analysis

The camera trap images mentioned in this article are from a systematic camera trapping survey for tigers and the survey was a collaborative study between Ugyen Wangchuck Institute for Conservation and Environment and Royal Manas National Park, both under the Department of Forest and Park services. For logistic reasons and ease of accessibility, camera traps were placed systematically across the study area by superimposing a grid of 2.5 km x 2.5 km along the lower foothills and a grid of 5 km x 5 km on the hills within the park. Once the grids were selected, camera trap locations were located to maximize probabilities of capturing photos of tigers; optimal locations based on the presence of tiger signs such as pugmarks, scrape marks, scent marks, scats



**Fig. 1.** Clouded leopard in Royal Manas National Park, 2014.

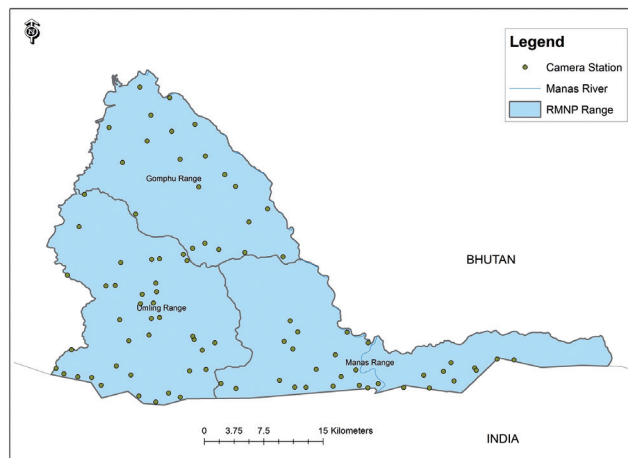


and kill sites were searched. Since the locations were selected ideally based on maximizing the capture of tigers, there are chances wherein the small cats might have avoided these stations and hence remain un- or under detected. As such, there is a need for subjective interpretation of the results for the smaller felids (Gumal et al. 2014).

A total of 89 camera trap stations were set in the 1,024km<sup>2</sup> study site. However, data from only 69 stations were available during the time of analysis and reporting and as of the rest, some were lost, some damaged by elephants and some could not be retrieved due to heavy monsoon shower and swollen rivers.

Two types of camera traps with passive infra red systems were used during the survey: Reconyx HC500 Hyperfire and Bushnell. At each station, two cameras were set so as to obtain images of both the right and left flank of the animal and the cameras were placed 6-7 m away from each other at a height of around 45-50 cm from the ground. It was positioned in such a way that two cameras were not in the same line of view. This was done to avoid flash of one camera disturbing pictures on the other camera. The sensitivity of the camera was set to very high to capture anything that passed by. The cameras were set to record both day and night which allowed us to infer on the day-night activity patterns of the frequently photographed species (Gumal et al 2014). Baits and lures were not used. Each camera stations were given an ID and a standard data collection format was used to record location, vegetation, presence of animal and human signs, distance to the nearest village etc.

Wherever possible, the cameras traps were monitored twice in a month to ensure that the camera traps were functional and to replace batteries and SD cards as required. For some stations, it was difficult to follow a twice a month schedule due to flooding rivers, logical constraints, lack of human resources and security reasons, and so, we resorted to once in a month and sometimes on one or two occasions, once in two months. All the photographic data were downloaded and sorted per species. To minimize self dependence while looking at a series of photographs of the same species, we considered that if a visit by a given species was taken >60 minutes after the previous picture of that species, it was treated as indicating a single visit (Sanderson & Harris 2013). Overall camera trap data organization and analysis was done using ReNamer.



**Fig. 2.** Royal Manas National Park with the three study sections: Gomphu, Umling and Manas with camera trap locations.

