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Tropical grasslands supporting the endangered hispid hare (*Caprolagus hispidus*) population in the Bardia National Park, Nepal

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The presence of the endangered hispid hare (*Caprolagus hispidus*) has been confirmed in the seven grasslands (approx. 900 ha) of the Babai valley, Bardia National Park (BNP), Nepal. We conducted a presence–absence survey, studied the diet of hispid hare and evaluated vegetation composition in hispid hare habitat of the park. The pellet density was 4.07/ha before the burning season and 8.71/ha after it. The diet of the hispid hare consisted of 23 plants species, of which *Saccharum* spp., *Imperata cylindrica*, *Desmostachya bipinnata* and *Cynodon dactylon* were most preferred. These plant species were also more abundant in the hispid hare habitat. Our results showed that composition of plant species in the diet was available proportional to the hispid hare habitat. We recommend that the management authorities should prepare a species-focused management plan to conserve and monitor the hispid hare population and other small mammals of the region.

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THE tropical grasslands of Nepal support a critical ecosystem and endangered wild animals, including the hispid hare (*Caprolagus hispidus*)[1–3]. The range of hispid hare is limited to the tropical grasslands of Nepal and northern India[1]. As these grassland habitats are the main source of livelihood for local people, they are simultaneously under the pressure of fire, grazing and occasionally encroachment[3–5]. Annual grass harvesting and burning are common practices adopted in the management of these tropical grasslands[3–6]. However, the management especially focuses upon the charismatic large mammals and their habitats (grasslands), with less concern toward the small mammals[1,3].

Occurrence of hispid hare population has been reported in the Shuklaphanta Wildlife Reserve, Nepal[2,3,5]. This species is possibly distributed throughout the grasslands, from the eastern to the western regions of Nepal[1–3,5–8]. Yet, there is no information on the distribution of this species in other parts of Nepal. Therefore, we studied the grasslands of the Bardia National Park (BNP), Nepal. The study focused on the abundance of hispid hare based on the presence/absence information, its habitat, diet and threats faced in BNP.

The BNP lies between 80°10′E to 80°50′E and 28°15′N to 28°40′N in the western part of Nepal, extending across 968 km^2 as the largest national park of lowland/tropical region in the country. The park supports a large tropical biological diversity and about 3.5% of the park area is classified as grassland. The dominant grass species include *Saccharum spontaneum*, *Imperata cylindrica* and *Desmostachya bipinnata*. The grasslands particularly support small and large mammals, birds and other biological diversity[9,10]. Seven different vegetation types have been identified, dominated by species such as *Shorea robusta*, *Terminalia tomentosa*, *T. bellirica* and *Buchanania latifolia.* BNP provides a prime habitat for endangered animal species, such as tiger (*Panthera tigris*), one-horned rhino (*Rhinocerus unicornis*) and elephant (*Elaphus maximus*)[9].

The study was conducted in two seasons: before the burning season (November 2008–February 2009) and after (March–June 2009) the burning season. We searched the whole grassland for hispid hare pellets in all the potential hispid hare habitats. Pellets, which are conspicuous, were identified based on earlier studies[2,3,5–8]. We laid out strip transect lines (50 m × 20 m of about 1 km) systematically in each grassland and counted the hispid hare pellets. The transect lines were drawn perpendicular to the river direction in each grassland of the Babai valley and the grassland near BNP headquarters. Once we identified the plots, we marked the areas for vegetation measurement, i.e. 10 m × 10 m for the tree layer, 4 m × 4 m for shrub layer and 1 m × 1 m for grass. The plot points for each area were transformed into the digitized Topo-map of BNP, and Arc GIS 9.3 was used to prepare the hispid hare distribution map.

In total, 29 and 62 hispid hare pellets were collected from the study area before and after the burning season respectively. The samples were analysed in laboratory of Central Department of Environmental Science, Tribhuvan University, Nepal. Each sample was further analysed for microhistrological diet analysis[3,11–13]. The samples were washed with distilled water and kept for 24 h in alcohol (2%). After washing with 25% alcohol, they were oven-dried at 40°C for 24 h. Samples were further analysed as described earlier[3]. In total, 29 and 62 slides were prepared from the samples collected before and after the fire. From each slide, 20 fragments were taken to identify the hares up to species level. The plant fragments which remained in each sample were analysed by comparing with the reference plant fragments of the area[3].

A total of 682 transect lines were laid out throughout the entire potential grasslands of the park. We divided the grasslands into four categories and conducted the transect survey. These included: (i) Around the park headquarters (169 transects), (ii) Lamkohli (114 transects) and adjacent areas, (iii) Lal Matti, Chisapani and Rambhapur (43 transects) and (iv) Babai valley (356 transects). Of these sites, only seven grassland patches of the Babai valley support the hispid hare population, which extends over an area of approximately 900 ha. The pellet density of the hispid hare was 4.07/ha before the burning season and 8.71/ha after it. The seven grasslands of BNP which support the hispid hare population (Figure 1) are the following.

