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MAKING GOAT HERDERS AS SCAPE GOATS FOR HIGH-ALTITUDE PASTURE DEGRADATION: A CASE STUDY OF HARIPUR-NARAN PASTORAL SYSTEM IN NORTHERN PAKISTAN

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ABSTRACT

This study identified and explored the changes in traditional trekking routes of pastoral communities between upland and lowland pastures. Data about trekking routes were collected by field surveys through constant trekking accompanying the herders and participatory meetings. Results show that landless herders resonated between lowland and upland pastures by moving along approximately 220 km long corridors seasonally. They were travelling through mountain trekking routes (Timbri-Kund Bangla and Makra-Gatti Galli) and road-based route to reach their seasonal pastures. Around 43% of the herders followed the Timbri-Kund Bangla route (TKB route) with 20 resting places, 41% herders followed the road-based route with 28 resting places, and 16 % herders followed Ghari-Makra-Gatti Galli route (GMGG route) with 26 resting places. Although there were more resting places on the road-based route, only about half of the resting places on this route were actually availed during mobility. Thus, time spent on the road-based route (20-25 days) was significantly less than on the mountain routes. Significantly less time (on average 1.72 days) was spent at each resting place along the road-based route. The early arrival and late departure of the herds at the upland pastures caused pasture degradation due to their consumption of vegetation which was still washy and not suitable for grazing then. The study concludes that closure of resting places and trekking routes is the main cause for changes in mobility patterns. Reopening resting places and trekking routes, accompanied by provision of veterinary care, mobile education and grazing rights, is recommended to safeguard this economical and environment-friendly traditional transhumance system.

Key words: Trekking routes, Mobility, Transhumance Corridors, Hindrances, Transhumance.

INTRODUCTION

Pastoral land covers about one third of the total terrestrial land surface of the earth that is largely managed and used by traditional pastoral communities for their livelihoods. These pastoral communities have shaped different pastoral systems for their livelihoods in different pastoral regions of the world, where they provide about 10% of the total meat production for human consumption and make a livelihood for 200 million pastoralists (Blench 2001; Hobbs *et al*. 2008; Nazir & Ahmad, 2016). China and Pakistan have the largest pastoral population of 19.5 million and 15.7 million pastoralists, respectively (Nazir & Ahmad, 2016).

Globally, pastoral systems are increasingly appreciated as an economically viable and environment-friendly practice due to its crucial roles in food security and the provision of ecosystem services (Moktan *et al*. 2008). Mobility of herds helps increase soil fertility in addition to seed dispersal, thereby increasing biodiversity (Olea *et al*. 2009; Mitra *et al*. 2013; Enri *et al*. 2017).

The continuous seasonal mobility of pastoral families and their livestock is based on annual cyclic movement between upland and lowland pastures (Kreutzmann 2012), where pastoralists are exploiting diverse ecological niches to graze their livestock (Basset 2006; Mitra *et al*. 2013). This seasonal livestock mobilty has a significant role in controlling monoculture of plants and other omni present plants, and also provides sufficient time for regrowth of fodder plants (Mitra *et al*. 2013). Mobility is critical for the survival of pastoral communities that play a key role in the livestock production (Swallow 1993; Boone *et al*. 2008; Behnke *et al*. 2016). In many regions of the world, mobility of the livestock is the key strategy in nomadic and transhumant systems for the sustainable land use by allowing flexible use of resources (Martin *et al*. 2016). Different mobility patterns prevail in the mountain regions, with differences in distance between uplands and lowlands (10-200 km), size and composition of herds, and access rights to lands (Gomez-Ibanez 1977; Ojeda *et al*. 2012). During the lowland-upland mobility, the pastoralist follows routes which have been used by their ancestors for decades (Moktan *et al*. 2008; Nyssen *et al*. 2009). The mobile

pastoralism is environmentally sustainable and economically viable, which has been accepted by most scholars around the world (Naess 2013; Khurshid *et al*. 2016; Martin *et al*. 2016).

Despite the various economic, social, cultural and ecological benefits as mentioned above, the mobile pastoralism is held responsible for the pasture degradation, overgrazing and forest loss (Eckholm 1975; Qasim *et al*. 2013; Ahmed *et al*. 2015). Some people generally consider the mobile pastoralism as uneconomical and unfriendly to environment. It is also considered as a cause for social conflicts between the mobile pastoralists and the resident communities. So, projects have started to relocate or re-settle the pastoralists in many regions including China (Liao *et al*. 2014; Haji *et al*. 2017). The forced settlement has lots of negative socio-economic and environmental impacts (Jordan *et al*. 2016).

