GRAZING RESOURCES FOR YAKS IN MERAK AND SAKTENG: ISSUES AND CHALLENGES

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ABSTRACT: Rangelands, known as *Tsamdro* in Dzongkha (Official language of Bhutan), play a vital role in sustaining the livelihoods of semi-nomadic herders in Merak and Sakteng blocks, providing essential grazing resources for yaks and hybrids of Yak (zo and zom). Major forage species available in summer and winter grazing areas of Merak and Sakteng blocks were assessed. This study examines the current state of grazing resources, challenges faced by herders, and potential management strategies that could be implemented. Data was collected from 145 yak-rearing households using structured interviews and analyzed using SPSS. The findings reveal that herders primarily utilize open meadows in summer (95.86%) and open forests in winter (74.48%), following a transhumance system which is based on seasonal availability of fodder and water. The major grazing resources in summer and winter grazing area are identified. It was however found that the grazing resources are increasingly threatened by invasive plant species, overgrazing, and policy restrictions on pasture management practices such as controlled burning. Encroachment by non-palatable species, particularly *Rhododendron arboretum*, *Juniperus recurva*, *Rumex nepalensis* and *Potentilla leuconata* has degraded pastureland, reducing forage availability. The respondents reported that despite attempts to improve rangeland productivity through fencing and rotational grazing, herders continue to face shortages, especially in winter. The study highlight the need for sustainable rangeland management practices, including controlled burning, removal of invasive species, and rehabilitation of pasture, to ensure rangeland stability and livelihood sustainability.

Keywords: Grazing resources; Merak; Rangeland; Sakteng; Yak; Zo; Zom

1. INTRODUCTION

Rangelands in Bhutan are synonym with the term "*Tsamdro*", which basically means grazing land for livestock and wild ungulates. Rangelands are an important source of livelihood for herders in 10 highland Districts (Bumthang, Gasa, Haa, Lhuentse, Paro, Thimphu, Trashigang, Trsahiyangtse, Trongsa and Wangdue Phodrang). As per the Population and Housing Census of Bhutan, 2017, the total herders population of 10 highland district was counted to be 39,911 (NSB 2018), who solely depend their livelihoods on rangelands. The rangelands provide wide array of economic, social and ecological functions. Theoretically, Bhutan has about 400,000 hectares of registered grazing land (Roder et al. 2001) in the name of individuals, communities and institutions. However, the registered "*Tsamdro*" has very little relevance to the area actually utilized for grazing by the yaks, zo and zom (Zo and zom are cross breed of yak and cattle). This is because the livestock are found to be grazing in the forests and scrublands adjoining the villages and dwellings. Rangelands are also called "*Ri"* in *Dzongkha*, are comprised of the subtropical

and temperate zones ranging from 150 to 3600 masl and alpine meadows at 3600 to 5000 masl. These rangelands are shaped by rugged terrain and cold climate and serves as crucial source of grazing resources, household fuel, medicinal plants and biodiversity conservations or the ecological balance.

The people of Merak and Sakteng blocks are usually referred to as *Brokpa*, meaning the semi-nomadic inhabitants of Merak and Sakteng, and is synonymous with herders, shepherds, or those who herd cattle (Wangdi and Norbu 2018). These *Brokpa* households own a total of 17371 yaks, zo and zom (NSB 2021), mainly dependent on grazing resources for better productivity and animal health. Herders' faces shortage of grazing resources due to several factors like climate change and strict policy enforcement required for forest conservation leading to encroachment of pasture land by unwanted plant species, over grazing ultimately resulting in degraded rangelands. Degraded rangeland has poor biomass productivity, reducing the forage availability in every season. The shortage of grazing resources for yaks, zo and zom has a great impact leading to poor animal health, low productivity, increased labour cost and human- wildlife conflict which affects the livelihood of the herders. The main objective of the study was 1) to document baseline data for grazing resources, 2) to ascertain migration pattern and 3) to identify the issues and challenges of the herders regarding the rangelands.

2. MATERIALS AND METHODS

2.1 Study area

The study was conducted in Merak and Sakteng blocks in Trashigang district, eastern Bhutan (Figure 1), between latitudes 270 17.84 to 270 18.51 N and longitudes 910 50.76 to 910 52.12 E with the elevation between 1800 to 4500 masl.