(i) Sanosiri: This is located on the southern side of the Babai valley on the upper margin adjacent to Thulosiri grassland on the southeastern side of the Guthi post, where *S. spontaneum* and *I. cylindrica* are the dominant grass species (Figure 1).

(ii) Thulosiri: This grassland lies on the southwestern part of the Sanosiri, where *S. spontaneum*, *I. cylindrica* and *Cynodon dactylon* are the dominant grass species (Figure 1). Larger pellet size was recorded here than in any of the other grasslands and good coverage provided escape from predators. This grassland is similar to that of Sanosiri and was observed to be prone to poaching of other big mammals and not hispid hare.

(iii) Guthi: The Guthi grassland, in the northern part of the Babai river, lies almost in the middle of the Chepang and Parewaodar Post, where *S. spontaneum* and *I. cylindrica* are the dominant grass species. The Guthi grassland as well as Sanosiri, Thulosiri and Chittale are the preferred elephant habitats (Figure 1).

(iv) Kalinara: The Kalinara grassland lies south of the Babai river, where *S. spontaneum* and *I. cylindrica* are the main grass species (Figure 1).

(v) Ratamate: This is the only grassland supporting the hispid hare, which is not drained by the Babai river. We encountered many wild pigs during the survey periods (Figure 1).

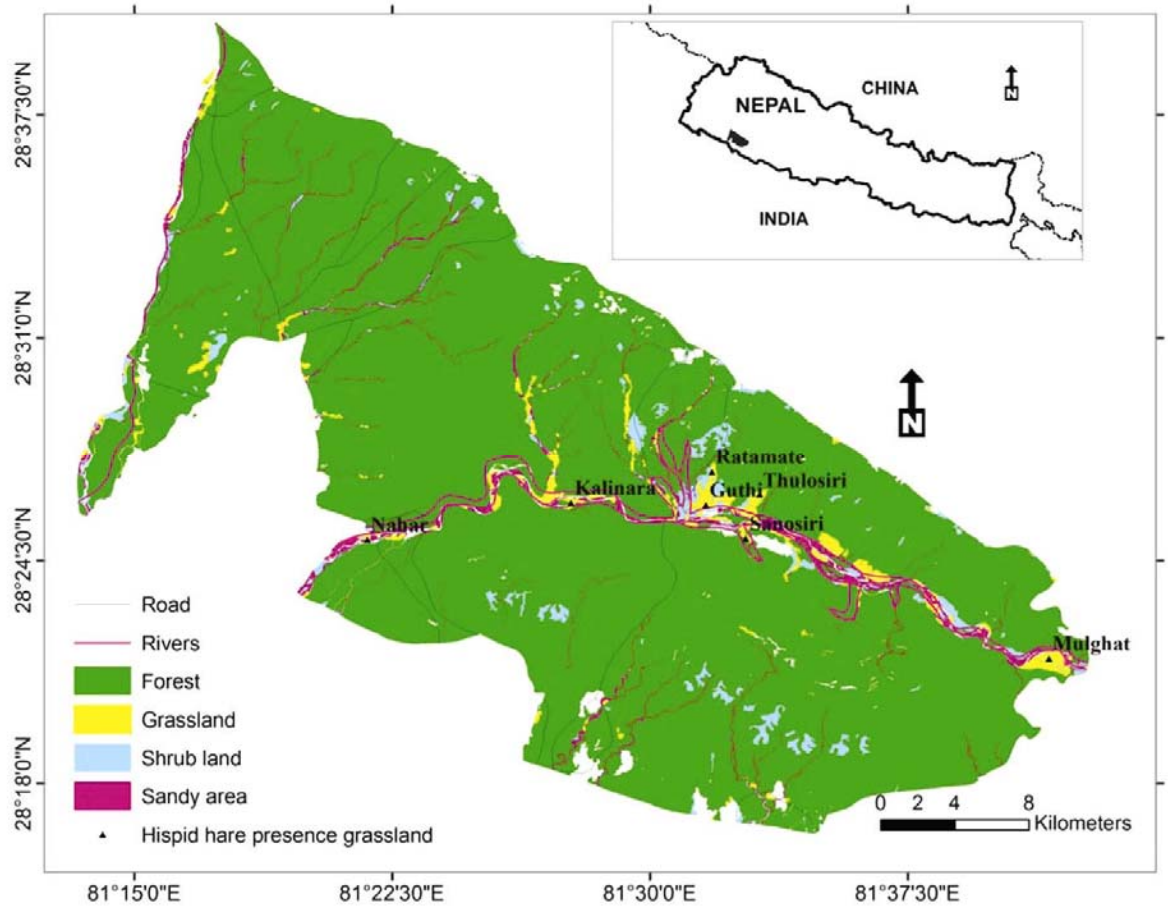

Figure 1. Vegetation types of the Bardia National Park, Nepal and map showing the hispid hare habitat, existing grassland and forest area besides other topographic features.

