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Anthropogenic threats and its conservation on Himalayan brown bear (*Ursus arctos*) habitat in Kugti wildlife sanctuary, Himachal Pradesh, India

Rajkishore Mohanta[1,*] and NPS Chauhan[2]

[1]*Wildlife Institute of India, Chandrabani, Dehradun, India*
[2]*Director, Amity Institute of Wildlife Sciences, Amity University Noida, New Delhi, India*

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ABSTRACT

Forest were fragmented and impacted from biotic interference, developmental activities, over exploitation of natural resources. Human population in the Kugti village was estimated to be 1442 but livestock population was more than 15558 grazing inside sanctuary where as total area are 379 km^2. Dung abundance per hectare was found to be maximum in grassland & forest blanks (36.74/ha), and minimum in glacier and snow covered peak (0.31/ha). We were identified 20 non-timber forest produce items, which were collected by the villagers from the bear habitats. The NTFP are very important for poor tribal people and other inhabitants because many of them get financial support for their sustenance.

Key words: Himachal Pradesh, Himalayan brown bear, habitat.

INTRODUCTION

Anthropogenic pressures may be defined as the disturbances caused by human induced activities on the surrounding environment. Since the dawn of human civilization, man-induced pressures in the form of fire, grazing, logging and lopping have influenced the forest ecosystems of the world. Excessive pressures negatively influenced the climax assemblages and bring instability in the ecosystem (Clements, 1936) or at moderate level such activities may increase species diversity in the community by preventing competitive exclusion by dominant species (Huston, 1979). Reduction of total forest cover, conversion of natural forest ecosystem to simplified and often even-aged monoculture plantations and fragmentation of remaining forests into smaller patches are some consequences of uncontrolled anthropogenic activities. Some indirect effects of forest degradation include impoverishment and regression of many wild species (Mukherjee, 1974) and increased human-wildlife conflicts (Studsrod & Wegge, 1995 & Sukumar, 1996). These human induced impacts at both global and local scales have aroused concern among ecologists, conservationists, and forest managers (Ives & Messeril, 1989; Johnsingh *et al.,* 1991; Mc Neelay *et al.,* 1995 & Vitousek *et al.,* 1997).

Some ecological impacts of fuelwood and fodder extraction at the local level may be difficult to assess but effects of such pressure on the individual species can be quantified as these hamper the regeneration and normal forest growth (Sousa, 1984) further affecting the distribution of wild animals and resource availability for them. Information on such pressures not only helps in predicting regional patterns of vegetation and wild animal distribution but also help in evolving area specific conservation measures (Stapanian *et al.,* 1997). Many studies in other parts of the world have documented the responses of plants and animals to human induced disturbances (Shackleton *et al.,* 1994; Vermeulen, 1996; Skarpe, 1990 & Sullivan, 1999). Need to evaluate the local level impacts of anthropogenic pressures on forests and wildlife of Himalaya has been felt by several authors (e.g. Dang, 1969; Green, 1978; Nainwal, 1994, Sundriyal and Sharma, 1996; Negi *et al.,* 1999 & Awasthi, 2001). For the conservation of the natural resources, an understanding of the region specific needs, socio-economics of the local people and patterns of biomass utilization has been emphasized (Moss & Morgan, 1981). Collection of baseline information on the forest resources utilization is also important for long-term monitoring and efficient land use management.

MATERIALS AND METHODS

The study was conducted in Kugti wildlife sanctuary (Figure 1), which is located in the north-eastern part of Bharmour forest division of Chamba district, Himachal Pradesh, covering an area of 379 km^2. The geo-coordinates of the study area lie between the latitude 32º 20' N and 32º 35' N, and longitude 76º 35' E and 76º 55' E. On one side, the study area falls in the Pir Panjal Himalayan range. It forms the upper catchment of Budhil nala, one of the tributaries of river Ravi. To assessment of anthropogenic pressure on Himalayan