Identifying mobility routes is an important pre-requisite to explore mobility hinderances. Different types of mobility hinderances are associated with mobility routes themselves or on the periphery of mobility routes. The pastoralists stay at the resting places with their herds during mobility (Moktan *et al*. 2008; Nyssen *et al*. 2009; Mitra *et al*. 2013), and the forested mountains are used for grazing in transition zone between summer and winter pastures (Yi *et al*. 2007; Liao *et al*. 2014). However, open livestock mobility of pastoralists is confronted with different challenges including violence, land tenure, climate change, political restrictions, urban expansion, land use changes, security threats, animal diseases, human diseases, large rivers and conservation initiatives (Kala 2004; Boone *et al*. 2008; Jordan *et al*. 2016; Wario *et al*. 2016; Haji *et al*. 2017). The increasing human population, encroachment of the previous pastoral lands and their mobility routes, shortage of land for grazing during mobility and the land development for urbanization and industrial use, etc., add to hindering transhumance (Samuel *et al*. 2002; Lengoiboni *et al*. 2011; Jordan *et al*. 2016).

In Khyber Pakhtunkhwa province of the Northern Pakistan, approximately 50,000 landless pastoralists are entirely dependent on herding of animals for their livelihood. These landless mobile pastoralists have approximately a million sheep and goats, excluding cattle and buffaloes which are also grazed by many pastoralists. These pastoralists are contributing to the national economy by approximately 10 billion rupees annually (Ojeda *et al*. 2012).

Mobility is the most important part of the transhumance system and the long term sustainability of this system depends upon mobility. The sustainable transhumance system will have socio-ecological and economic benefits for the local population, the region and ultimately to the entire country. The current study was carried out in Western Himalayan region of the Northern Pakistan with the aim to explore the different mobility routes of the landless pastoralist, to identify various hindrances along the mobility routes, and to analyze the socio-political and ecological implications of the mobility hindrances in the region. Therefore, this study can provide a base to find solutions to the existing problems of transhumance and help maintain this economical and environment-friendly traditional system.

Study area: This study was carried out in Hazara division of Khyber Pakhtunkhwa province, Northern Pakistan. Geographically, the study area is located from 72˚ 51′ 69.10″ to 73˚ 56′ 37.38″ E and 33˚ 56′ 13.05″ to 35˚ 03′ 30.67″ N (Fig.1). The elevation ranges from about 1500 feet a.s.l in the lowland pastures to about 13000 feet a.s.l in the upland pastures (Sardar1999; Khan *et al*. 2015).

The upland pastures of the Haripur Naran Pastoral System (HNPS) are Kaghan and Naran uplands (Fig.1). These upland pastures are the summer grazing areas for landless mobile herders. Temperature of the upland area remains below 0˚C during the five winter months (November through March), and mean annual rainfall is 1545 mm (Schickhoff 1995). The upland pastures consists mainly of grasses and shrubs in Alpine and Sub Alpine zones, with small number of trees including Fir, Blue pine, birch and Junipers species. The landless mobile pastoralists use these trees as fuel wood and also for making temporary shelters in summer (Sardar1999). The notable fodder tree in the upland pasture is *Betula utilis,* and is also used as fuel wood (Rahim *et al*. 2011). The growing season is limited to July, August and September only (Sardar 1999).

The lowland settlements and the lowland pastures of the landless mobile herders in the HNPS lie in the Haripur District (Fig. 1) and these herders spend their winter seasons in the foothills and plain areas of Haripur (Sardar 1999). Haripur district has a mean elevation of about 2000 feet (610 meters). This area lies in the arid subtropical region and has mild winter season. The maximum average temperature recorded for the winter months was about 15˚C and in summer the temperature reached upto 45˚C (Khan *et al*. 2012). The maximum rain falls in the summer months of June and July (Khan *et al*. 2015). In Haripur district, the herds of the pastoralists are grazed in the broad leave tree forests. Vegetation in this region consists of shrub and trees including *Acacia modesta*, *Acacia nilotica*, *Olea cuspidate*, *Zizyphus jujuaba, Melia azedarach, Ailanthus chinesis, Indigofera heterantha, Morus alba, Morus nigra,* and *Celtis caucasica* (Sardar1999; Rahim *et al*. 2011).