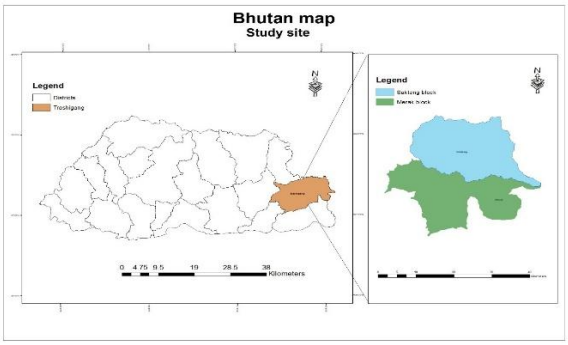

Figure 1: Study area

2.2 Sampling procedure

There are a total of 482 households which are engaged in rearing yak, zo and zom in Merak and Sakteng blocks (T Samdrup and N Dorji, personal communication, January 11, 2024). A 30% of these households were selected for the structured interview, using the probability sampling at 95% level of confidence to ensure equal opportunity to choose both blocks for the study. This method of selection of interviewee is based on the suggestion made by the statisticians Uakarn et al. (2021) which recommends a sample size adequacy of 15-30% for a population ranging in hundreds. Therefore, 30% of 482 is 144.6, so the sample size was 145.

2.3 Data collection

Data was collected from 145 respondents. 81 respondents were from Merak and 64 from Sakteng in the age ranges from 17 to 87 years old. Of the total selected respondents, 40% comprised of female and 60% male. They were interviewed using a set of questionnaires. The responses from these respondents are taken as the baseline data for the grazing resources in the study area and the major problems faced by the herders with regards to grazing resources.

2.4 Data analysis

The data was entered in Microsoft Excel (2016) and exported to International Business Machines Corporation, Statistical Product and Service Solutions (IBM SPSS), version 23.0 for statistical analysis. Data collected were checked for typographical error and then coded for further analysis in SPSS. The normality of the data was checked using Shapiro-Wilk test. Respondents' characteristics were estimated in percentage. The data were also analyzed using descriptive statistics.

3. RESULTS AND DISCUSSION

3.1 Grazing area

Grazing area is generally categorized into three groups as 1) open meadow (Pastureland/ Sedges/ broadleaved), 2) open forest and 3) underneath open shrubs and herbs. Though the herders keep their animals in all three categories of the grazing land during the summer season, 95.86% of the respondents mentioned that they mostly graze their animals in open meadow. Accordingly, during winter season, 74.48% respondents said that their animals are grazed under open forest. The herds migrate from place to place mainly due to scarcity of availability of the fodder and drying up of drinking water resources in one location. The migration of herd is ushered by the availability of grass, water and favorable climatic conditions in the new grazing area.

The respondents stated the immense grazing pressure on the rangelands of Merak and Sakteng due to growth of invasive plant species, over grazing, land degradation, seasonal variations and competition from the wild ungulates. The study done by Namgay et al. (2013) show that grazing pressure is due to the ongoing developmental activities and change in policies.Grazing areas below tree line and those closer to settlements were found to be under more grazing pressure than in the alpine meadows, where yaks graze only for maximum of six months due to severe winter there. 82.07% of the respondent reported that the pasture is inadequate during the winter months and 79.31% responded that the summer pasture is inadequate and the grazing pressure is increasing yearly. According to Haynes et al. (2013) grazing pressures is attributed to rise in herd size while land area remains limited.

3.2 Available summer grazing resources

The study shows that the available fodder increases with the clearing and controlled burning of the unwanted shrubs in the grazing area. The major available grazing resources (Table. 1) are *Carex uncinoides* (Figure 2), *Carex nubigena* (Figure 3), *Taraxacum spp.* (Figure 4), *Bistorta griffithii* (Figure 5) and *Ligularia mortonii.* Similarly, it was reported by the respondents that the grazing resources grew well in areas with proper grazing management and where controlled burnings were carried out. The respondents observed that plant species like *Kobresia nepalensis*, *Calamogrostis filiformis*, and *Festuca valesiaca* that grew properly (Tambe and Rawat 2009) were taken care.