*Corresponding Author's E-mail: brownbear143@gmail.com

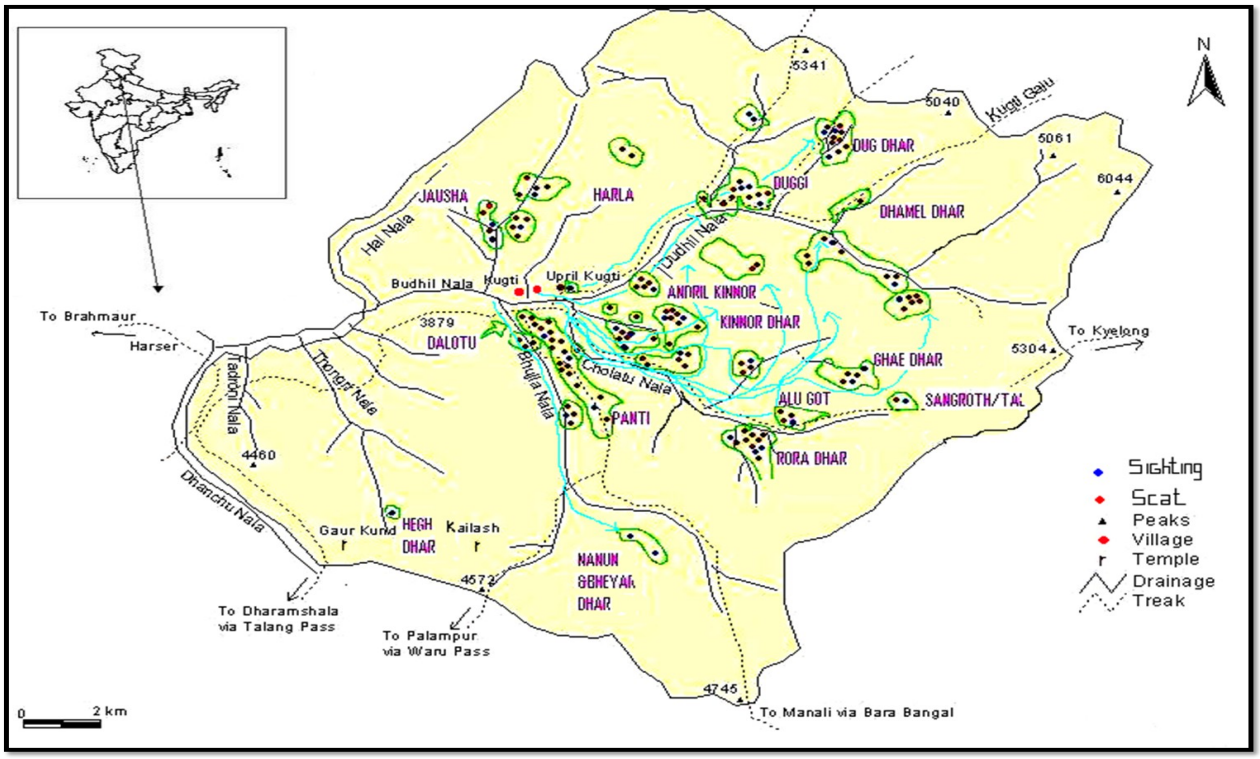

Figure 1. Brown bear sighting and scat collection points in Kugti wildlife sanctuary, Himachal Pradesh.

brown bear habitats, linear transect were laid in the representative areas covering all the available habitats and landuse categories in Kugti wildlife sanctuary. Each transect was 1 km in length and sample plots of 10m radius at every 250m interval were taken to assess the impact of anthropogenic pressures on bear habitat and in total data were taken from 175 plots. There were evidence of anthropogenic pressures such as cattle grazing (dung), lopped trees, distance from human habitation, disturbance from roads, camping of glaziers and other human activities were recorded in the redesigned formats. Observation technique helps to crosscheck the information collected through interviews. Integration of observation data with questionnaire surveys gives more reliable information (Fox, 1984 & Clarke, 1986). Although use of structured questionnaire is a systematic and standardized approach (Clarke, 1986) that makes quantitative measurements possible, its limitations is that it restricts the range of possible answers. In addition to transect methods, information on anthropogenic pressures was also collected through village surveys of different household over the period of two years.