Traditionally the landless pastoralists have utilized the upland pastures of Hazara division in summer and lowland pastures in winter. Their upward mobility starts in late April and early May and reaches to the uplands in June. The downward mobility starts in Mid-

October and reaches to lowland pastures in late November.

METHODOLOGY

The current main trekking routes used by the pastoralists between the upland and lowland pastures were identified through initial consultative meetings with the pastoralists and participatory rural appraisals (PRA) held in different pastoral settlements. We then travelled through these trekking routes from lowlands and reached to uplands during the mobility period in May 2015. A total of 100 pastoralists were interviewed on their trekking routes about their choice of routes, resting places and major hindrances in their mobility. The trekking routes and resting places were recorded using GPS. ArcGIS 9.3 was used to map the trekking routes and resting places between upland and lowland pastures. For this purpose, GPS data were converted into ArcGIS and the trekking routes were digitized.

Data analysis and statistics: The mobility questionnaire data were entered into Excel Spread Sheets. Graph pad prism software version (5) was used for statistical analysis. The variation in the herd composition was analyzed using Chi-square tests. The variation in the mobility duration, number of resting places occupied during mobility, herd sizes using different trekking routes was analyzed using one way ANOVA.

RESULTS

Trekking routes of Haripur Naran pastoral system (HNPS): The results of questionnaire surveys and PRA meetings showed that three routes were adapted by the landless herders: Timbri Kund Bangla Mountain Route (TKB route), Garhi Habibullah-Makra-Gatti Galli Mountain Route (GMGG route), and Main Road-based trekking route (road-based route). The first two routes passed through the mountains and the third one was a road based route (Fig. 2). These routes stretched along the elevation gradient starting from 2031 feet a.s.l. at the lowland up to 10370 feet a.s.l at Besal (Naran Upland) which is the extreme end of the valley.

The TKB route started from Bheer (Haripur) and reached the three upland areas, i.e., Kaghan, Narran (Mansehra) and Chorr (Batagram). This route was about 150 km long (Fig. 2), and was mainly used by the herders belonging to the lowland pastures of Bheer, Soha, Nartopa, Kagh and Darwaza to reach out the upland pastures of Nilli Nadi, Soch, Chorr and Saikundi in Kaghan-Naran. About 43% of the interviewed landless herders used this route for mobility between the lowland and upland pastures (Table 1).

The GMGG route started from the lowlands of Haripur near Havillian and ended in the Kaghan and Naran upland pastures. The total length of this trekking route was about 160 km. This route was used by about 16% of the interviewed herders for mobility. The landless herders followed GMGG route to take their livestock to Batakundi, Dadar Nar, Burawai, Jorra, Daschalli and Ratti Galli upland pastures from their lowland settlement at Khanpur, Bagra, Kaladam, and kala Mirpur.

The road-based trekking route started from the lowlands of Haripur and ended in the extreme northern part of Naran uplands. The herders using this route for mobility between upland and lowlands had settlements in Khanpur, Sarie Saleh, and Kala Mirpur. The road-based trekking route which was 220 km long was used by 41% of the interviewed herders. This route led the landless herders to Naran (Porbinar, JhalKhad, Besal and Nori Top) upland pastures.

Problems and Hurdles during mobility: One of the key indicators to assess the mobility difficulties of landless pastoralists is to determine the presence of resting places containing enough fodder for livestock of landless herders. Therefore, we asked the herders about the existence of resting places along the different routes during their year round mobility.

The number of resting places along the trekking routes was different from each other: 20, 26 and 28 resting places on the TKB route, the GMGG route and the road-based route, respectively. However, 10 resting places along the road-based route were completely closed for herders and most of the remaining ones were impacted by the development activities along the route. The herders who used the mountain routes occupied more resting places than those using the road-based route during their upland mobility ($P<0.05$) and lowland mobility ($P<0.05$) (Table 1). Meanwhile, the herders who used the road-based route tended to spend less time at each resting place than those using the mountain routes during both their upland and lowland mobility, although the differences were not significant (Table 1).

