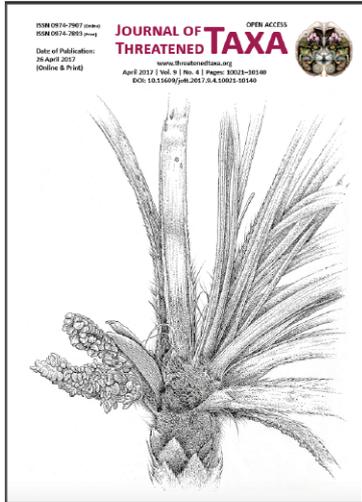


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## PEER COMMENTARY

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## LIVESTOCK AND WILD HERBIVORES IN THE WESTERN HIMALAYA: COMPETITION OR CO-EXISTENCE?

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**Abstract:** Pastoralism is among the major land use practices in the Himalaya and the main source of livelihood for local communities. In naturally occurring herbivore populations, the co-occurrence of native species has evolved through evolutionary processes over millions of years which has enabled coexistence. In the modern scenario, however, the intrusion of livestock into the wild habitats impose additional pressure on the limited resources, given that there has been insufficient time for resource partitioning to evolve. Realizing the need to develop a better understanding of wild herbivores and livestock interactions, the present review was compiled. The review demonstrates that a group of similar species using similar habitats and feeding on similar foods leads to more competition. Also, goat/sheep impose a potential threat to the resource of wild herbivores and such resource exploitation by livestock is not compatible with their conservation. Further, wild herbivores shift their habitat to avoid the risk of being exposed to competition or predation. Livestock grazing and associated activities affect the wild herbivores' habitat use and foraging behaviour, and these are changes that may also affect their survival in the future. There is a prime need to find out the threshold of livestock population which can sustain itself without compromising livestock production and wildlife. High conflict areas need to be identified and compensatory mechanisms should evolve. It is also necessary for ecology to be integrated with an understanding of the social dynamics that influence the status of the resources.

**Keywords:** Co-existence, competition, herbivore, himalaya, human-animal conflict, livestock, ungulates.

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**Author Details:** ZARREEN SYED works with The Corbett Foundation as Programme Officer. She is actively involved in research and conservation of Indian fauna since 2010 with different pioneer institutes of the country. She was associated with Wildlife Institute of India when this manuscript was communicated. MOHD SHAHNAWAZ KHAN is associated with WWF-India for about seven years and actively involved in the ecological study of aquatic biodiversity in Indus, Ganga and Brahmaputra river Basins.

**Author Contribution:** ZS contributed in literature review and secondary data collection. Both authors contributed in drafting the manuscript. MSK was involved in comparison of results of reviewed literature and the revision of the manuscript.

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## INTRODUCTION

The unprecedented rate at which human population is growing since the beginning of the industrial revolution has had an immeasurable impact on the ability of wildlife to survive. More people need more resources which results in exploitation of natural resources in an unsustainable way. The ever increasing human population is encroaching into wild habitats and making it fragmented. The division of big forested area into smaller fragments increases the edge which subsequently provides the geographical area for human-wildlife conflict. One such conflict can be exemplified through livestock and wild ungulate competition. Pastoralism is one among major land use practices in sub-alpine, alpine, and the trans-Himalayan region of India (Image 1) and it is a major source of livelihood for the local community in the Himalaya (Khan 2012). Approximately, 10% of the world's population lives in mountain areas, with livestock contributing substantially to their economy (Pun & Mares 2000). Further, India supports the world's largest livestock population (FAO 2002), hence livestock grazing's impact on native wildlife is an important conservation concern.

The co-existence and spatial or trophic resource partitioning among populations of native wild species of ungulates have developed through evolutionary processes over millions of years (Voeten & Prins 1999). In the modern scenario, however, with rapidly increasing human population around the world, the environmental conditions of ecosystems are changing at a pace that doesn't give enough time for resource partitioning to evolve between wild ungulates and their domestic counterparts. More humans result in the need for more livestock for their sustenance and these increased numbers of livestock intrude into the wild habitats which impose the additional pressure on the limited resources available for wild ungulates in the region (Putman 1996; Voeten & Prins 1999). Theoretically, species populations can grow until resource availability is reduced to the point of resource limitation (threshold point) and after that point the population growth rate is balanced by mortality (Huisman 1997). Livestock however are supplementarily fed by their owners and therefore their populations can continue to grow beyond this threshold; a process called overstocking (Mishra et al. 2001). In the case of high overlapping of habitat and forage requirements of livestock and wild herbivores, the overstocking of livestock may cause competitive exclusion of the wild herbivores (Mishra et al. 2002; Bagchi et al. 2004).



