

Status and Conservation of Markhor in Jammu & Kashmir



Interim Project Report (2009-2010) Markhor in Kajinag National Park: Important habitats and interactions with livestock

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Markhor in Kajinag National Park: Important habitats and interactions with livestock

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1 Background and Introduction

Markhor is the largest goat but also a globally threatened species. It is an endangered species (IUCN Red List 2000) and is included in Schedule 1 of the Indian Wildlife Protection Act (1972) and Jammu and Kashmir Wildlife Protection Act (1978).

The distribution of markhor is limited and is mainly confined to moist to semi-arid mountain tracts of Pakistan, India, Afghanistan, Uzbekistan, Turkmenistan and Tajikistan. In India, markhor is found only in Jammu and Kashmir. The state is one of the important areas for markhor globally, and the primary area for the Pir Panjal markhor *Capra falconeri cashmiriensis*. Historically, markhor was distributed more or less continuously from Banihal pass in the Pir Panjal range to Shamsabari range across the river Jhelum. In a recent state wide survey of markhor, only two viable populations were confirmed in Kashmir besides identifying a few more markhor potential areas in the state Bhatnagar et al. (2009) and unfortunately these isolated small populations are also under continued threat. The major threats to the species were identified, foremost among which were competition with livestock and insurgency related disturbances to the area. The other threats being faced by markhor in J&K were identified as - continued poaching for trophy and meat, increasing fragmentation of the population due to the new fencing that has come up at the Line of Control (LoC) with Pakistan, and lack of awareness among locals and officials. Looking at the global status of markhor, the conservation of markhor in Jammu and Kashmir becomes crucial and every single population has a key role. Recognizing the immediate threat to the survival of the markhor, we proposed to start a conservation program in J&K to ensure its survival. The First among these steps was to document the basic ecology of the species and undertake targeted awareness programmes.

We believe that the Kajinag range is the last hope for the species and a thorough understanding of the areas that may be critically important for them, so that these are afforded the highest legal protection and kept out of the burgeoning exploitation of the area. The important aspects that we investigated included seasonal markhor distribution, especially the seasonal 'core' or critical areas, habitat and the levels of use by pastoralists and villagers and the level of extant threats. It is also important to have a clearer understanding of the potential range of the species based on its present habitat and identify other potential areas and corridors that can support markhor. An understanding of all these factors would be essential in preparing a conservation program designed to allow continued existence of markhor. Based on these factors the objectives of the recent phase of the study had following objectives:

1. Identify important areas for markhor
2. Understand the nature of interactions between markhor and livestock

2 Study area and methods

2.1 Study site

The study was carried out in the Kajinag NP, western Himalayas, Baramulla district of Jammu and Kashmir, India (Figure.1) during the year 2009. The NP covering C. 210 km² is mountainous, encompassing an altitudinal gradient of c. 2000-4000 m interspersed by cliffs and rocky outcrops. It is a temperate system, with cold winters and warm summers, with a temperature range of -15 to +30°C. Precipitation is mainly in the form of snow in winter and rains in March with occasional showers during summer. Four distinct seasons can be classified during a year, viz. Winter (Dec-Feb) with very low temperatures and snow covering most of the area, Spring (March- May) when temperatures begin to rise and sprout appears at lower elevations first and gradually moves to upper elevations, Summer (June-August) when temperatures rise further and the area contains abundant forage and receives some monsoon showers and Autumn (Sept-Nov) when senescence sets in plants. Late spring (May end) and early summer (June-first half) is the parturition period of markhor in the area. This is the time when migratory (Bakkarwals) and local graziers arrive with their livestock to graze in different parts of the Park. Vegetation is dominated by Coniferous forests of Kail Pinus wallichiana, Fir Abies spectabilis, Spruce Picea smithiana, and Deodar Cedrus deodara. Birch Betula utilis forests occur near the tree line in combination with Fir and Kail whereas the other broad leaf forests are mainly confined to areas along nallas (hill streams). The sub alpine area is dominated by juniper scrub Juniperus squamata. Most of the area is interspersed with cliffs and rocky outcrops.