Not all the resting places were used by the landless herders during their mobility. During upland mobility, the herders occupied more resting places along the mountain-based routes (18.40 along the TKB route and 16.31 on the GMGG route) than along the road-based route (13.32). Our interview showed that 62% of the herders faced difficulties in finding resting places, particularly along the road-based route.

The results showed that 76.74% of the herders who used the TKB route considered the availability and suitability of this trekking route as their main problem, while 87.80% of the herders using the road-based route faced a main problem of availability of grazing areas along the route (Table 2). Over 80% of the herders using the GMGG route had problems in other important aspects of transhumance during their mobility (Table 2).

The mobility hindrances along the mountain-based trekking routes were mainly due to the closure of some parts of the routes, while the mobility hindrances along the road-based route were resulted from the closure of some grazing areas. Our interview with the herders showed that some mountain routes which were used by the landless mobile herders in the past were closed for the mobile herders by the forest department due to its afforestation activities.

The grazing areas for the livestock were mostly closed along the road-based route as compared to the mountain-based routes for different reasons. The grazing areas along the road route were totally closed from Balakot to Kaghan due to afforestation activities, while the grazing areas were partially closed from lowlands of Haripur to Balakot along the road-based route due to privatization of land and extensions of settlements. From Kaghan to Naran uplands, the grazing areas along the road route were closed due to crop encroachment, including introduction of the off-season potato and pea cultivation. Because of the closures of these grazing areas along the road-based route, the herders spent on average 50 days in upland and lowland mobility on the road-based route, but an average of 67 days along the mountain routes each (Table 4).

Mobile pastoralist's vulnerability to hazards: The results of our open structured questionnaires showed that the herders who used the road-based and mountain-based routes for upland and lowland mobility suffered from both natural and anthropogenic hazards.

The main natural hazards included earthquake, landslides, snowstorm and floods which caused injury and even death to the herders and loss of their livestock. For example, Qazi Alam lost 280 goats and sheep during an earthquake in Paras in 2005 when he was returning from upland pastures through the TKB route. Similarly, another herder named Haroon of Haripur lost his brother and 80 sheep and goats due to falling rocks in the earthquake when they were on the way back to their winter settlement. A devastating flood in 2009 killed 15 sheep of Ayub while he was on his way to the Nilli Nadi (upland pastures). Unexpected or early snowstorm in summer at high elevated mountain pastures also posed serious threats to the herders and their livestock. Sarwar lost 90 sheep and goats and his two companions due to an unexpected snowstorm during upland mobility at Mussa Massalah Mountains seven years ago. Mohammad Zaman lost 10 goats during mobility due to abnormal snowfall in early summer of 2010.

The herders often suffered from predation by wild carnivores such as black bear and leopard. Umar Syed lost five goats as a result of attack by black bears at a night during mobility in 2010 along the TKB route. Similarly, Haider lost 6 goats and sheep when a leopard attacked his herd in 2011 during mobility on Makra-Gatti Galli mountain route.

Many herders suffered from man-made hazards. A car crushed 20 sheep of Raza Khan while he and his herd were trekking on the road-based route from Haripur to Naran in 2010. The car escaped without giving compensation for the incurred losses.

On the basis of the group discussion conducted with the herders, many of them routinely suffered from huge losses due to theft of animals during mobility. Mohammad Ishaq lost 103 goats and sheep while they were spending night at a resting place during their mobility to the upland pastures of Palodar in Naran (Mansehra). Similarly, Syed Rehman from Haripur lost his 40 sheep and goats when dacoits forcefully took the animals at Mansehra in 2009, while he and his livestock were moving to Naran Upland pastures during summer using the TKB route.

Herd composition and mobility speed along different trekking routes: The herd composition was different between the landless herders who used the road-based route and those who used the mountain routes (Table 3). Herds with significantly higher percentage of goats followed the mountain routes and those with significantly higher percentage of sheep followed the road-based route ($\chi^2_{(1,5)}$=197; P<0.0001). The herds using the road-based route had more mules and donkeys than the herds using the mountain routes.