RESULTS

Demographic structure

The age group of family members was highest in 5 to 8 (54.24%), followed by 1 to 4 (30.08%), 9 to 12 (12-29%) and 13 and more (03.39%). Whereas the education status was maximum in high school level 25.43%, followed by intermediate 22.44%, primary school 20.34%, middle school 14.41%, graduation 04.66% but illiterate was 12.72%. The occupation structure of families was highest in agriculture 39.40%, followed by livestock 16.11%, services 14.40%, labourer 11.45%, agriculture and collection of medicinal plants 10.60%, carpenters, tailors etc. 04.23% and shopkeepers 03.81% based on Questionnaire survey.

Extent of anthropogenic pressures

In Kugti wildlife sanctuary one village in human habitation and some patches of the cultivation areas. Forest were fragmented and impacted from biotic interference. Human population in the kugti village was estimated to be 1442 and livestock population was 736 as per the village questionnaire survey. Grazier parties and number of livestock survey different pastures (n=12) of Kugti wildlife sanctuary was more than 15558. About 85.38 sq.km areas of Kugti was found as highly affected, whereas only 102.37 sq.km areas without any anthropogenic pressures, 76.68 sq.km areas was low and 114.57 sq.km area was medium of affected anthropogenic pressures. More than 85.38 sq.km area was highly affected and was less to be occupied by the bears. We identified 20 non-timber forest produce items, which were collected by the villagers from the bear areas. These forest produce items were of wide variety and extracted from different sources, 19 items plant origin, one of mushrooms (Table 1).

Livestock grazing

The presence of cattle dung in the bear areas is the most prominent disturbance factor. Dung abundance per hectare was found to be maximum in grassland & forest blanks (36.74/ha), followed by Himalayan moist temperate forest with conifers (13.50/ha), Mixed forest with conifer and broad leaves species (13.19), Near water bodies, river and streams (12.56/ha), Agricultural (12.25/ha), Dry alpine scrub characterized by *Juniperus* species

Table 1. List of non-timber forest produce collected by people in Kugti wildlife sanctuary, Himachal Pradesh.

S.No.	Common name	Genus	Species	Family/class	Parts	Season	Uses
1.	Guchhi	*Morchella*	*esculenta*	Morchella-ceae	Whole part	April-June	Eating
2.	Chura	*Angelica*	*glauca*	Apiaceae	Root	July	Stomach disorder
3.	Bhutkesh	*Selinum*	*vaginatum*	Apiaceae	Rhizome	June-September	Evil spirit treat-ment
4.	Dhoop	*Jurinea*	*macro-cephala*	Asteraceae	Root	June-September	Aromatic, hys-terical medicine
5.	Kasmal, Roshit	*Berberis*	*aristata*	Berberida-ceae	Root, stem	April-May	Ophthalmic, eye disease
6.	Bhujpatra	*Betula*	*utilis*	Betulaceae	Bark	June-October	Worship
7.	Bhang	*Cannabis*	*sativa*	Cannabaceae	Stem, leaf	June-September	Drug
8.	Shingli-mingli	*Dioscorea*	*deltoidea*	Dio-scoreaceae	Rhizome	June-September	Rheumatism
9.	Sergerh	*Rhododen-dron*	*campanula-tum*	Ericaceae	Root	June-September	Headache
10.	Sergerh	*Rhododen-dron*	*anthopogon*	Ericaceae	Root	June-July	Headache
11.	Bhutkeshi	*Corydalis*	*govaniana*	Fumariaceae	Root	June-September	Evil sprit treat-ment
12.	Kuroo	*Gentiana*	*kurroo*	Gentianaceae	Rhizome	August-September	Gastric problem
13.	Akhrot	*Juglans*	*regia*	Juglandaceae	Fruit	May-October	Eating, medicine
14.	Salam panja	*Dacty-lorhiza*	*hatagirea*	Orchidaceae	Root	June-August	Diabetes, ener-getic
15.	Diyar	*Cedrus*	*deodara*	Pinaceae	Stem	October	Skin disease
16.	Bankakudu, kakri	*Podophyl-lum*	*hexandrum*	Berberida-ceae	Root	July-September	Skin disease
17.	Patish	*Aconitum*	*heterophyl-lum*	Ranuncu-laceae	Root	August-September	Diabetes, weak-ness
18.	Aru	*Prunus*	*persica*	Rosaceae	Fruit	May-October	Eating
19.	Jammu	*Prunus*	*cornuta*	Rosaceae	Fruit	June-October	Eating
20.	Kaud	*Picrorhiza*	*kurrooa*	Scrophulari-acea	Whole plant	June-September	Gastric problem