**Image 1. Exemplary livestock grazing in the natural habitat of Himalayan ungulates in Byans Valley on Indo-Nepal border.**

The theory of 'niche' emphasizes the role of inter-specific competition and resource partitioning in allowing species co-existence (Hutchinson 1959; Schoener 1974; Giller 1984; Goldberg & Barton 1992; Whitfield 2002). Sympatric species of similar-sized ungulates that have similar foraging strategies may thus compete (Owen-Smith 2002; Prins & Olf 1998), although for this to occur there must be a high degree of overlap in their use of spatial and trophic resources, and such resources must be limited (Putman 1996; Prins & Olf 1998; Hulbert & Andersen 2001). The struggle occurs when the amount of sharing resources among two or more competing species is depleted due to the presence of each other (Sale 1974; Abrams 1998). Furthermore, anthropogenic pressure on that particular resource which is rangeland, in this case, may cause the daunting consequences for the native wild species.

Although many examples indicate negative impacts of cattle grazing on wild ungulates, the effects of grazing on range conditions are not always clear (Shrestha & Wegge 2008). In the present article five studies covering the western Himalaya (Image 2) were reviewed to develop a better understanding about wild herbivore and livestock interactions. In particular the paper addresses the question -- what is the impact of sharing the grazing areas between livestock and wild ungulates?

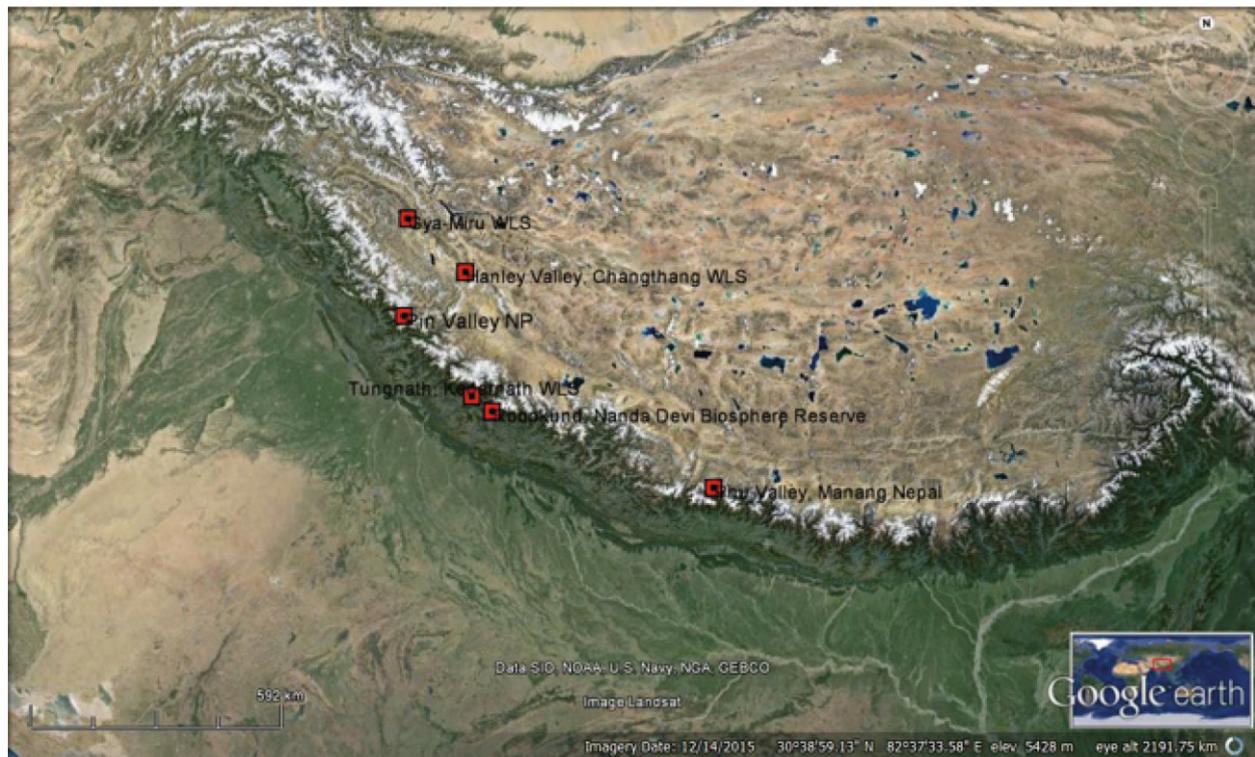


Image 2. Map of sites covered in this review study

## MATERIAL AND METHODS

The present review article is based on the secondary data of five case studies covering the western Himalaya. The reviewed case studies were based on empirical data collection, the species habitat selection using standard methods such as trail monitoring, scanning from vantage points, quantification of habitat variables and through vegetation structure assessment. Feeding habits were assessed through dung analysis (Hussain et al. 2010; Bhattacharya et al. 2012) and direct observation (Bagchi et al. 2004). Habitat selection by Ibex *Capra ibex* (Bagchi et al. 2004), Argali *Ovis ammon* (Namgail et al. 2007) and livestock was analysed using non-metric multidimensional scaling (Bagchi et al. 2004; Namgail et al. 2007), while Bagchi et al. (2004) used chi-square test of association to determine the association of Kiang *Equus kiang* and correspondence analysis was carried out by Shrestha & Wegge (2008) to look at seasonal and cross-seasonal patterns of association between animal groups and habitat categories. A matrix of percentage-utilisation of different plant species was generated for the diet profile of wild and domestic herbivores. Overlap in the diet of different pairs of species was assessed using the Pianka's (Bhattacharya et al. 2012), and Schoener's index (Hussain et al. 2010).