2.2 Markhor

Markhor is a medium sized, sexually dimorphic, endangered mountain ungulate (IUCN 2004; <http://www.iucnredlist.org/apps/redlist/details/3787/0>). It exhibits sexual segregation which is very prominent during summer (parturition and lactation period). Parturition occurs in late spring and early summer (15May to 15 June) when forage availability becomes high after a lean winter. The potential predators of markhor are Common leopard Panthera pardus, Himalayan brown bear Ursus arctos, Himalayan black bear Ursus thibetanus, and the Golden eagle Aquila chrysaetus. Sightings and indirect evidences (pug marks, scrapes, scats) of these predators in the area have been recorded. Attacks by Common leopard, Brown bear and Black bear on livestock in the area have also been reported (pers.observ.). Other wild ungulates in the area include Himalayan musk deer Moschus chrysogater and Goral Nemorhaedus goral. Five species of pheasants including the endangered Western Tragopan Tragopan melanocephalus also occur here.

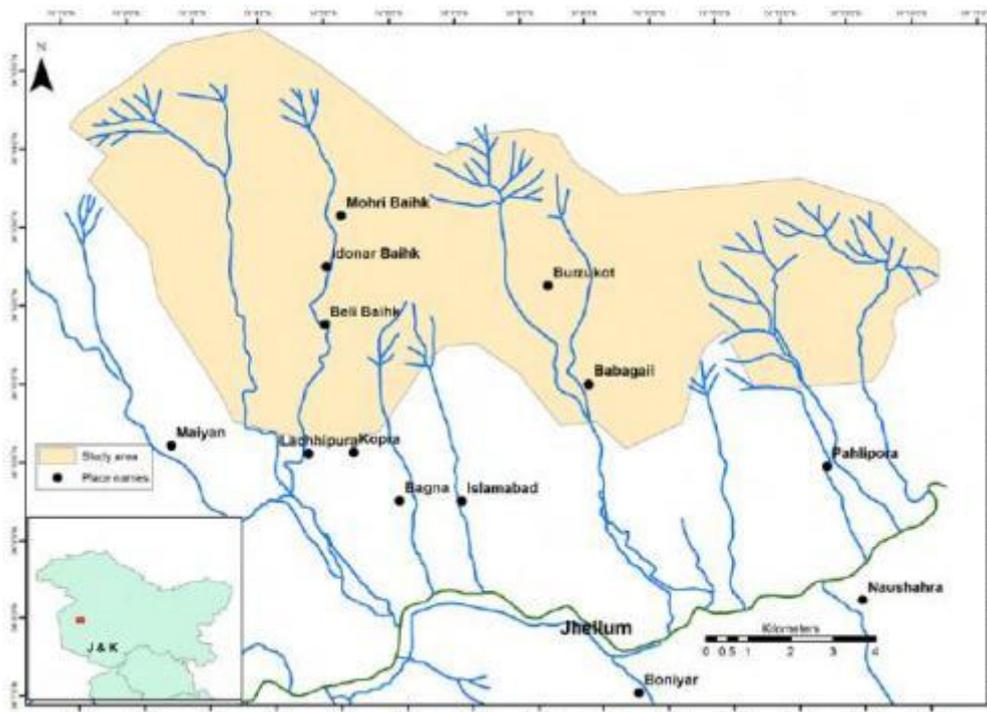


Figure 1: Study area

The Study area in the Kajinag National park. The area lies in the catchments of northern tributaries of river Jhellum. LOC is west of the study area. Inset shows the location of Kajinag in the state of Jammu & Kashmir.

Kajinag is very important for livestock herding, about 12000 sheep, goats and other livestock belonging to migratory Bakkarwals and local herders occupy the region between May and September. Livestock is one of the important sources of income for the local people and the only source of income for migratory Bakkarwals; however these livestock occupy much of the potential habitat of markhors.

