What is it About the Terai of Nepal that Favors Sloth Bears over Asiatic Black Bears?

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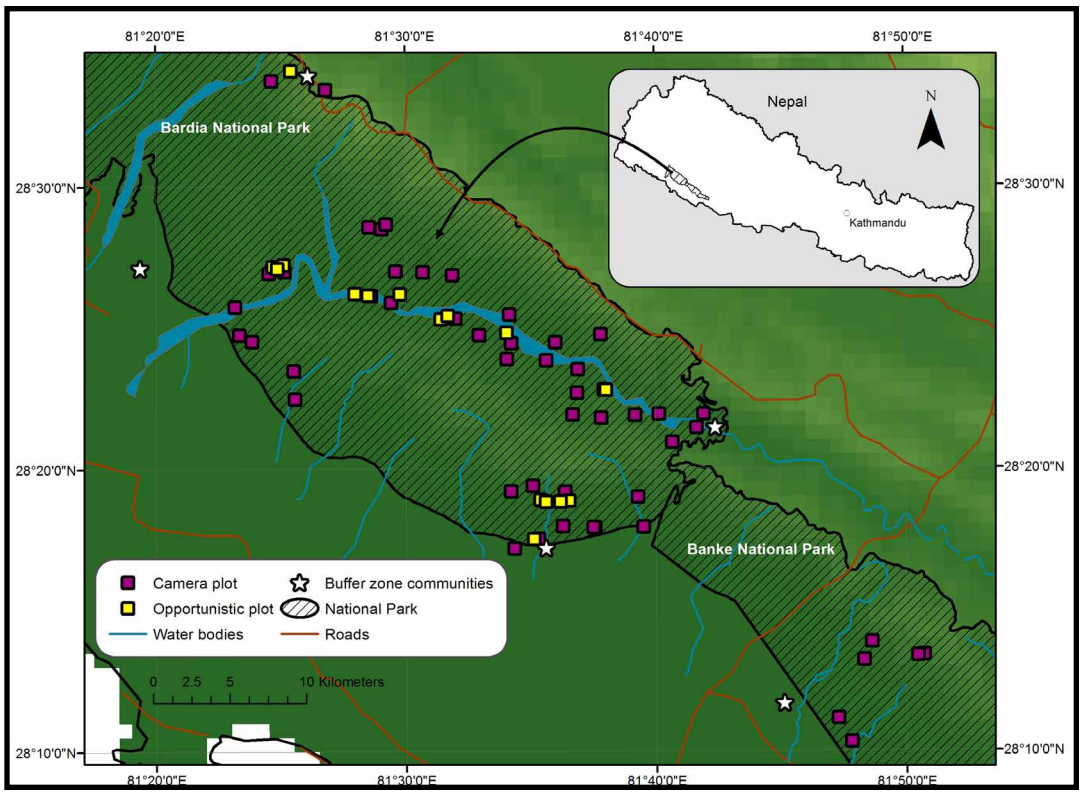
Few studies have examined the coexistence of bear species and whether interspecies competition can cause one species to decline or even disappear from an area (Mattson et al. 2005; Steinmetz et al. 2011, 2013). The case of Asiatic black bears (*Ursus thibetanus*) and sloth bears (*Melursus ursinus*) is particularly interesting because within the Terai Arc Landscape — a lowland strip along the foothills of the Himalayas — there are areas where these 2 species overlap (Uttarakhand, India), and areas that appear similar, where they do not (Nepal with almost exclusively sloth bears; Bhutan with exclusively Asiatic black bears). To date, we know little about ecological requirements that could explain why sloth bears and Asiatic black bears appear to coexist in some areas but not others. A recent report of a photo of an Asiatic (Himalayan) black bear within the Terai of Nepal, the first such evidence of this species in this region of Nepal (Yadav et al. 2017), focused our interest in this area. Was this bear a lone individual wandering in from a higher elevation area, or did black bears exist in low density, undetected until now? Or was something changing in terms of the habitat that might lead to colonization of the area by black bears?

For this study, we had a unique opportunity to make use of by-catch data acquired from motion-detecting cameras set-up in protected areas of Nepal as part of an ongoing monitoring effort for the National tiger (*Panthera tigris*) population surveys (Dhakal et al. 2014). We were provided photos of bears obtained from the camera traps set out in 2013 by the Department of National Parks and Wildlife Conservation, Nepal. We conducted field investigations at these sites aiming to assess species-specific habitat preferences and understand the occurrence and persistence of Asiatic black bears and sloth bears in a gradient of environments along the Terai.