Table 1: Major summer grazing resources

Local name	Scientific name	Altitude (masl)
Komtsa/Tsalep	*Carex uncinoides*	3500-5000
Tsarso	*Carex nubigena*	3500-3500
Khurmang	*Taraxacum sp.*	3500-5000
Shang sha meto	*Bistorta griffithii*	3500-5000
Bongdokpa	*Ligularia mortonii*	3500-5000

Figure 2: *Carex uncinoides*

Figure 3: *Carex nubigena*

Figure 4: *Taraxacum spp*

Figure 5: *Bistorta griffithii*

3.3 Available winter grazing resources

The table 2 presents the major grazing resources in Merak and Sakteng. A study by Tambe and Rawat (2009) shows a similar grazing resource for yak and their crossbreeds (zo and zom). The study pointed out presence of multi-layered, evergreen oak and silver fir woods with a dense middle layer of dwarf bamboo and rhododendron, followed by a moss-dominated ground cover. Again, similar to Tambe and Rawat (2009), the current study showed the prominent presence of bamboo species that include *Yushania maling* and *Thamnocalamus spathiflorus.*

Table 2: Major winter grazing resources

Local name	Scientific name	Altitude (masl)
Shi	*Yushania maling*	2500-3000
Zhingru	*Qenanthe javanica*	2500-3000
Tsarso	*Carex nubigina*	3000-3500
Zazeb	*Girardina sp.*	2500-3000
Damberu	*Elatostema lineolatum*	2500-3000

On the sustainability of improved pastures developed by the project such as Sustainable Rangeland Management to protect Red Pandas and Herders Livelihood, the respondents (89.65%) reported that there was hardly any pasture left for winter grazing in Merak and 10.35% reported that they don't know about the project. The above project had developed 80 ha of improved pasture as a winter grazing resources for yaks, zo and zom in Cheabling (27819044.8700N; 91846014.2700E), Drana (278190 04.2400N; 918450 41.3000E), and Sheytemi (27819002.0400N; 91844026.0600E) in the year 2016 to 2019 (Millar and Tenzing 2021).

3.4 Encroachment of summer grazing areas

Under the set of question inquiring the encroachment of summer grazing areas, the herders in Merak and Sakteng mentioned that the pastureland were mostly covered by non-edible tree species like *Rhododendron arboretum* and *Juniperus recurva* and grass species like *Rumex nepalensis* (Figure 6), *Potentilla leuconata* (Figure 7), *Bupleurum candoleii*, *Rheum australe*, *Senecio spp.* which lowers the quality and deteriorates the pasture (Table 3). According to Tambe and Rawat (2009), pastoralism can enhance species richness and fodder cover in Juniper and Rhododendron scrub habitats by creating disturbances that promote vegetation diversity. A recent study conducted in herders of North Sikkim reported fewer grazing areas and poor pasture quality compared to that 15-20 years ago. However, the authors were unable to identify specific species change that happened in the study area (Feroze et al. 2019). According to Wangchuk et al. (2013), highland pastures may suffer from warming and drying effects. The authors reported that as temperatures rises and snowfall decreases, the species composition of alpine meadows shifts. 51.72% of respondents reported that there was a shift in growth pattern of the pasture in the alpine region of Merak and Sakteng region with the rise in temperature and warmer temperature led the upslope migration of plant species that alters in vegetation composition.

Table 3: Major invasive plants in the summer grazing area

Local name	Scientific name	Altitude (masl)
Takshing	*Rhododendron arboretum*	3500-5000
Shukpushing	*Juniperus recurva*	3500-5000
Tsadroma	*Potentilla leuconata*	3500-5000
Shoma	*Rumex nepalensis*	3000-3500
Zhan	*Bupleurum candoleii*	3500-5000
Masang meto	*Senecio spp*	3500-5000
Dholay	*Rheum australe*	3500-5000

Figure 6: *Potentilla leuconata*

Figure 7: *Rumex nepalensis*

3.5 Encroachment of winter grazing areas

As shown in table 4, most common non-edible tree species that encroached and affects the proper growth of pasture are *Daphne bholua*, *Rhododrendron arboretum* (Figure 8), *Elsholtzia fruticose*, *Gaultheria fragrantissima*, *Adies densa* and *Berberis aristata* (Figure 9).

Likewise there are also many non-edible grass species which dominate the grazing resources. Some of the non-edible grass species are *Teridium spp.*, *Rumex nepalensis*, *Eupatorium adenophorum* and *Artimessia spp.* According to (Shrestha et al. 2024) two invasive plants have caused imbalances in plant communities in grazing land at an altitude of 3300 masl of Bhutan.