(vi) Mulghat: This grassland lies on the west, adjacent to Machan, where the dominant grass species include *C. dactylon* and *I. cylindrical* (Figure 1). This grassland was found to be most frequently harvested by the local inhabitants from Chepang. Such activities have disturbed hispid habitat and its species, *C. dactylon*.

(vii) Nahar: This grassland lies on the western part of the Babai irrigation dam (Babai bridge on the eastwest highway; Figure 1). *I. cylindrica* and *C. dactylon* are the dominant grass species. The species population was found to be the most isolated and confined among the grasslands studied, with the hispid hare population surviving under threat, i.e. flooding and the connectivity with this grassland was broken down by forest patches and rivers. Visits by the public to the Babai dam add to the threat to this grassland. No annual burning is practised here.

The diet of the hispid hare consists of 23 plants species, the 5 most preferred species are: *S. spontaneum*, *I. cylindrica*, *D. bipinnata*, *C. dactylon* and *Saccharum munja*. These constitute more than 85% of the food plant species (Figure 2).

S. spontaneum occurred with the highest frequency followed by *I. cylindrica* and *C. dactylon* before the burning season; *I. cylindrica* had the highest frequency followed by *S. spontaneum* and *C. dactylon* after the burning season (Figure 2). Our results showed that the composition of the plant species in the diet of the hare was available proportional to the hispid hare habitat.

This study has confirmed the presence of the hispid hare in the Babai valley. Due to the nocturnal nature of the hispid hare, we adopted the survey method, studying hispid hare pellets to understand the status and conduct a presence–absence survey. Aryal *et al.*[3] and Yadav[5] estimated the hispid hare population based on the pellet density in the Shuklaphanta Wildlife Reserve. We used the same method to estimate the population density from the pellet density. We found a population density of 0.452 and 0.967/ha before and after the burning seasons, with estimates that were much lower than those of the earlier studies[3,5].

I. cylindrica, *C. dactylon* and *S. spontaneum* were the most preferred plant species for the hispid hare to feed upon in both seasons. Similar plant species in the hispid hare diet were recorded[3]. All the pellets were found in the grasslands dominated by *I. cylindrica* and *S. spontaneum* in the park, similar to the findings of Aryal *et al*.[3].

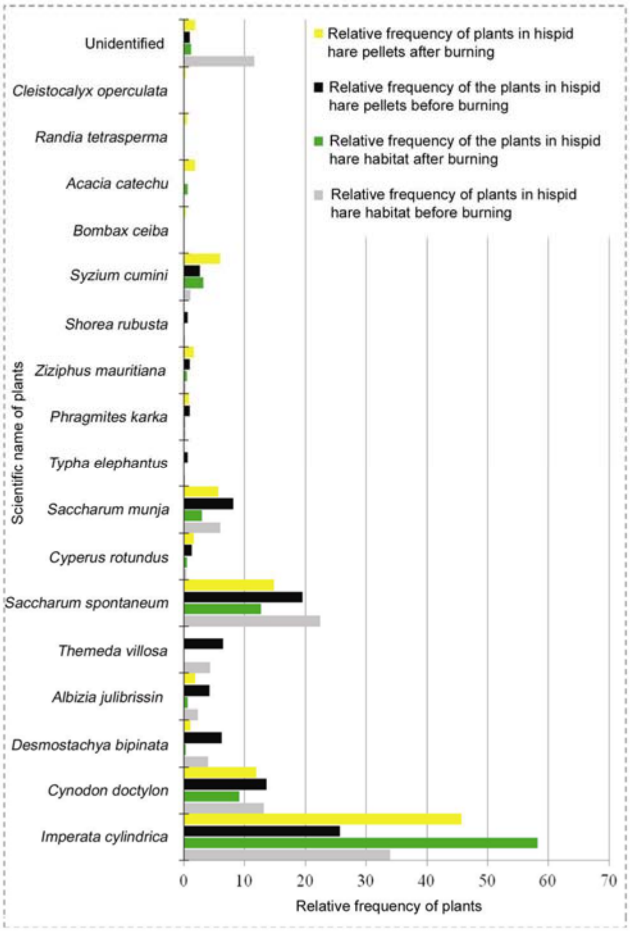

Figure 2. Frequency of plant species found in hispid hare habitat and hispid hare pellets.

Therefore, we conclude that the hispid hare prefers *I. cylindrica*, *C. dactylon* and *S. spontaneum*-dominated grasslands, and these plant species would offer the most suitable habitat for the hare. We suggest that the presence–absence survey be conducted in other grasslands (dominated by *I. cylindrica* and *S. spontaneum* with a combination of *C. dactylon*) as well as in the Protected Areas of the tropical region (i.e. Chitwan National Park). We also suggest that the concerned authorities prepare a species-focused management plan for the conservation of the hispid hare and other small mammals of the region. At the same time a fire management strategy needs to be prescribed and implemented.

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