Location of sampling sites associated with camera locations and opportunistic plots surveyed within Bardia and Banke National Parks in an attempt to discern habitat characteristics associated with presence of sloth bears and Asiatic black bears. Also shown are communities adjacent to the parks (buffer zone communities).

In late January 2018, we set-out to Bardia and adjacent Banke National Parks in southwestern

Birendra Adikari

The Nepal Terai field team, from left to right: Birendra Adikari (Bardia National Park staff), Karine Pigeon (research biologist), Ram Shahi (ornithologist), Manbir Kami (retired park staff), and Pooja Basnet (forestry graduate).

Number of sampled sites where we recorded evidence of claw marks on trees, diggings, or scats from a sloth bear, Asiatic black bear, or unknown bear species in Bardia and Banke National Parks, Nepal, during January–March 2018. %Lowland is the percentage of species-specific signs observed in lowland plots over the total number of plots where we observed signs of that species. At some plots, more than 1 type of sign was found (e.g., claw marks and digging). We considered all digging into termite mounds to be from sloth bears and classified other types of ground digging as "unknown" bear species.

Bear Species	Claw Marks	Digging	Scat	%Lowland
Sloth	16	17	4	80%
Asiatic Black	6	NA	NA	17%
Unknown	2	4	2	20%
Total	24	21	6	NA

Nepal (both with 1–2 recent records, but no historic records of Asiatic black bears) to measure habitat characteristics and food availability for sloth bears and Asiatic black bears in the lowlands and Siwalik hills (i.e., steep rugged forested hills). Climate in the region dictates the seasonality of food availability and varies between the subtropical monsoon (June to October), the dry season (October to February), and the hot season (March to June; Bhuju et al. 2007). Lowlands are composed of Sal (*Shorea robusta*) forests, Khair-sissoo (*Acacia catechu, Dalbergia sissoo*) / riverine forests, and grasslands (each in distinct patches), while the Siwaliks are composed of riverine forests, tropical deciduous forests / hill Sal, and tropical evergreen forests (i.e., Chir pine, *Pinus roxburghii*) at higher elevation (Dinerstein 1979, Bhuju et al. 2007). Elevation ranges from 100 to 1450 m above sea level.

From January through March, we measured concealment cover, canopy cover, stand composition and structure, and food availability at 51 camera sites and 17 opportunistic sites, including 79 line transects. At each camera site (i.e., plot), we sampled 3 subplots (30 x 30 m) and 2 line transects (100 m length each), while only 1 subplot was sampled at opportunistic sites. We sampled a total of 168 subplots associated with 25 camera sites that produced photos of sloth bears (n=22 sites) or Asiatic black bears (n=3 sites), 26 cameras with pseudo-absences (i.e., no recorded photos of either bear species), and at 17 opportunistic sites where we found presence of sloth bears or Asiatic black bears (based on sign). We surveyed a total of 9.6 ha within transects (9600 m total length x 10 m-wide) in the lowlands and Siwalik hills to assess the presence and abundance of tree markings, ground digs, termite mound diggings, and the density of termite mounds and ant hills within each landscape. We knew from previous work of others that sloth bears, but not black bears, feed largely on termites and ants, and that their digging into mounds is distinctly characteristic. We also distinguished the sign of these species based on characteristics of their claw marks on trees. We recorded the presence of fresh and old bear signs at camera sites, along

Ram Shahi

Karine Pigeon

(left) Karine holding a cover board used to quantify horizontal concealment at habitat plots. (right) Birendra (on the left) and Manbir (on the right) recording data associated with sloth bear markings on a mature 'kainjalo' tree (Bishcofia javanica). The long sliding marks are characteristics of sloth bear climbing.

transects, and at opportunistic sites while we were going to or coming from camera sites.

Including camera sites and opportunistic sites, we observed evidence of activity from sloth bears at 28 sites, Asiatic black bears at 6 sites, and at 8 sites the bear sign could not be distinguished to species. The average density of termite mounds was highest in lowland Sal forests (8.5 mounds/ha), and averaged less than half that in other lowland habitats (3.8/ha), upland Sal forests (3.6 mounds/ha), and other upland habitats (2.3/ha).

We are now using the information gathered during our field survey to investigate the relationships among food availability (presence of fruiting tree species and densities of termite mounds and ant mounds), habitat characteristics, and habitat use by sloth bears and Asiatic black bears in the region. Moving forward, we hope to continue fine-scale and broad-scale investigations within Nepal and India that will allow for a better understanding of 1) specific ecological characteristics associated with potential competition between these 2 species, possibly including exclusion of 1 over the other, and 2) how habitat degradation at the boundaries of protected areas might change the dynamic of these 2 species.

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