## RESULTS AND DISCUSSION

Bagchi et al. (2004) reported the habitat partitioning of ibex with domestic livestock. Ibex were found to occupy upper slopes and horses, goat/sheep and yaks also occupied the upper-middle slopes; however the donkeys and cattle were found to occupy pastures at lower altitudes only (Bagchi et al. 2004). They further reported that ibex, free-ranging horses and goat/sheep feed on grasses while cattle and donkeys prefer to have more sedges in their diet. This latter finding has suggested that the group of similar species use similar habitats and feed on similar food: hence more competition.

The similarities in the feeding habits and habitat choice among ibex, free-ranging horses, and goat/sheep make it difficult for them to co-exist (Schoener 1974; Harris & Miller 1995; Bagchi et al. 2003). On the other hand, the spatial overlap among them also indicated the species comfortability with other sympatric species. The higher spatial overlap between ibex and free-ranging horses suggested the greater chances to co-exist than that with goat and sheep as they have more similar habitat and diet requirements.

In the case where two or more species found themselves unable to co-exist with each other, then

they appear to shift to other habitats depending on the relative costs and benefits of leaving their current site and going elsewhere. Several other studies have also shown the habitat shift by species to avoid the risk of being exposed to competition or predation. Hussain et al. (2010) reported that kiang shifted to higher elevations and hill aspects with low vegetation cover and avoid steep slopes due to high predation risk. Argali was reported to use habitat away from cliffs with moderate slopes and high vegetation cover in the absence of livestock, and shifted close to cliffs with steeper slopes and low vegetation cover in their presence (Namgail et al. 2007). In addition, the intrusion of goat and sheep further up the hill during summer resulted in competition on elevations of Blue sheep *Pseudois nayaur* (Shrestha & Wegge 2008).

In Nandadevi Biosphere Reserve 49% diet overlap was reported between livestock and wild ungulates (Bhattacharya et al. 2012); 68% Himalayan Tahr (*Hemitragus jemlahicus*) and livestock in Tungnath (Bhattacharya et al. 2012); 58% between kiang and sheep (Hussain et al. 2010); 57% kiang and goats (Hussain et al. 2010); 82% kiang and horses (Hussain et al. 2010). A high degree of diet overlap, either indicates a higher competition among consumer species (if the resource is limiting) or, alternately, it may also imply the smooth sharing (co-existence) of resources that are abundant (Gordon & Illius 1989; Putman 1996; Mysterud 2000). In the Trans-Himalaya, the growing season for vegetation is restricted to the few months in summers. In winter, the leaves die off and most of the rangelands become inaccessible for herbivores due to snow cover. Therefore, compared to the summer diet where herbivores probably exhibit some choice in what they eat, winter diets are expected to be largely constrained by what is available.

## CONCLUSION AND FURTHER IMPROVEMENT

The studies demonstrate that goat/sheep impose a potential threat to the resource of wild herbivores and such resource exploitation by livestock is not compatible with their conservation. Further the agro-pastoral practices in the Himalaya are constantly changing (Mishra 2000). Future alterations in herding practices (causing a shift in habitat use by livestock) could become important conservation concerns since most livestock have a relatively high diet similarity with most of the wild herbivores and exploited large amounts of forage from the pastures.

To sustain the local human population livestock is inevitable hence livestock is expected to compete for the same forage when feeding on the same range. Sheep and goats consume a large proportion of the biomass, which may be critical during winter when the forage species are scarce.

Livestock grazing and associated activities affect the wild herbivores habitat use and foraging behaviour, and these are changes that may also affect their survival. The article emphasizes the need to devise the micro-plan and local strategy for better management of resource competition between wild herbivores and livestock which is locally concentrated in the key resource areas that contain the sedge meadows. In order to develop strategy, high conflict areas need to be identified. Moreover, an adequate compensatory mechanism needs to be worked out for herders who face genuine forage competition from wildlife (Bhatnagar et al. 2006). It was found that there is a great degree of inconsistency in methodologies and conclusions among the results of different studies, which make any comparison difficult for the managers. Hence, a systematic approach that could be used to assess the impact of livestock on wild ungulate range is recommended for all on field studies. The key to establish a sustainable grazing system, however, is to not only look at the impact of cattle grazing itself but to also assess required forage off-take by the wild ungulates (Chaikina & Ruckstuhl 2006). There is a need to find out the threshold of livestock population which can be sustained without compromising livestock production and wildlife. It is also necessary for ecology to be integrated with an understanding of the social dynamics that influence the status of the resources (Reynolds & Mace 1999).

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