(5.97/ha), Exposed rocks with slope grasses (4.71/ha), Subalpine forest dominated by birch & fire sp (4.40/ha), Moist subalpine scrub characterized by *Rhododendron* sp. (2.83/ha) and Glacier and snow covered peak (0.31/ ha). In summer, nomadic graziers from Punjab visit Kugti wildlife sanctuary and other PAs of Himachal Pradesh to graze their sheep and goats, which cause tremendous pressure on bear habitats. They bring thousands of sheep and goats to these areas every year. A herd of sheep and goat stays at sixth month or so in Kugti WLS halting at different places (Plate 1). They were frequently seen camping at Ghaiula, Nanun, duggi, Sarni, Relling, Tal, Kinnar, Dhamel, Bhid, Dhamel dhars, the important bear areas.

Local people and land use practices

The main occupation of these people (*Gaddi* tribes) is agriculture along with horticulture. However, rearing sheep and goats also fetches a good income. These activities are contributed to highest annual cash income. Rearing sheep and goats is still practiced on fairly large scale as it is the traditional practice of these villagers. Horticulture is becoming more popular in the areas and raising orchards of apple, plum and walnut are being developed while maize, wheat, barley, rajma and potato are generally cultivated as food crops. Besides, there are also preponderance of alpine areas beyond tree line such as meadows, rocky and snow bound areas one natural glacial lack "Manimahesh" (4572m) in side sanctuary, which has been developed and maintained by local people 'eco-development' areas. Every year more than seventy thousands of visitors come to different districts and state these areas for Shiv darshan.

Fuel wood collection

A section of people inside PAs are not only depends on agriculture and livestock but also forest dependency in various ways fuel wood collection, fodder, medicinal plants, mushroom collection. Ecological impacts of fuel wood and fodder extraction at the local level may be difficult to assess but effects of such pressure on the individual species can be quantified as these hamper the regeneration and normal forest growth. We identified the major fuel wood species and which is more use, the highest prefer for fuel wood species are *Abies pindrow* (Tos), *Pinus wallichiana* (Kail), *Cedrus deodar* (Diyar) and lowest was *Betula utilis* (Bhuj). Fuel wood consumption is very high because of three reasons: A. Cold weather, B. Lack of other sources of energy and C. Without investment getting high benefit from natural resources.

Forest fires

During the summer and winter season, forest fires were common in Kugti WLS. Forest fire did not impact much on trees, but it had adversely impacted the fruiting shrubs abundances and herb/grass. Occurrence of forest fire, important food species of bears was drastically reduced. Most fire prone areas were nearest village areas and Duggi dhar, Harla, Josha, Panti, and Buggi. These forest fires were found to destroy few shrubs species, which were important food plants for the bears. Apparently, the fires might be adversely affecting the food and habitat use by bears. About 550 cases of forest fires were detected, affecting an area of 8,393 ha. In most of the cases the fires were reported to be ground fires. Mainly the grasses, young plantations and new regeneration were affected. The main reason of fire was attributed to the carelessness of villagers/travellers passing through the forest, and discarding cigarette butts (Annual report, 2008).