2.3 Field methods

Habitat use

Data on habitat use by markhor were collected in different seasons throughout the year. Data on interaction between markhor and livestock was collected during summer just before livestock arrived and in presence of livestock, so as to facilitate comparison of Markhor habitat use in presence and absence of livestock. Observations were made on markhor groups with the aid of 8 x 40 binoculars and 15-45x spotting scopes along predetermined trails (n=17) and vantage points (n=6) selected to extensively cover the study site. Observations on livestock were also made in a similar way. All sightings were marked on 1:50,000 topographic maps with elevation contour interval of 40 m. The time and date of all sightings, age and sex composition of the groups seen, were recorded. Along with these, the following habitat variables were recorded:

- Vegetation type - open conifer, moderate conifer, dense conifer, broad leaf, riparian scrub, sub alpine scrub, alpine meadows
- Vegetation cover- ground cover (%), shrub cover (%)
- Topography - slope ($^{\circ}$), aspect ($^{\circ}$), altitude (m), shortest (straight line) distance from escape terrain (cliffs),
- Distance to livestock.

The vegetation variables (type & cover), snow cover and distance from escape terrain were visually estimated. Topographic variables altitude, aspect were recorded through Global Positioning Systems (GPS, Garmin Inc.). The topographic variable, aspect was classified into north (N, NW), south (S, SE), east (E, NE), and west (W, SW) for analysis. These variables (except distance from livestock) were also recorded for the livestock sightings.

2.4 Analytical methods

Data was analysed to identify important variables that determine the markhor habitat use. Important variables that distinguished the habitat use in presence and absence of livestock were identified by generalized linear modelling (GLM). The important variables were further verified through t-tests. Principal Component Analysis (PCA) was performed on the combined habitat use data of markhor and livestock to identify the key habitat components correlated with the observed locations of markhor and livestock. PCA identifies the groups of interrelated variables called the principal components. The first component captures the highest amount of variation and successive components extract the maximum residual variation. Distance to cliff (m), slope ($^{\circ}$), tree cover (%), shrub cover (%), ground cover (%), were used in PCA.

3 Results and Discussion

3.1 Key Results

Methwani, Gujjar, Malangan and the Naganari nallahs contain some of the important habitats and areas with high potential suitability for Markhor. Rambra, Gode zeen, Akbar khanun gate, Balapud, Meem ka nalla, Kuch kard are locations in these nallas critical birthing sites of markhor (Figure 2). Kajinag NP receives about 15000 thousand livestock in summer (starting in last days of May - early June) mostly from migratory Bakkarwal and shepherds which stay for the whole summer and use most of the area (Figure 3). The livestock consists mainly of sheep and goats. Bakkarwals are mainly goat rearers but now they also graze