Figure 8: *Rhododrendron arboretum*

Figure 9: *Berberis aristata*

Table 4: Major invasive plants in the winter grazing area

Local name	Scientific name	Altitude (masl)
Talumba	*Teridium spp.*	2500-3000
Shoma	*Rumex nepalensis*	3000-3500
Ngera ngon	*Eupatorium adenophorum*	2500-3000
Khanma	*Artimessia spp*	2500-3000
Shogu shing	*Daphne bholua*	2500-3000
Laskang	*Elsholtzia fruticose*	2500-3000
Seyshingma	*Gaultheria fragrantissima*	2500-3000

The two native plants are *Rumex nepalensis* and *Anisodus luridus*, that caused disruption in ecosystem services and the seasonal migration and use of these pastures by transhumant yak herders.

3.6 Migration pattern

As Bhutan has north-south running mountains, the upslopes going towards north which are summer settlements, are called *Yar Drok.* On the opposite, the downslopes, going southwards which are at lower elevations, are winter settlements and are called *Guen Drok.* The migratory routes in between *Yar Drok* and *Guen Drok* are called *Toen Drok.* . The seasonal migration of herders depends on the availability of grazing resources. As per respondents, 82.1% of summer migration begins in the month of May to June and the herders stay in the *Yar Drok* for two months (from July to August). Similarly, 78.6% of winter migration begins in the month of September to October and herders stay in the *Guen Drok* for six months (from November to April). Similar studies showed that the herds migrate south in early autumn and return to temperate pastures (or the *Toen Drok*) in late spring or early summer. The southward migration occurs between September and October, while the northward return begins between May and June (Namgay et al. 2013).

3.7 Distance from the village to the furthest summer and winter grazing area

Herders use their own hereditary pastoral land and livestock management approaches. Transhumance system of migrating with animals up and down journeys occurs at different altitudes in search of grazing resources. As per the herders, the furthest grazing area is five days journey (0.69%) from their village and the nearest an hour (3.45%). It was noted that 51.72% of the herders had their pasturelands within the reach of about one day journey while 22.07% of the herders had their pastures at a distance of two days journey. The remaining (8.97%) of the herders possessed their pastures only as far as two and half hour journey away. Likewise, during winter migration, the furthest journey took 10 days from the village (1.38%) while the nearest was only an hour away (1.38%). The data indicated that the majority (30.34%) of the herds travelled distances for only one day

while the 19.31% herders took three days journey.

3.8 Rotational grazing system

Rotational grazing system is normally followed by the herders of Merak and Sakeng. In winter grazing areas or the *Guen Drok*, rotational grazing is practiced up to four times annually, with 48.28% of herders rotating once, followed by 34.48% rotating twice, 4.83% do so thrice, 2.07% with four times and 10.34% do not practice rotational grazing due to limited grazing land. In summer grazing areas, 64.83% of herders implemented rotational grazing once per season, while 21.37% do so twice, 6.90% do so thrice and 6.90% do not practice due to limited grazing land. Effective pasture management in grazing areas is crucial for ensuring sustainable livestock production. The duration of grazing in a specific area is influenced by factors such as the size of the grazing land, the number of animals, and the availability of forage resources. To sustain pasture availability throughout the year, all herders implement a rotational grazing system (Moktan et al. 2006).

3.9 Relation of animal health, nutrition and migration

The health of Yaks in Merak and Sakteng region has weakened due to unforeseen, erratic weather conditions such as untimely heavy snow fall and the outbreak of Lumpy Skin Disease in 2020. 83.44% of the respondents felt that feeding yaks, zo and zom adequately maintains a good health. A study done by Brower (1991); Sherpa and Kayastha (2009), stated that the specific thermo-regulatory mechanisms in yaks enables them to sustain in cold climate and high elevation while they are unable to withstand temperature beyond 13^{o}C and above (Krishnan et al. 2016). Thus, the migration of yak to a rangeland abundant with forage and temperatures 13^{o}C or less is vital to their survival. The importance of animal health during migration was also proven by (Wangdi and Wangchuk 2021).

Since yaks and herders in Bhutan play a significant role in the northern international borders, it is important to keep the yaks healthy. To maintain the health of yaks, it is important to document and assess the baseline data on available grazing resources for yaks. Further, indentifying grazing resources on the mountain and developing modern pastures was proven/stated by (Millar and Tenzing (2021) to be effective to mitigate fodder shortage in the mountain.