The mean size of the herds following the road-based route was bigger than that of the herds following the mountain routes (218.0±18.4 *vs.*190.0±16.9, mean± SE), but no significant variation was observed (P=0.2746). The higher number of goats for the mountain routes was because goats were browsers and moved faster compared to sheep. Similarly, the possession of more mules and donkeys on the road-based route reflected the need for carrying goods over comparatively long distance (Table 3). The speed of the landless herder with which they covered the distance during upward and lowland mobility was a function of the choice of trekking routes and availability of resting places. Our results indicated that the number of days spent moving from the lowland to the upland was 29.84 days along the TKB route and 37.63 days along the GMGG Route. This amount of time was significantly higher than that spent on the road-based route (23.00 days). The same was true for the number of days spent returning from the upland to the lowland on mountain routes (Table 4).

During the upland mobility, the average number of days spent at each of the resting places was 1.61 days along the road-based route, 2.21 days along the TKB route and 2.38 days along the GMGG route. Similarly, the number of days spent at each of the resting places during the lowland mobility was 1.83 days, 2.53 days and 2.00 days along the road-based route, the TKB route and

GMGG route, respectively. No significant difference was observed in the number of days spent at each resting place during mobility on the road-based route and the mountain trekking routes (P >0.05) (Table 4).

Fig 1. Location of the study area

Fig. 2. The trekking routes used by landless herders during seasonal upland-lowland mobility and the closed resting places on the Road based trekking route

Table 1. Herders' choice of trekking routes and the number of resting places

Route Used during mobility		Trekking Route choice of landless herders (%)	Total length of the trekking route (Km)	Average Number of Resting places occupied during upland mobility	Average Number of Resting places occupied during lowland mobility	Average Number of days spent at each resting place during upland mobility	Average Number of days spent at each resting place during lowland mobility
Timbri Kund Bangla Route	Mountain trekking routes	43	150	18.40*	17.58*	2.21	2.53
Garhi Habibullah Makra Gatti Galli Route		16	160	16.31*	14.50*	2.38	2.00
Road based trekking route	Road trekking route	41	220	13.32*	13.90*	1.61	1.83

*: $P < 0.05$.

Table 2. Hindrances in transhumance along the trekking routes

Route Used during mobility	Route choice of landless herders (%)	Availability and suitability of trekking routes	Availability of grazing area	Other important aspect of Transhumance
Timbri Kund Bangla Route	43	76.74 %	65.12 %	30.23 %
Garhi Habibullah Makra Gatti Galli Route	16	62.50 %	43.75 %	81.25 %
Road based trekking route	41	75.61 %	87.80 %	34.15 %

Table 3. Herd composition in different route classes

Species	**Road route (%)**	**Mountain routes (%)**
Goat	36.37	44.84
Sheep	60.14	52.19
Horse	1.38	1.82
Mule	0.38	0.10
Dog	0.64	0.67
Donkey	1.08	0.37

Table 4.Mobility speed along various trekking routes

Route Used during mobility		Route choice of landless herders (%)	Total length of the trekking route (Km)	Average Number of days spent during upland mobility	Average Number of days spent during lowland mobility	Total Number of days spent on upland & lowland mobility
Timbri Kund Bangla Route	Mountain trekking routes	43	150	29.84 *	32.63	62.47
Garhi Habibullah Makra Gatti Galli Route		16	160	37.63 *	33.81	71.44
Road based trekking route	Road trekking route	41 220	23.00 *	27.27	50.27	

* ($P < 0.05$)

DISCUSSION

Trekking routes in the Haripur-Naran pastoral system: Amongst the three trekking routes identified in this study, the TKB route was used by the majority of the herders (43%), possibly due to its short distance (150 km) and easy terrain where animals could move easily. The herders (41%) used the road-based route possibly due to the availability of certain facilities like food, health facilities and accessibility. The GMGG route was used by the lowest number of herders (16%) because of its difficult terrain and the nearby Machaira National Park. The herders had to pay tax per animal in order to cross the park, and predation by wild animals was high within the park. Furthermore, they also had to pay tax to the landowners at Gatti Malli to cross the valley. Similarly, three distinct trekking routes are described in the transhumant system in Baluchistan province of Pakistan, where the Balochi and Brahui tribes are predominantly transhumant pastoralists using the three ancient trekking routes for transhumance (Akhtar *et al*. 2006).

Among the three trekking routes in HNPS, the current road-based route was the previous cattle herder route following the Kunhar River flowing into the valley bottom. A road was constructed later along the cattle route and is now also used by the landless herders. Because the crop cultivation extension has occupied the key cattle grazing areas, very few cattle are brought by trucks to upland pastures now.