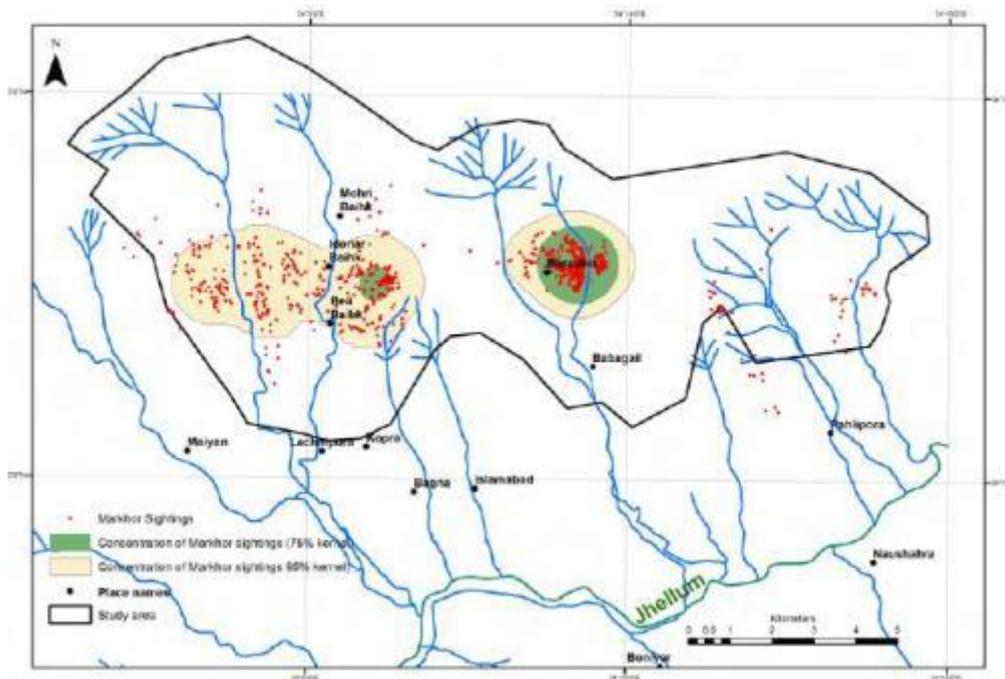


Figure 2: Important areas for Markhor

The shaded areas show concentrations of markhor sightings throughout the year. Greatest concentration of sightings occur around Burzukot, in the centre of the study area, which also contains important birthing sites.

livestock (sheep) of other owners for cash returns. Few hundred cattle from the local's villages are also grazed mostly in the lower parts of the park. Most of the area is heavily grazed except for one nalla (Malagan nalla) that is lightly grazed (Figure 4). Markhor seem to be away from livestock grazed areas in most of the area (except near Burzukot), likely indicating avoidance of heavily grazed areas (Figure 5).

We found that markhor habitat use was different in presence and absence of livestock. It was further determined that markhor habitat use also differed in areas with heavy livestock grazing and light livestock grazing.

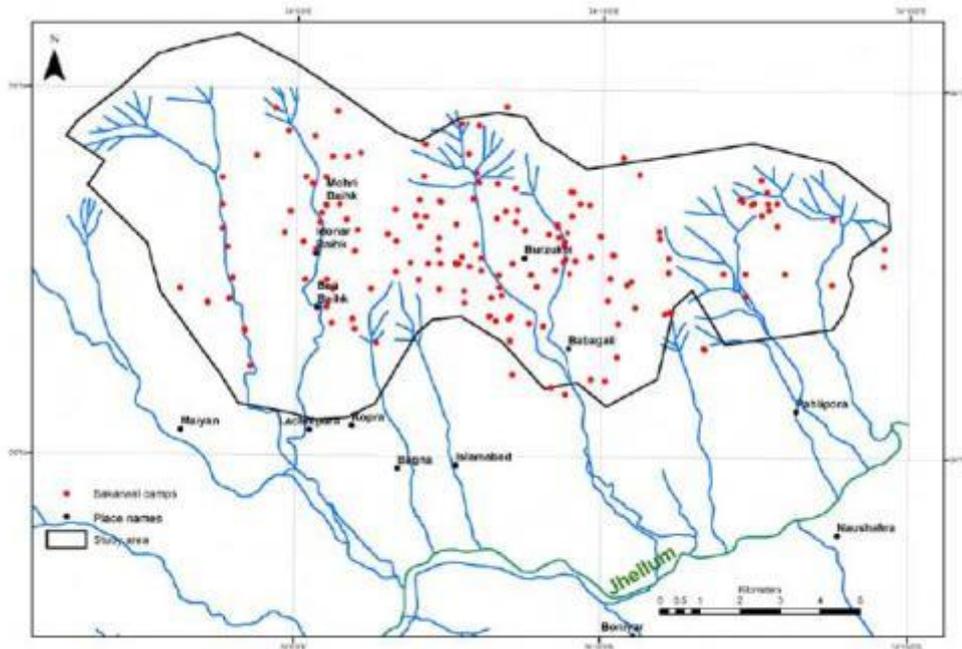


Figure 3: Grazing camps in Kajinag

The map shows Bakkarwal camps in the core area of Kajinag NP. Their distribution is throughout. They start with the lower elevations in the early summer and continue to move camps to reach the alpine areas in peak summer, where they spend the peak summer period (July-August). They descend through more or less the same route.