DISCUSSION

Some developmental activities and the exploitation of natural resources of non-timber forest produces are exerting their combined effect on species, and in such a situation, animals have few options to avoid these pressure. In Kugti WLS, the forest patches interspersed with human settlement and agriculture areas seem to be highly disturbed from anthropogenic pressure. Concentration of bears was mostly in areas with high anthropogenic pressures and in least disturbed areas. The areas with maximum disturbances areas were not occupied by bears. Avoidance of these highly disturbed areas might be due to the absence of forest cover and human activities, which could be considered as the limiting factors for bear distribution. And use of highly disturbed areas by bears was correlated with the availability of grassland for food and shrub forest cover for temporarily shelter places. We identified 20 non-timber forest produce items, which were collected by the villagers from the bear areas. These forest produce items were of wide variety and extracted from different sources, 19 items plant origin, one of mushrooms. The NTFP are very important for poor tribal people and other inhabitants because many of them get financial support for their sustenance. Economy of local people is based on agriculture and NTFP collection.

Maximum density of dung was observed in Grassland and forest blank, followed by Himalayan moist temperate forest with conifer, Mix forest with conifer and broad leave species, Water bodies river and stream, Agriculture, Dry alpine scrub characterized by *Juniperus sp.,* Exposed rock with slope grasses, Subalpine forest dominated by birch and fire sp., Moist subalpine scrub characterized by *Rhododendron sp.* and Glacier and snow covered peak. In India, Livestock population is very high; it has 15% of the world cattle, 10% sheep and goats and 50% buffaloes in 4% of the global land area. Forest degradation due to livestock grazing pressure was found to be significant (Brandon and Ramankutty, 1993). The grazing pressure was estimated to be about 5 livestock per ha of forest and pastureland. The heavy livestock pressure will affected the forest vegetation succession at potential shift of species driven by climatic parameters. Infrastructure factor such as human settlement, roads, other communication and artificial water bodies are likely to interference with climatic change driven shifts in forests or species. As the human population is growing, pressure is increasing. Due to the encroachment on the forests, more and more land is being converted into agriculture land.

Lopping of trees was mainly done for extraction of fuelwood and timber wood for home construction. Estimation of cut and lopped trees after one year showed constant increase in the requirement of wood for fuel and

other purpose at the rate of approximately 8.15/ha in Kugti WLS. (Zuidema *et al.,* 1994) has projected that the areas under the forests would sharply decline in coming decade in India. Fuelwood is the dominant biomass in the forests. The current consumption level has been estimated to 224 metric tones (Ravindranath & Hall, 1995) and has been projected to increase to 350 metric tones by year 2005, which would make worse condition of the forests. Harvesting of shrubs and lopping of trees could affected the plant diversity in the lower canopy due to opening of canopies; it might lead to forest degradation and ultimately to invasion of pioneer(s) suppressing natural regeneration. In Kugti WLS, the rate of increase of cutting and lopping trees per year was estimated 3.12/ ha and 12.79/ha respectively. Some forest land was cutting to poor tribal community for agriculture purpose without the government permission. But it would be direct threat to brown bear habitats and their survival.

CONCLUSION

We are well know that both the rights of wildlife and the livelihood rights of communities dependent on natural habitats need to be protected. The current processes of development and commercialization threaten both wildlife and local community livelihoods. Therefore, there is an urgent need to build a system that integrates biodiversity conservation and people's livelihood rights. The integration of wildlife conservation and people's livelihood requires actions to enable local communities to manage and sustainably harvest natural resources for their livelihoods, through establishing appropriate tenure rights, and combining traditional and modern knowledge to monitor the ecological impacts of such harvesting. There is also a need to devise ecologically and culturally appropriate and equitable alternatives for livelihoods that are currently unsustainable. So there is need to develop innovative mechanisms or strategies including the use of traditional methods used by the local communities, which can reduce brown bear damage problems. The forest management plan is aimed to protect the interests of the inhabitants, as well as the biodiversity. Different eco-developmental programs are taken into consideration to meet the ecological demands, as well as to protect Kugti wildlife sanctuary. Efforts are being directed toward wildlife education, awareness, research and training of the common people by the different government organizations and many non government organizations. It has ensure that long term conservation of Himalayan brown bear is need to identify a few areas in their distribution range and manage it exclusively as future bear habitats.

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Plate 1. Anthropogenic pressures on Himalayan brown bear habitat, Kugti WLS.