It is the herd composition rather than the herd size that determines the patterns of route usage. The herds with higher percentage of sheep preferred to move along the road-based route, while the goat-dominant herds mainly moved along the mountain routes. This is obviously related to the grazing and browsing behavior of the species. Furthermore, the crossbred Rambouillet sheep cannot move easily through the mountain terrain. Similar trend has also been reported in Buner-Swat pastoral system where the sheep herders follow the roadside route and goat herds follow the mountain side route (Rahim *et al*. 2011).

The mountain routes and the current road-based route are based on ease of access to the destined upland pasture locations. Thevenin (2011) has similarly described and mapped four different trekking routes, which, unlike Naran pastoral system, are used by different Kurdish tribes in Turkey. Mobility route maps have been developed in a similar way for Bhutan (Moktan *et al*. 2008). Imaginary maps for the mobile pastoral systems in Gilgit-Baltistan in Pakistan (Kreutzmann 2012) and Buner-Swat in Northern Pakistan (Rahim *et al*. 2011) have been developed, but these have not been properly digitized. However, the mobility pattern in Gilgit-Baltistan is sequential with sheep and goat moving first, followed by cattle and Yaks, respectively (Kreutzmann 2012).

Mobility duration in Haripur Naran Pastoral System: Significantly more days were spent on the mountain-based routes than on the road-based route possibly because of the availability of more resting places along the mountain-based routes. The average number of days spent at a resting place along the mountain-based routes was more, although not significant, than along the road-based route. This is possibly due to comparatively better availability of grazing facilities on the mountain-based routes than on the road-based route. The average distance of the roadside route was 220 km, and it usually took the herders 23 days for travelling. This means that the herds traveled on an average speed of 9.57 km/day along the road-based route to the upland pastures. The average distance of the mountain-based trekking routes was 155 km and the herders usually travelled in 33 days. This means that 4.70 km/day was the routine average speed of the herds travelling along the mountain-based routes to the upland pastures. During the returning mobility from the uplands to the lowlands, on average, 8.15 km/day and 4.66 km/day was the routine speed of herds travelling along the road-based route and mountain-based routes, respectively. Hence the mobility along the road-based trekking route is very fast as compared to the mountain based trekking routes. This is due to the fact that the grazing areas and resting places actually availed by the herds on the road-based route were much less than on the mountain-based routes. Similar study has been conducted for the transhumance system in Romanian Carpathian mountains, where the average daily speed is 4.7 km/day while travelling to the uplands (Huband *et al*. 2010). In the Gaddis transhumant system of Himachal Pardesh (North West India), the herders travel at a speed of 7 to 8 km/day during upland mobility (Bismal 2003). While in the Swabian-Franconian transhumant system in Germany, the mobile herders travel at a speed of 10 to 20 km/day and walk for several weeks to cover the transhumant distance of 300-400 km (Luick 2008). The landless mobile herders in Haripur-Naran pastoral system now spend a total of 50 days on upland and lowland mobility along the road-based trekking route, while the duration of transhumance is an average of 67 days for upland and lowland mobility along the mountain routes.

Availability of resting places along the trekking routes: The number of resting places used by the herders along the road-based route was significantly lower than along the mountain routes possibly due to unavailability of grazing areas along the road route. Thus, the mobile herders using the road route tended to move quickly and availed less resting places. They arrive at the upland pastures quickly as compared to the herders using mountain routes. Because many grazing areas were available for the herds along the mountain routes, the herders availed more resting places along the mountain routes. Similar study has been carried out in the

Romanian Carpathians transhumant system, where the upland mobility is very fast due to the presence of crops in the field and the unavailability of grazing areas for the herds (Huband *et al*. 2010). In the transhumant system in Northwest Yunnan (China), a study finds out that the resting places decreased by 83.3% due to crop encroachment, grape gardens and development activities in 10 out of 12 villages during the past 20 years (Yi *et al*. 2007). All these have resulted in the loss of the transhumance system which is now present only in a few remote villages (Yi *et al*. 2008). Similarly, the reduced availability of resting places for the transhumant families in Bhutan who do not own their transect ranges has forced them to move quickly and have shorter mobility (Moktan *et al*. 2008). In the Gaddis transhumant system of Himachal Pardesh province (North West India), the herders have resting places at a distance of every 7 or 8 km and the resting places are available from the plains of Kangra to their settlement in the Middle lands of Palampur. Beyond the area of Palampur the mountains are steep and have few open spaces for the herders to rest. So the herders move quickly to reach the Alpine pastures in the Himalaya Mountains (Bismal 2003). Our interview revealed that 62% of the interviewed landless mobile herders in our study were facing difficulties in finding resting places, particularly along the main road in Haripur-Naran pastoral system.