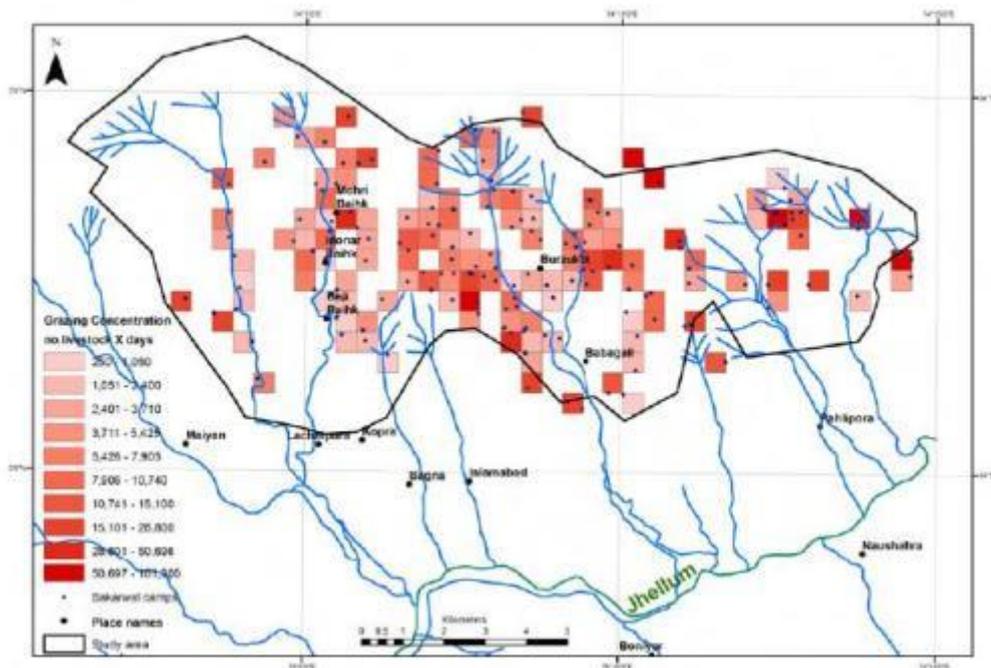
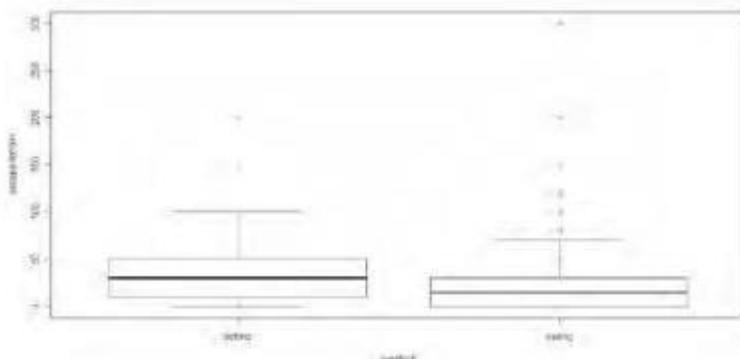