3.10 Impact of policy on *Tsamdro* Protection

The highlanders stated that they are facing challenges regarding the protection of individual *Tsamdro*. While Merak and Sakteng has total of 33,411 and 44713 acres of pasture land respectively, 324 household in Merak and 285 household in Sakteng received Tsamdro Use Thram [TUT] in 2022 (Kuensel 2022). Further, upon the issuance of the Tsamdro Use Thram by the National Land Commission Secretariat [NLCS] to the individuals for summer grazing area, almost all herders have taken initiatives and fenced their respective grazing areas to protect the grazing resources from encroaching and competition

from the wild herbivores. The TUT has played a crucial role in enabling the herders to define the land ownership and access their rights thereby ensuring regulated and sustainable use of pasture and forage resources.

However, the yak herding community have disputes on the winter grazing area. The NLCS has not yet issued the TUT for the *Guen Drok* and the common winter grazing areas are not fenced. This situation has caused a number of disputes on the rights over the *Guen Drok.* Additionally, a study by Wangdi and Norbu (2018) revealed that the encroachment of *Tsamdro* by the same community is a common issue in yak rearing community. The study discusses that fencing of rangeland plays a vital role in stopping rangeland encroachment, controlling the competition from wild herbivores, improve the rangeland productivity and health of the land. The findings of the study by Wangdi and Norbu (2018) were also in line with the findings of this study.

3.11 Burning of invasive plants

A study by (Singh et al. 2018) found that *Bokpas* practiced controlled burning to enhance grass growth in mid-hill pastures (*Toen drok*). However, a blanket restriction, enforced by the Department of Forest and Park Services [DoFPS], resulted in difficulties in carrying out controlled pasture burning (Dorji et al. 2020). However, after knowing the severity of shrub encroachment in rangelands and its impacts, the Forest and Nature Conservation Act of Bhutan 2023, recognizes fire as a strategic management tool. The Act states, *"The Department of Forests and Park Services may permit controlled or prescribed burning for habitat management and forest fire prevention."* As a result, the herders in Merak and Sakteng have been able to access improved grass biomass, benefiting both animals and herders.

In the winter grazing areas however, the restriction on burning pastures is still not lifted despite studies by (Wangchuk et al. 2013) showing that pasture burning is effective in improving pasture quality and quantity. To enable yaks get adequate fodder in winter as well, the herders have proposed for approval to carryout controlled burning in both summer and winter pastures.

3.12 Issues of the herders

Generally, yaks and herders face increasing challenges due to insufficient pasture leading to overgrazing the same pasture. The situation is exacerbated by the growth of invasive plant, and land degradation. Pasture scarcity is especially severe in high-altitude rangelands, where access to drinking water is also critical (Wangchuk et al. 2013; Dorji et al. 2020). In Merak and Sakteng, pastures are overgrazed, while invasive species growths have further reduce the availability of forage. Competition with other livestock (eg. sheep) and wild ruminants exacerbates the problem (Dorji et al. 2020). Restrictions on burning the pastures have allowed non-forage species to spread uncontrollably (Tsheten et al. 2023). While controlled burning in summer pastures have helped pasture re-growth and suppression of weeds, winter pasture shortages remain unresolved.

4. CONCLUSION AND RECOMMENDATION

The grazing resources in Merak and Sakteng play a critical role in supporting the livelihoods of local communities, particularly those dependent on yaks, zo and zom. The rangeland areas are endowed with rich pasture, but challenges such as invasive plant encroachment, overgrazing, land degradation and seasonal fluctuations in forage availability are widely prevalent. While controlled burning in summer grazing areas has improved grazing quality, issues persist in winter grazing areas. Issuance of TUT is essential for ensuring fodder resource availability by establishing land ownership and access rights, promoting regulated and sustainable use of pasture and forage resources. Since winter months last for a period of six months, the yaks, zo and zom graze longer in winter grazing area leading to overgrazing the pasture and degrading the land. If the livelihoods of yak herders are to be maintained, there is an urgent need to improve and restore the grazing areas which are encroached by invasive plant species. The degraded areas can be improved through sustainable management practices, including improved pasture management and community-led conservation initiatives. Acknowledgement of issues and appropriate initiatives from the Government is essential to ensure the long-term productivity of these grazing lands which is the core of yak herding. With concerted efforts, Merak and Sakteng can maintain the rangeland stability in the region while supporting traditional livelihoods of yak herders.

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