Mobility hindrances: The major mobility hindrances were the closure of trekking routes due to afforestation and privatization of land and unavailability of resting places, coupled with lack of grazing facilities along the routes. Rahim *et al*. (2011) also reported similar mobility hindrances of route closure and unavailability of resting places to the mobile pastoralists in Buner-Swat pastoral system, Northern Pakistan. The plantation of the hill sides by forest department and the landowners has closed many previous trekking routes of the landless mobile herders. This has not only created the problem of finding suitable routes for trekking, but also problem of grazing livestock. Similar study has been conducted in Buner-Swat where the previous trekking routes were blocked by afforestation projects (Rahim *et al*. 2011). A case study finds out that the grazing areas have reduced by 55% due to afforestation in Buner-Swat (Leede *et al*. 1999).

The loss of resting places for the herders is also a major hindrance for the transhumant herders. A similar study (Yi *et al*. 2007) of the transhumant system in Yunnan province of China shows that the transhumant system is severely affected by loss of the resting places for the herders.

The study of transhumant pastoralists reveal that the traditional sheep routes have been either encroached by agriculture or used for other developmental purposes. So it is now difficult for the transhumant herders to find a suitable trekking route. The transhumant herders always see a danger of conflict with the local farmers over crop damage or other property. The fear of the transhumant herders is due to the fact that the police always favor the land owners during a conflict (Huband *et al*. 2010). During mobility, the herders are usually compelled to give animals from their herd to police, other officials or the community, so the transhumant herders favors the night mobility as in a similar case of the Romanian transhumants. These hindrances have affected the herd size of the transhumant herders, as in a similar study in Buner-Swat (Rahim *et al*. 2011).

Management implications: Hindrances on the trekking routes have reduced the duration of transhumance along both the road route and mountain trekking routes. The closure of resting places is forcing the herders to move day and night on the road-based trekking route, resulting in stress on both the animals and herders. Due to significantly more mobility hindrances along the road-based route, the herds following the route usually reach at the upland and lowland pastures much earlier and faster, resulting in negative ecological impacts on the pastures. The sheep herders using the road-based trekking route have faced the most severe hindrances. The HNPS seems to be at severe risk due to loss of trekking routes, resting places and grazing areas for the landless mobile herders.

In order to reduce the negative ecological impacts on the pastures and the stress on the herders and their livestock, we put forward following recommendations to save HNPS.

1) Closed mountain trekking routes need to be re-opened to provide more grazing opportunities for herders using them.
2) More resting places need to be secured/opened, particularly along the road-based trekking route.
3) Adequate policy measures are required to safeguard the marginalized poor community of the landless mobile herders in the Haripur Naran Pastoral System.
4) Veterinary services must be provided by the government to reduce the mortality of the herd animals and to sustain this economical system of availing seasonal pastures.
5) The landless mobile herders must be provided with incentives to save this important system from complete collapse.
6) Proper demarcation between the grazing lands and agricultural lands must be done, to avoid any further expansion of the cropping on the slopes of the upland pastures.
7) Plantation of the exotic and alien species like Eucalyptus must be avoided further. The indigenous fodder trees and shrubs must be planted. These fodder species will be serving as source of food security for the landless mobile herders and the land

owner who will have the opportunity to prune the leaves of the trees and shrubs in drought periods.

Novelty Statement: The changing socio-ecological conditions as a result of rapid population growth pose serious threats to indigenous communities and their livelihoods such as pastoralism and nomadism. The landless pastoralist system in Pakistan is one such example of being in siege due to both natural and anthropological drivers. Pastoral system is a century-old livelihood system adopted and shaped by landless mobile pastoral communities in Northern Pakistan. The changing socio-ecological conditions are seriously threatening traditional pastoral systems in last few decades in term of herders' accessibility to upland-lowland pastures. This study is a unique one of its kind in the whole region on mobility hindrances to the landless mobile pastoralists. It will help shed light on the existing knowledge and is helpful in relevant policies for the pastoral development in the future.

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