Figure 4: Grazing concentration in Kajinag

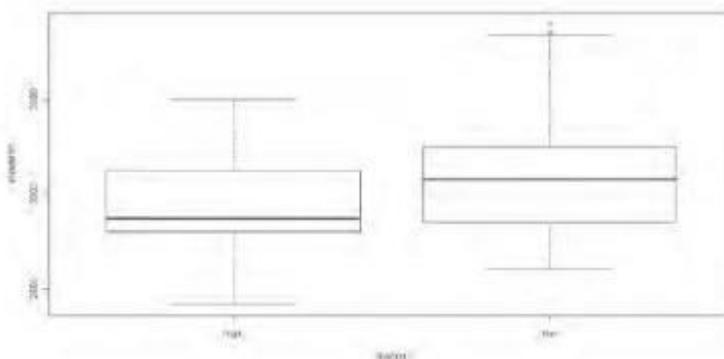
The map shows that grazing pressure is high in most parts of the area including some areas important for Markhor. However there are a few pockets with low grazing intensity. The blank cells in the map do not mean that there is grazing, it is more likely that these areas receive low intensity of grazing. Each cell is 250 _ 250 m. The values of all grazing camps falling within these cells was summed to produce this map.

significant ($t=-3.3791$, $P < 0.01$). Markhor used steep slopes in presence of livestock and less steep slopes after the livestock left the area, supporting the results of use of areas closer to cliffs in presence of livestock.

PCA was performed to explore the difference in habitat use by markhor and livestock. The first three components explained 73% of the variation. Component 1 had a high loading for distance to escape terrain, slope and ground cover whereas Component 2 had a high loading for elevation, tree cover and shrub cover. Markhor used areas closer to cliffs when livestock were in lower elevations than when livestock were in upper elevations.



(a) Use of escape terrain



(b) Use of altitude

Figure 6: Differences in Markhor habitat use in relation to livestock- use of escape terrain

Figure 6a. Markhor occur further away from cliffs (escape terrain) before arrival of livestock, in presence of livestock they occur much closer to the cliffs, as indicated by the medians.

Figure 6b. Markhor use lower elevations in areas with high livestock grazing, but use higher elevations in areas with low grazing intensity. This indicates that in areas with high grazing intensity, livestock occupy the better high altitude areas, pushing the Markhor to less suitable lower elevations.

The box plot shows the 75th and 25th percentile (upper and lower lines of the box), the central bar in the box shows the 50th percentile (median of the data), upper and lower horizontal bars joined by dotted lines are at the 1.5 upper and lower interquartile range respectively. Small circles indicate the outliers in the data (extreme values).

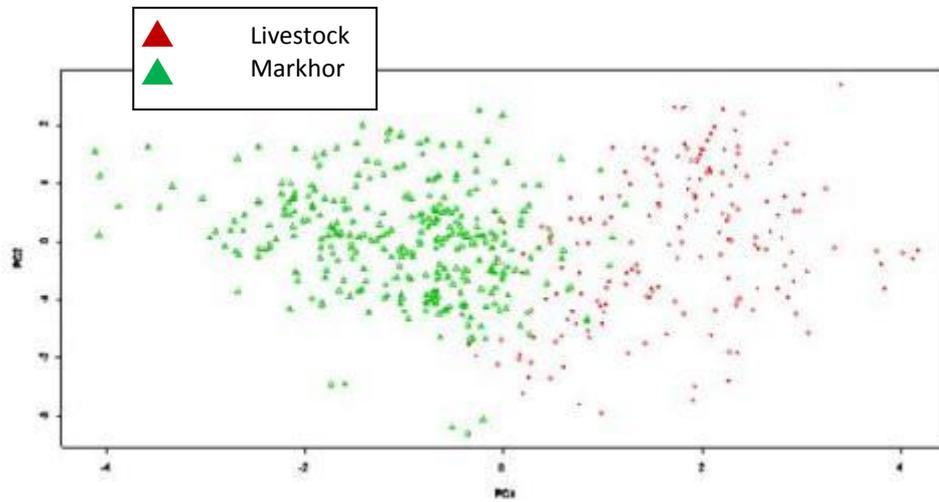


Figure 7: Principal Component analysis of habitat use of markhor and livestock

Principal Component scores indicate that livestock use areas with gentle slopes, high forage cover whereas markhor use areas with steep slopes, close to cliffs with less forage cover. Green triangles denote markhor and red diamonds livestock. Axes are PC1 (X axis) and PC2 (Y axis).