**Results and Discussion**

The data has been analyzed from a total of 69 camera trapping stations with a total of 1,281 camera trap nights. Clouded leopards were recorded in 18 stations with 42 independent photographic captures and we report at least 11 individuals in the study area. All the clouded leopards were adults and no young ones were recorded. However, their sex could not be determined. Clouded leopards were recorded in a total of 19 camera trap locations: 11 in Gomphu with 27 independent pictures, 6 in Manas with 12 independent pictures and 2 in Umling with 3 independent pictures (Table 1). They were captured in areas with dense coverage of cool evergreen and deciduous broadleaved forests. In some areas, bamboo was also found dominating the lower storey. In Bhutan, the species is believed to be found in dense evergreen and sub tropical forest (Wangchuk et al. 2004). As a primary dweller of dense vegetation and remote habitat

(Fletcher 2000), the species is found throughout tropical and subtropical forests ranging from Himalayan foothills through mainland South Asia to China (Appel et al. 2012, Choudhury 1993, Dinerstein & Mehta 1989, Ghose 2002, Mehta & Dhewaju 1990, Rabinowitz 1988). Most of the clouded leopard pictures were captured on trails deep in the forest, along the river banks and on few occasions along ridges. The species was also seen using feeder roads. 35% (21) of the total camera trap stations showed human interferences and the highest was recorded in Gomphu. People were observed herding their cattle; extracting bamboo and canes, fodder and stones from the site. On few occasions vehicles were also seen plying along the feeder roads. Of the total stations which recorded clouded leopards, more than 68% showed human presence. Previously, Dinerstein & Mehta (1989) also reported clouded leopard in habitats in frequent interactions with humans in Nepal.

**Table 1.** List of camera trap independent events for the cat species and number of camera trap locations occupied.

Species	# of stations where species recorded				% stations recorded	# independent events
	Gomphu	Manas	Umling	Total		
Clouded leopard	11	6	2	19	27.5	42
Leopard Cat	14	22	10	46	66.7	187
Marbled Cat	17	5	2	24	34.8	92
Golden cat	16	4	0	20	29.0	67
Leopard	3	22	7	32	46.4	177
Tiger	7	13	7	27	39.1	60
Jungle Cat	1	0	1	2	2.9	3



**Fig. 3.** Leopard in Royal Manas National Park, 2014.



**Fig. 4.** Tiger in Royal Manas National Park, 2014.

During this study, seven of the eleven cat species known to occur in Bhutan i.e. tiger, leopard, clouded leopard, asiatic golden cat, marbled cat, leopard cat and jungle cat of which one is listed as endangered (tiger), two as vulnerable (clouded leopard and marbled cat) and two near threatened (Asiatic golden cat and common leopard) in the IUCN Red List, were captured in camera traps. Table 1 summarizes the capture records. Within the park, Gomphu is found to be the hotspot of felid occurrence as the entire seven cat species have been recorded there. A recent camera trapping survey in 2012 at the Manas Range (74 km<sup>2</sup>) yielded six cat species (Tempa et al. 2013) and they reported 7 individual clouded leopards. However, they did not record the jungle cat or the fishing cat. The latter still remains unconfirmed in the park; however, the species is known to occur in the nearby Manas National Park in India (Borah et al. 2013). This could be so because camera trapping focused on large cats often prove ineffective in detecting small felids especially fishing cats that are mainly reported along riverine habitats and as a result, may bias capture probabilities of these small felids.

We detected higher small to medium felid species including the clouded leopard in the northern part of the park and then the larger ones in the south. This is in consistency with the findings reported by RMNP (DoFPS 2015). These suggest that though tigers, leopards and clouded leopards are sympatric (Choudhury 1993), clouded leopard maybe avoiding the larger predators. (Figures 3-8).

The largest number of capture locations as well as independent events was observed for leopard cat. The species was recorded in 46 stations with 187 independent events and was found sharing camera trap locations with rest of the other 6 felid species, indicating a strong attribute to a wide use of habitat and better adaptability. The least captured felid species was the jungle cat with only two capture locations and three independent pictures.

The high felid diversity of Royal Manas National Park is comparable with seven species record in Jeypore-Dehing rainforest in Assam, India (Hance 2010). A practical conservation approach is to prioritize the focus of conservation efforts and if the objective is to save the maximum number of wild cat species

from extinction, then focusing conservation efforts and resources in areas such as Royal Manas National Park will be most effective in meeting conservation objectives (Tempa et al. 2013)

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**Fig. 5.** Leopard cat in Royal Manas National Park, 2013.



**Fig. 6.** Asiatic golden cat in Royal Manas National Park, 2013.





**Fig. 7.** Jungle cat in Royal Manas National Park, 2014.



**Fig. 8.** Marbled cat in Royal Manas National Park, 2014.

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