Migratory livestock arrive around end of May and leave around mid-September. During this period, Kajinag receives about 15,000 sheep and goats from local and migratory graziers and about 2000 cattle from locals.

3.2 Discussion

Most of the important wildlife areas have been important areas for the livestock grazing also. Impact of livestock on wildlife has been debated Mishra and Rawat (1998). Studies specifically investigating impacts of livestock on native wild ungulates can help resolve some of the questions. Some recent studies which examined interactions between wild ungulates and livestock have found that livestock either excludes wild ungulates from certain habitats or pushes them to suboptimal habitats Mishra (2001); Mishra et al. (2002); Bagchi et al. (2004); Raghavan (2006); Suryawanshi et al. (2010). Markhor shows a shift in habitat use in presence of livestock. It uses areas closer to cliffs and moves to middle elevations. The use of areas closer to cliffs is for security. This implies that markhor tries to use safer areas in presence of livestock but such areas are also having less forage. Once the livestock moves to upper elevations, markhor moves up to some extent but still remains in the middle elevations. In heavily grazed areas of Kajinag markhor did not migrate to upper elevations in the peak summer as they should naturally do, mainly because these areas are occupied by the livestock at that time. But in areas of light livestock grazing, where alpine areas were free from livestock, markhor did move to the alpine areas in peak summer, as is expected from their natural behaviour.

The above situations indicate an interference competition between markhor and livestock with livestock emerging as a superior competitor. Livestock occur in large groups and are

accompanied with herders and dogs that simply make an area inaccessible to the markhor. This pushes markhor to use areas that are free from livestock. Since the optimal areas are occupied by livestock, markhor uses the areas which are mostly sub-optimal. Thus presence of livestock acts to shrink the available habitat space of markhor in three important ways:

1. By excluding markhor from higher elevations in summer: The high elevation alpine areas provide a rich source of nutritious forage as due to temperature dependent delayed phenology, new plant growth takes places with the advancement of summer. This becomes unavailable to markhor, particularly in the season of paturation and lactation.
2. By pushing markhor closer to cliffs: In presence of livestock markhor occur much closer to cliffs, thus depriving them of forage further away from cliffs.
3. By reducing area with high forage cover: Markhor are limited to areas with lower ground cover in presence of livestock grazing, this also is a reflection of they being pushed closer to cliffs. Though forage near cliffs may be more palatable, there is less of it and hence there is a loss of food resources.

These negative impacts take place when female markhor are lactating. Besides nutrition in summer may be critical to survival in winter as well.

Livestock rearing is the only livelihood option (source of income) for Bakkarwals and one of the main livelihood options for the locals. Therefore completely stopping livestock grazing is neither easy nor perhaps, judicious. On the other hand, livestock grazing at present levels creates a situation of serious constraints to the markhor. The grazing practices of Bakkarwals is also changing and nowadays they also graze livestock (mainly sheep) of other people for cash returns. These clients are not local and are from different places further away from the locality. This practice increases the cash flow to the Bakkarwals, but also greatly increases the pressure on the system.

At the end a few point which may help in better management of markhor in Kajinag can be listed:

1. Areas like Malangan nalla that were closed by army for grazing for about two decades need to be continued. Grazing should be restricted in this nalla in future too and the new Bakkarwals who are trying to start grazing in this valley also should be stopped soon otherwise they can claim rights.
2. The critical areas of birthing and rutting should get better protection both temporally and spatially. Bakkarwals should not be allowed to camp near these locations around end May and early June when they arrive.

3. Rutting areas should be monitored closely during rutting season in December and January when chances of poaching are high.
4. Bakkarwals that are coming to Kajinag should be listed and monitored every year so that no new entries can occur.

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